Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11}$ = $\left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$ = ...

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96$.

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 ……….. 15 b) 2^3 ……….. 3^2 c) 7^4 ……….. 5^4

d) 10000 ……….. 10^5 e) 6^3 ……….. 4^4

a) 3^2 ……….. 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^8 \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x \, X \, y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \times 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^{5=}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2 \div 1)^{-2} \div (5 \div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} x\, 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8x\ 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2x\ 2\ x2\ x2^{n+2}$

$=2x2x2x2x2$

$2^3\ x2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\, X\, 5^{n+1} + 25\, x\, 5^n}{3\, X\, 5^{n+2} + 10\, X\, 5^{n+1}}$

$= \frac{2X5\, X\, 5^n X5 + 5x5\, x\, 5^n}{3\, X\, 5^n\, X5X5 + 2X5X5X\, 5^n}$

$= \frac{5X5\, X\, 5^n X2 + 5X5\, xX5^n}{5X\, 5\, X\, 5^n\, X3 + 5X5X5^n\, X\, 2}$

$= \frac{5X5\, X\, 5^n (2+1)}{5X\, 5\, X\, 5^n\, (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

$$\begin{array}{r|l} 5 & 3125 \\ \hline 5 & 625 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

$$\begin{array}{r|l} 2 & 512 \\ \hline 2 & 256 \\ \hline 2 & 128 \\ \hline 2 & 64 \\ \hline 2 & 32 \\ \hline 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

= $\frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

=3^{1-1} x 7^{2-1} x 11^{8-3} [$\therefore a^m \div a^n = a^{m-n}$]

=3^{1-1} x 7^{2-1} x 11^{8-3}

=3^6 x 7^1 x 11^5

= 1 x 7 x 11^5

= 7 x $11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} = \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5}$ x $6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [∵$(a \text{ x } b)^m = a^m \text{ x } b^m$]

$\Rightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [∵$a^m \text{ x } a^n = a^{m+n}$]

$\Rightarrow 2^{3n-9}$ x $3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9}$ x $3^{2n-4} = 2^{-9}\ X3^{-4}$ [∵ $\frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5$ X $\left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [∵$a^m \text{ x } a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8 \times 48 \times 10$ [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by $2 = 2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by $2 = 4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x
c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is …….. ; where $a \neq 1$

   $\because a^0 = 1$

   So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ……

   Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

   $\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

   $(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

   $2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

   $\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

   Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (\ldots\ldots)^5 \left(\frac{11}{15}\right)^9$ NCERT

   $\because a^m + a^n = a^{m+n}$

   $\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\ldots\ldots} = \left(\frac{-1}{4}\right)^{11}$

   $\because a^m \times a^n = a^{m+n}$

   $\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

   $\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

   $\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^{3}}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

   $\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ... \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{......}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} =$ (-3) x (-3) = 9

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n})$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2 \div 1)^{-2} \div (5 \div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2 \times 2 \times 2 \times 2 \times 2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\, X\, 5^{n+1} + 25\, x\, 5^n}{3\, X\, 5^{n+2} + 10\, X\, 5^{n+1}}$

$= \frac{2X5\, X\, 5^n X5 + 5x5\, x\, 5^n}{3\, X\, 5^n\, X5X5 + 2X5X5X\, 5^n}$

$= \frac{5X5\, X\, 5^n X2 + 5X5\, xX5^n}{5X\, 5\, X\, 5^n\, X3 + 5X5X5^n\, X\, 2}$

$= \frac{5X5\, X\, 5^n(2+1)}{5X\, 5\, X\, 5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^m = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^2 = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 \, X \, 7^2 X \, 11^8}{21 \, x \, 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \, X \, 7^2 X \, 11^8}{3X \, 7 \, X \, 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

$ii)$ 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \; X \; 3^2 \; X \; 3^n - (27)^n)}{(3^3)^5 x \; 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \; 3^2 X 3^n - (3 \; x \; 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \; x \; 3 \; x \; 3}$$

$$\Longrightarrow \frac{(3^2)^n \; X \; 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \; X \; 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} x \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1} + (2\text{-}1 - 3\ \text{-}1)\text{-}1$

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \, X \, 9^3 \, X \, 4}{6^3 \, X \, 8^2 \, X \, 27}$

b. 2^3 x a^3 x $5a^4$

$a. \quad \frac{12^4 \, X \, 9^3 \, X \, 4}{6^3 \, X \, 8^2 \, X \, 27} \quad = \quad \frac{(3 \, X 2^2)^4 \, X \, (3^2)^3 \, X \, 2^2}{(2 \, X \, 3)^3 \, X \, (2^3)^2 \, X \, 3^3}$

$\frac{3^4 \, X 2^8 X 3^6 X 2^2}{2^3 \, X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \, X \, 3^{6+4}}{2^{6+3} \, X \, 3^{3+3}}$ $= 2^{10-9}$ x 3^{10-6}

$= 2$ x $3^4 = 2$ x $81 = 162$.

b. 2^3 x a^3 x $5a^4$

$= 8$ x a^3 x 5 x a^4

$= 40$ x a^{3+4}

$= 40$ x a^7

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x $(5-1) = 100$

$\Longrightarrow 5^{2n-2}$ x $4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2$.

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4) X (-4) X (-4) X (-4) X (-4)}{3 X 3 X 3 X 3 X 3}$

$= \frac{(-4)^5}{(3)^5} = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x 6^{2n-4} = \frac{1}{12^4 X 2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4 X 2}$

$\Rightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2 X 2 X 3)^4 X 2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4 X 2^4 X 3^4 X 2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1} X 3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9 X 3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9} X 3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3 - 4 X 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) x \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \text{ x } 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

x = 3x 10^8 x 48 x 10 [By cross multiplication]

x = 144x 10^8 = 144x 10^{11} metres.

∴ The distance of Sun from Earth is 1.44 x 10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x 2=2^2 = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x 2=2^3 = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x (-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)x(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27 x 10^4 b) 12.7 x 10^4 c) 127 x 10^2 d) 1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^0) x 4^0$ d) $(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$ = ...

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m \div a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m \div a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m \times a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^8 \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \times 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2\,=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore$ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \text{ x } 5)^{5\,=}$ 10^5 ($\therefore$ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = \ a^{m-n}\right]$

= a^2 x a^8 ($\therefore$ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x $10^{\,5}$ + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times2 \times2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times 2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3   b) 128 as power of 2   c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^2 = 7^{50x2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2x2x2x2x2x2x2x2x2 = 2^9$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ $[\therefore a^m \div a^n = a^{m-n}]$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \ X\ 3^2\ X\ 3^n - (27)^n)}{(3^3)^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X\ 3^2 X 3^n - (3\ x\ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1} + (2\text{-}1 – 3\ \text{-}1)\text{-}1$

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a.\frac{12^4 \ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a.\ \frac{12^4\ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27} = \frac{(3\ X 2^2)^4\ X\ (3^2)^3\ X\ 2^2}{(2\ X\ 3)^3\ X\ (2^3)^2\ X\ 3^3}$

$\frac{3^4\ X 2^8 X 3^6 X 2^2}{2^3\ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2}\ X\ 3^{6+4}}{2^{6+3}\ X\ 3^{3+3}} = 2^{10-9} \text{ x } 3^{10-6}$

$= 2 \text{ x } 3^4 = 2 \text{ x } 81 = 162.$

b. 2^3 x a^3 x $5a^4$

$= 8 \text{ x } a^3 \text{ x } 5 \text{ x } a^4$

$= 40 \text{ x } a^{3+4}$

$= 40 \text{ x } a^7$

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \text{ x } (5-1) = 100$

$\Longrightarrow 5^{2n-2} \text{ x } 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5}$ x $6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [∵(a x b)^m = a^m x b^m]

$\Rightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [∵a^m x a^n = a^{m+n}]

$\Rightarrow 2^{3n-9}$ x $3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9}$ x 3^{2n-4} = $2^{-9}\ X3^{-4}$ [∵ $\frac{1}{a^m}$= a^{-m}]

8. Find x such, that $\left(\frac{1}{5}\right)^5$ X $\left(\frac{1}{5}\right)^{19}$ =$\left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [∵a^m x a^n = a^{m+n}]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8 X 60}$

$x = 3x\ 10^8 \times 48 \times 10$ [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \times 3^2}{4 \times 18}$ b) $[(-2)^3 \times (-2)^4] \div (-2)^7$ c) $\frac{3^0 \times 5^3}{5 \times 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b) 72×10^8 c) 7.2×10^8 d) 7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m \div a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m \div a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m \div a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ... \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because 3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{......}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \; 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^8 \div (-3)^5 = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 x 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 x x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. x^m x $x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 x \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. 5^0 x 25^0 x $125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. 876543 = 8 x 10^5 + 7x 10^4 + 6 x 10^3 + 5 x 10^2 + 4 x 10^1 +3 x 10^0

22. 600060 = 6 x 10^5+6 x 10^2

23. 4 x 10^5 + 3 x 10^4 +2 x 10^3 +1 x10^0 = 432010

24. 8 x 10^6 + 2 x 10^4 +5 x 10^2 + 9 x 10^0 = 8020509

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^{5=}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2 \div 1)^{-2} \div (5 \div 1)^{-1}]^2 \text{ x } \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \text{ x } \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\, X\, 5\right)^2 \text{ x } \left(\frac{2\,X\,2X\,2}{-5}\right)$

$= \frac{1}{2^2} \text{x } 5^2 \text{ x } \frac{2^3}{-5}$

$= \frac{2^3\,X\,5^2}{2^2 X\,5}$

$= -2^{3-2} \text{ x } 5^{2-1}$

$= -2 \text{ x } 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \text{ x } 5^3 = 5^9$ b) $8\text{x } 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\text{x } 2 \text{ x}2 \text{ x}2^{n+2}$

$=2\text{x}2\text{x}2\text{x}2\text{x}2$

$2^3 \text{ x}2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\,X\,5^{n+1} + 25\,x\,5^n}{3\,X\,5^{n+2} + 10\,X\,5^{n+1}}$

$= \frac{2X5\,X\,5^n X5 + 5x5\,x\,5^n}{3\,X\,5^n\,X5X5 + 2X5X5X\,5^n}$

$= \frac{5X5\,X\,5^n X2 + 5X5\,xX5^n}{5X\,5\,X\,5^n\,X3 + 5X5X5^n\,X\,2}$

$= \frac{5X5\,X\,5^n(2+1)}{5X\,5\,X\,5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} x 7^{2-1} x 11^{8-3}$ $[\therefore a^m \div a^n = a^{m-n}]$

$=3^{1-1} x 7^{2-1} x 11^{8-3}$

$=3^6 x 7^1 x 11^5$

$= 1 x 7 x 11^5$

$= 7 x 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \; X \; 3^2 \; X \; 3^n - (27)^n)}{(3^3)^5 x \; 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \; 3^2 X 3^n - (3 \; x \; 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \; x \; 3 \; x \; 3}$$

$$\Longrightarrow \frac{(3^2)^n \; X \; 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \; X \; 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1} + (2\text{-}1 – 3\ \text{-}1)\text{-}1$

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} = \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}}$ $= 2^{10-9}$ x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x (5-1) =100

$\Longrightarrow 5^{2n-2}$ x 4 =100

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3\times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1}$ as a rational number

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4}-\frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3\times 10^8 = \frac{x}{8 X 60}$

$x = 3\times 10^8 \times 48 \times 10$ [By cross multiplication]

$x = 144\times 10^8 = 144\times 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5 \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)x(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d)$(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$x $\left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2\ X\ 3^2}{4\ x\ 18}$ b) $[(-2)^3 X\ (-2)^4] \div (-2)^7$ c) $\frac{3^0\ X\ 5^3}{5\ X\ 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b)72 x 10^8 c)7.2 x 10^8 d)7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to 2^{6}?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is …….. ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$ = ……

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (\ldots\ldots)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\ldots\ldots} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 x\ 3^{....}$

$\because 432 = 2\ x 2\ x 2 x 2 x 3 x 3 x 3 = 2^4 x\ 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ...\ x\ 10^{10}$ NCERT

$\because$ $88880000000 = 8.888\ x\ 10^7$ and $8888 = 8.888\ x\ 10^3$

So, $88880000000 = 8.888\ x\ 10^7\ x\ 10^3 =$ **8.888**$x\ 10^{10}$

7. $340900000 = 3.409\ x\ 10^{....}$

$\because$ $3409 = 3.409\ x\ 10^3$

$\Longrightarrow 3.409\ x\ 10^3\ x\ 10^5 = 3.409\ x\ 10^8$

8. $53700000 = ...\ x\ 10^7$

$53700000 = 537\ x\ 5.37\ x\ 10^2$

and $= 5.37\ x\ 10^2\ x\ 10^5$

$= 5.37\ x\ 10^7$

9. $27500000 = 2.75\ x\ 10^{.....}$

$27500000 = 275\ x\ 10^5$

$\because$ $275 = 2.75\ x\ 10^2$

So, $2.75\ x\ 10^2\ x\ 10^5 = 2.75\ x\ 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15
$\because 3^2 = 3\ x\ 3 = 9$
$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \; 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and 216 < 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^8 \div (-3)^5 = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. 1^0x 0^1 =1

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \text{x} x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. x^m x $x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \text{x} \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. 5^0 x 25^0 x $125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. 876543 = 8 x 10^5 + 7x 10^4 + 6 x 10^3 + 5 x 10^2 + 4 x 10^1 +3 x 10^0

22. 600060 = 6 x 10^5+6 x 10^2

23. 4 x 10^5 + 3 x 10^4 +2 x 10^3 +1 x10^0 = 432010

24. 8 x 10^6 + 2 x 10^4 +5 x 10^2 + 9 x 10^0 = 8020509

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2\,=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \text{ x } 5)^{5\,=}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = \; a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

$25730 = 2.573 \times 10{,}000$

$= 2.573 \times 10^4$

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

$270404 = 2{,}00{,}000 + 70{,}000 + 400 + 4$

$= 2 \times 1{,}00{,}000, + 7 \times 10{,}000 + 4 \times 100 \times 4 + 1$

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) $230061 = 2{,}00{,}000 + 30{,}000 + 60 + 1$

$= 2 \times 1{,}00{,}000, + 3 \times 10{,}000 + 6 \times 10 + 1$

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\,X\,2X\,2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\,X\,5^2}{2^2 X\,5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times 2 \times 2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times 2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\,X\,5^{n+1}+25\,x\,5^n}{3\,X\,5^{n+2}+\,10\,X\,5^{n+1}}$

$= \frac{2X5\,X\,5^n X5+5x5\,x\,5^n}{3\,X\,5^n\,X5X5+2X5X5X\,5^n}$

$= \frac{5X5\,X\,5^n X2+5X5\,xX5^n}{5X\,5\,X\,5^n\,X3+5X5X5^n\,X\,2}$

$= \frac{5X5\,X\,5^n(2+1)}{5X\,5\,X\,5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m =} a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2 =} 7^{50x2} = 7^{100}$ [As we know $(a^{m})^{n =} a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 \times 7^2 \times 11^8}{21 \times 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \times 7^2 \times 11^8}{3 \times 7 \times 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^5$.

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \ X \ 3^2 \ X \ 3^n - (27)^n)}{(3^3)^5 x \ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \ 3^2 X 3^n - (3 \ x \ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \ x \ 3 \ x \ 3}$$

$$\Longrightarrow \frac{(3^2)^n \ X \ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \ X \ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a.\ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} = \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}} = 2^{10-9}$ x 3^{10-6}

$= 2$ x $3^4 = 2$ x $81 = 162$.

b. 2^3 x a^3 x $5a^4$

$= 8$ x a^3 x 5 x a^4

$= 40$ x a^{3+4}

$= 40$ x a^7

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x $(5-1) = 100$

$\Longrightarrow 5^{2n-2}$ x $4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore 2n-2 = 2$

$\Longrightarrow 2n = 2 + 2$

$\Longrightarrow 2n = 4$

$\Longrightarrow n = \frac{4}{2} = 2$.

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \text{ x } 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \text{ x } (3\text{x } 2)^{2n-4} \text{ x}2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \text{ x } 3^{2n-4} \text{ x}2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [∵(a x b)^m = a^m x b^m]

$\Rightarrow 2^{(n-5)} \text{ x } 2n\text{-}4 \text{ x}3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [∵a^m x a^n = a^{m+n}]

$\Rightarrow 2^{3n-9} \text{ x } 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \text{ x } 3^{2n-4} = 2^{-9}\ X3^{-4}$ [∵ $\frac{1}{a^m}$= a^{-m}]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \text{ X } \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [∵a^m x a^n = a^{m+n}]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ as a rational number

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3 - 4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^2\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x
c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 $x3^2$ c) 2^3x3^3 d) 2^2 $x3^2$

2. Value of $(-2)^3$ $x(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}) x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b) 72×10^8 c) 7.2×10^8 d) 7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $\quad [\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (\ldots\ldots)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^{5} = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\ldots\ldots} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^{3}}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 x\ 3^{....}$

$\because 432 = 2 \ x 2 \ x 2 x 2 x 3 x 3 x 3 = 2^4 x\ 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. 88880000000 = ... x 10^{10} NCERT

$\because$ 88880000000 = 8.888 x 10^7 and 8888 = 8.888 x 10^3

So, 88880000000 = 8.888 x 10^7 x 10^3= **8.888**x 10^{10}

7. 340900000 = 3.409 x $10^{....}$

$\because$ 3409 = 3.409 x 10^3

$\Rightarrow$3.409 x 10^3 x 10^5 = 3.409 x 10^8

8. 53700000 = ... x 10^7

53700000 = 537 x 5.37 x 10^2

and = 5.37 x 10^2 x 10^5

= 5.37 x 10^7

9. 27500000 = 2.75 x $10^{.....}$

27500000 =275 x 10^5

$\because$ 275 = 2.75 x 10^2

So, 2.75 x 10^2 x 10^5 =2.75 x 10^7

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ----------
3. $\left[\left(\frac{7}{11}\right)^3\right]^4 = \left(\frac{7}{11}\right)$ ----------
4. $\left(\frac{6}{13}\right)^{10} \div \left[\left(\frac{6}{13}\right)^5\right]^2 = \left(\frac{6}{13}\right)$ ----------
5. $\left[\left(\frac{-1}{4}\right)^{16}\right]^2 = \left(\frac{-1}{4}\right)$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \times 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, 2^8 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and **8^2 = 8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} = (-3) \times (-3) = 9$

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^5 = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = $3.186500000 \times 10^9 = 3.1865 \times 10^9$

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2 \times 2 \times 2 \times 2 \times 2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1} + 25\ x\ 5^n}{3\ X\ 5^{n+2} + 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5 + 5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5 + 2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2 + 5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3 + 5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3   b) 128 as power of 2   c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^{m})^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^5$.

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27}$

b. 2^3 x a^3 x $5a^4$

$a. \; \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27} \; = \; \frac{(3 \; X 2^2)^4 \; X \; (3^2)^3 \; X \; 2^2}{(2 \; X \; 3)^3 \; X \; (2^3)^2 \; X \; 3^3}$

$\frac{3^4 \; X 2^8 X 3^6 X 2^2}{2^3 \; X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \; X \; 3^{6+4}}{2^{6+3} \; X \; 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \text{ x } (5-1) = 100$

$\Longrightarrow 5^{2n-2} \text{ x } 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times\left(-\frac{4}{3}\right) \times\left(-\frac{4}{3}\right) \times\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} \quad = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} \quad = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} \quad = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} \quad = \frac{1}{2^4\ X2^4X3^4X2}$ $\quad [\because (a \times b)^m = a^m \times b^m]$

$\Longrightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} \quad = \frac{1}{2^{4+4+1}\ X3^4}$ $\quad [\because a^m \times a^n = a^{m+n}]$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} \quad = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} \quad = 2^{-9}\ X3^{-4}$ $\quad [\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} \quad = \left(\frac{1}{5}\right)^{8x}$ $\quad [\because a^m \times a^n = a^{m+n}]$

$\Longrightarrow \left(\frac{1}{5}\right)^{24} \quad = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} \quad = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by $2 = 2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by $2 = 4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)x(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x
c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 ……….. 15 b) 2^3 ……….. 3^2 c) 7^4 ……….. 5^4

d) 10000 ……….. 10^5 e) 6^3 ……….. 4^4

a) 3^2 ……….. 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) ∵ 2^3 = 2 x2 x 2 = 8 and

3^2 = 3 x 3 = 9,8< 9

So, $2^3 < 3^2$

c) ∵ 7^4 = 7 x 7 x7 x 7 = 2401

and5^4 = 5 x 5x 5 x 5 = 625

∴2401 > 625

So, 74 > 59

d) 10000=10 x 10 x 10 x 10 = 10^4

10^4 =10000, 10^5 =100000

∵ 10000 < 100000

So, 10000<10^5

e) ∵ 6^3 = 6 x 6 x6 = 216

and4^4 = 4 x 4 x 4 x 4 = 256

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, 2^8 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and **8^2 = 8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2} =$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^{5} = 10^5$ (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

$25730 = 2.573 \times 10{,}000$

$= 2.573 \times 10^4$

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

$270404 = 2{,}00{,}000 + 70{,}000 + 400 + 4$

$= 2 \times 1{,}00{,}000, + 7 \times 10{,}000 + 4 \times 100 \times 4 + 1$

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) $230061 = 2{,}00{,}000 + 30{,}000 + 60 + 1$

$= 2 \times 1{,}00{,}000, + 3 \times 10{,}000 + 6 \times 10 + 1$

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times2 \times2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\, X\, 5^{n+1}+25\, x\, 5^n}{3\, X\, 5^{n+2}+ 10\, X\, 5^{n+1}}$

$= \frac{2X5\, X\, 5^n X5+5x5\, x\, 5^n}{3\, X\, 5^n\, X5X5+2X5X5X\, 5^n}$

$= \frac{5X5\, X\, 5^n X2+5X5\, xX5^n}{5X\, 5\, X\, 5^n\, X3+5X5X5^n\, X\, 2}$

$= \frac{5X5\, X\, 5^n(2+1)}{5X\, 5\, X\, 5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^2 = 7^{50\times2} = 7^{100}$ [As we know $(a^{m})^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2\times2\times2\times2\times2\times2\times2\times2\times2 = 2^{9}$.

4. Simplify : $\frac{3 \ X \ 7^2 X \ 11^8}{21 \ x \ 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \ X \ 7^2 X \ 11^8}{3X \ 7 \ X \ 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^5$.

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000×10^8

= 3.84×10^8

∴The distance between Earth and Moon is 3.84×10^8m

ii) 1,02,70,00,000 = 1.027000000×10^9

= 1.027×10^9

∴ The population of India was 1.027×10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \times \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, $n = \frac{12}{3} = 4$.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 X 9^3 X 4}{6^3 X 8^2 X 27}$

b. 2^3 x a^3 x $5a^4$

$a. \frac{12^4 X 9^3 X 4}{6^3 X 8^2 X 27} = \frac{(3 X 2^2)^4 X (3^2)^3 X 2^2}{(2 X 3)^3 X (2^3)^2 X 3^3}$

$\frac{3^4 X 2^8 X 3^6 X 2^2}{2^3 X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} X 3^{6+4}}{2^{6+3} X 3^{3+3}} = 2^{10-9} \times 3^{10-6}$

$= 2 \times 3^4 = 2 \times 81 = 162.$

b. 2^3 x a^3 x $5a^4$

$= 8 \times a^3 \times 5 \times a^4$

$= 40 \times a^{3+4}$

$= 40 \times a^7$

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ $[\because(a \text{ x } b)^m = a^m \text{ x } b^m]$

$\Longrightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ $[\because a^m \text{ x } a^n = a^{m+n}]$

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = 2^{-9}\ X3^{-4}$ $[\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5$ x $\left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ $[\because a^m \text{ x } a^n = a^{m+n}]$

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1} \quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8 \times 48 \times 10$ [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 x3^2 c) 2^3x3^3 d) 2^2 x3^2

2. Value of$(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1)-1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to $2^{6?}$

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$ = ...

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \text{x } 3^{\cdots}$

$\because 432 = 2 \text{ x} 2 \text{ x} 2 \text{x} 2 \text{x} 3 \text{x} 3 \text{x} 3 = 2^4 \text{x } 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \text{ x } 10^{10}$ NCERT

$\because 88880000000 = 8.888 \text{ x } 10^7$ and $8888 = 8.888 \text{ x } 10^3$

So, $88880000000 = 8.888 \text{ x } 10^7 \text{ x } 10^3 = \mathbf{8.888} \text{x } 10^{10}$

7. $340900000 = 3.409 \text{ x } 10^{\cdots}$

$\because 3409 = 3.409 \text{ x } 10^3$

$\Longrightarrow 3.409 \text{ x } 10^3 \text{ x } 10^5 = 3.409 \text{ x } 10^8$

8. $53700000 = \ldots\ldots\ldots \text{ x } 10^7$

$53700000 = 537 \text{ x } 5.37 \text{ x } 10^2$

and $= 5.37 \text{ x } 10^2 \text{ x } 10^5$

$= 5.37 \text{ x } 10^7$

9. $27500000 = 2.75 \text{ x } 10^{\cdots\cdots}$

$27500000 = 275 \text{ x } 10^5$

$\because \quad 275 = 2.75 \text{ x } 10^2$

So, $2.75 \text{ x } 10^2 \text{ x } 10^5 = 2.75 \text{ x } 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15
$\because 3^2 = 3 \text{ x } 3 = 9$
$\therefore 15 > 9$

So, $3^2 < 15$

b) ∵ 2^3 = 2 x2 x 2 = 8 and

3^2 = 3 x 3 = 9,8< 9

So, $2^3 < 3^2$

c) ∵ 7^4 = 7 x 7 x7 x 7 = 2401

and5^4 = 5 x 5x 5 x 5 = 625

∴2401 > 625

So, 74 > 59

d) 10000=10 x 10 x 10 x 10 = 10^4

10^4 =10000, 10^5 =100000

∵ 10000 < 100000

So, $10000 < 10^5$

e) ∵ 6^3 = 6 x 6 x6 = 216

and4^4 = 4 x 4 x 4 x 4 = 256

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5=} 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573 x 10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, 2^5 = 2 x 2 x 2 x 2 x 2 = 32

And 5^3 = 5 x 5 x 5 = 125

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3}$ x 9

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

= 2 x 10^5 + 7 x 10^4 + 4 x 10^2 + 4 x 10^0

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

= 2 x 10^5 + 3 x 10^4 + 6 x 10^2 + 1 x 10^0

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2\times2\times2\times2\times2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\, X\, 5^{n+1} + 25\, x\, 5^n}{3\, X\, 5^{n+2} + 10\, X\, 5^{n+1}}$

$= \frac{2X5\, X\, 5^n X5 + 5x5\, x\, 5^n}{3\, X\, 5^n\, X5X5 + 2X5X5X\, 5^n}$

$= \frac{5X5\, X\, 5^n X2 + 5X5\, xX5^n}{5X\, 5\, X\, 5^n\, X3 + 5X5X5^n\, X\, 2}$

$= \frac{5X5\, X\, 5^n (2+1)}{5X\, 5\, X\, 5^n\, (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3   b) 128 as power of 2   c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50\times 2} = 7^{100}$ [As we know $(a^{m})^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 \ X \ 7^2 X \ 11^8}{21 \ x \ 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \ X \ 7^2 X \ 11^8}{3X \ 7 \ X \ 11^3}$

$=3^{1\text{-}1} \times 7^{2\text{-}1} \times 11^{8\text{-}3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1\text{-}1} \times 7^{2\text{-}1} \times 11^{8\text{-}3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, $270 = 2\text{x } 3 \text{ x}3\text{x}3 \text{ x}5 = 2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

$729 = 3 \text{ x}3\text{x } 3 \text{ x}3 \times 3 \times 3 = 3^6$

$64 = 2\text{x}2\text{x}2\text{x}2\text{x } 2\text{x}2 = 2^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \ X\ 3^2\ X\ 3^n - (27)^n)}{(3^3)^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X\ 3^2 X 3^n - (3\ x\ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} x \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} = \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}}$ $= 2^{10-9}$ x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x (5-1) =100

$\Longrightarrow 5^{2n-2}$ x 4 =100

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [∵$(a \times b)^m = a^m \times b^m$]

$\Longrightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [∵$a^m \times a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9}$ x 3^{2n-4} = $2^{-9}\ X3^{-4}$ [∵ $\frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [∵$a^m \times a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8 \text{ x } 48 \text{ x } 10$ [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x $2=2^2$ = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x $2=2^3$ = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11}$ = $\left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 x3^2 c) 2^3x3^3 d) 2^2 x3^2

2. Value of$(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of ‘243’?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1)-1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}) x 4^0$ d)$(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b)72×10^8 c)7.2×10^8 d)7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to $2^{6?}$

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$ = ...

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m \div a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m \div a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96$.

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m \times a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 x\ 3^{....}$

$\because 432 = 2\ x2\ x2x2x3x3x3 = 2^4 x\ 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. 88880000000 = ... x 10^{10} NCERT

$\because$ 88880000000 = 8.888 x 10^7 and 8888 = 8.888 x 10^3

So, 88880000000 = 8.888 x 10^7 x 10^3= **8.888**x 10^{10}

7. 340900000 = 3.409 x $10^{....}$

$\because$ 3409 = 3.409 x 10^3

$\Longrightarrow$3.409 x 10^3 x 10^5 = 3.409 x 10^8

8. 53700000 = ... x 10^7

53700000 = 537 x 5.37 x 10^2

and = 5.37 x 10^2 x 10^5

= 5.37 x 10^7

9. 27500000 = 2.75 x $10^{......}$

27500000 =275 x 10^5

$\because$ 275 = 2.75 x 10^2

So, 2.75 x 10^2 x 10^5 =2.75 x 10^7

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) ∵ 2^3 = 2 x2 x 2 = 8 and

3^2 = 3 x 3 = 9,8< 9

So, $2^3 < 3^2$

c) ∵ 7^4 = 7 x 7 x7 x 7 = 2401

and5^4 = 5 x 5x 5 x 5 = 625

∴2401 > 625

So, 74 > 59

d) 10000=10 x 10 x 10 x 10 = 10^4

10^4 =10000, 10^5 =100000

∵ 10000 < 100000

So, 10000<10^5

e) ∵ 6^3 = 6 x 6 x6 = 216

and4^4 = 4 x 4 x 4 x 4 = 256

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \, X \, 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} = (-3) \times (-3) = 9$

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^5 = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2 \div 1)^{-2} \div (5 \div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2 X\, 2 X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3 X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2 \times 2 \times 2 \times 2 \times 2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10 X\, 5^{n+1} + 25\, x\, 5^n}{3 X\, 5^{n+2} + 10 X\, 5^{n+1}}$

$= \frac{2X5 X\, 5^n X5 + 5x5\, x\, 5^n}{3 X\, 5^n\, X5X5 + 2X5X5X\, 5^n}$

$= \frac{5X5 X\, 5^n X2 + 5X5\, xX5^n}{5X\, 5 X\, 5^n\, X3 + 5X5X5^n\, X\, 2}$

$= \frac{5X5 X\, 5^n(2+1)}{5X\, 5 X\, 5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^2 = 7^{50x2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3\ X\ 7^2 X\ 11^8}{21\ x\ 11^3}$

We know, 21 = 7 x 3

$= \frac{3\ X\ 7^2 X\ 11^8}{3X\ 7\ X\ 11^3}$

$=3^{\ 1-1}$ x 7^{2-1} x $11^{\ 8-3}$ [$\therefore$ $a^m \div a^n = a^{m-n}$]

$=3^{1-1}$ x 7^{2-1} x $11^{\ 8-\ 3}$

$=3^6$ x 7^1 x 11^5

= 1 x 7 x 11^5

= 7 x $11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \; X\; 3^2 \; X \; 3^n - (27)^n)}{(3^3)^5 x \; 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X\; 3^2 X 3^n - (3\; x\; 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\; x\; 3\; x\; 3}$$

$$\Longrightarrow \frac{(3^2)^n \; X\; 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \; X\; 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 X 9^3 X 4}{6^3 X 8^2 X 27}$

b. 2^3 x a^3 x $5a^4$

$$a. \frac{12^4 X 9^3 X 4}{6^3 X 8^2 X 27} = \frac{(3 X 2^2)^4 X (3^2)^3 X 2^2}{(2 X 3)^3 X (2^3)^2 X 3^3}$$

$$\frac{3^4 X 2^8 X 3^6 X 2^2}{2^3 X 3^3 X 2^6 X 3^3}$$

$= \frac{2^{8+2} X 3^{6+4}}{2^{6+3} X 3^{3+3}} = 2^{10-9} \times 3^{10-6}$

$= 2 \times 3^4 = 2 \times 81 = 162.$

b. $2^3 \times a^3 \times 5a^4$

$= 8 \times a^3 \times 5 \times a^4$

$= 40 \times a^{3+4}$

$= 40 \times a^7$

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore 2n-2 = 2$

$\Longrightarrow 2n = 2 + 2$

$\Longrightarrow 2n = 4$

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [∵$(a \text{ x } b)^m = a^m \text{ x } b^m$]

$\Longrightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [∵$a^m \text{ x } a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = 2^{-9}\ X3^{-4}$ [∵ $\frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5$ X $\left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [∵$a^m \text{ x } a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 X 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left\{\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right\}^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left\{\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right\}^{-1}$ $\quad$ $\left\{\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right\}^{-1}$

$= \left\{\left\{\frac{1}{16}\right\}^{-2}\right\}^{-1} = \left\{\left\{\frac{1}{16}\right\}^{-2}\right\}^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3.The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2) x (3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 $x3^2$ c) 2^3x3^3 d) 2^2 $x3^2$

2. Value of$(-2)^3$ $x(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20}\div(2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27×10^4 b)12.7×10^4 c)127×10^2 d)1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div(-1)-1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995,}$ then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}) x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^{m} \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^{m}\right]^{n}$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^{6}?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because\ a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because\ 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\qquad [\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $\qquad [\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^{3}}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because$ $88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because$ $3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because$ $275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \ 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^8 \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} =$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^{5} + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore$ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^{2} \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^{2} \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\text{x } 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\text{x } 2 \text{ x}2 \text{ x}2^{n+2}$

$=2\text{x}2\text{x}2\text{x}2\text{x}2$

$2^3 \text{ x}2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 27,00,00,00,00,000$

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 15,00,00,000$

Since $27,00,00,00,00,000 > 15,00,00,000$

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 \ X \ 7^2 X \ 11^8}{21 \ x \ 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \ X \ 7^2 X \ 11^8}{3X \ 7 \ X \ 11^3}$

$=3^{\ 1-1} \times 7^{2-1} \times 11^{\ 8-3}$ $\qquad$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{\ 8-\ 3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 $\qquad$ ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000×10^8

$= 3.84 \times 10^8$

∴The distance between Earth and Moon is 3.84×10^8 m

ii) 1,02,70,00,000 = 1.027000000×10^9

$= 1.027 \times 10^9$

∴ The population of India was 1.027×10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \times \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} \ = \ \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}}$ $= 2^{\ 10-9}$ x 3^{10-6}

$= 2$ x 3^4 $=2$ x $81 = 162$.

b. 2^3 x a^3 x $5a^4$

$= 8$ x a^3 x 5 x a^4

$= 40$ x $a^{\ 3+4}$

$= 40$ x a^7

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{\ (2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{\ n-1} \ + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{\ 2n-2} \ + 100 = 5^{2n-1}$

$\Longrightarrow 5^{\ 2n-2}$ - $5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1}$ - $5^{\ 2n-2} = 100$

$\Longrightarrow 5^{\ 2n-2}$ x $(5-1) =100$

$\Longrightarrow 5^{\ 2n-2}$ x $4 =100$

$\Longrightarrow 5^{\ 2n-2} = \frac{100}{4} \ = 25$

Thus, $5^{\ 2n-2} = 5^2$

As base is same on both sides

$\therefore$ $2n-2 = 2$

$\Longrightarrow 2n = 2 + 2$

$\Longrightarrow 2n = 4$

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \text{x} \left(-\frac{4}{3}\right) \text{x} \left(-\frac{4}{3}\right) \text{x} \left(-\frac{4}{3}\right) \text{x} \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \text{ x } 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \text{ x } (3\text{x } 2)^{2n-4} \text{ x} 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \text{ x } 3^{2n-4} \text{ x} 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ $[\because (a \text{ x } b)^m = a^m \text{ x } b^m]$

$\Rightarrow 2^{(n-5)} \text{ x } 2n\text{-}4 \text{ x} 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ $[\because a^m \text{ x } a^n = a^{m+n}]$

$\Rightarrow 2^{3n-9} \text{ x } 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \text{ x } 3^{2n-4} = 2^{-9}\ X3^{-4}$ $[\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5 \text{ X } \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ $[\because a^m \text{ x } a^n = a^{m+n}]$

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3 \times 10^8 = \frac{x}{8 X 60}$

$x = 3 \times 10^8 \times 48 \times 10$ [By cross multiplication]

$x = 144 \times 10^8 = 144 \times 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

$\Longrightarrow$ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) $2^2 x3^2$ c) 2^3x3^3 d) $2^2 x3^2$

2. Value of $(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27×10^4 b)12.7×10^4 c)127×10^2 d)1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1)-1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995,}$ then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b) 72×10^8 c) 7.2×10^8 d) 7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^8 \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} = (-3) \times (-3) = 9$

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n})$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = $3.186500000 \times 10^9 = 3.1865 \times 10^9$

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573 x 10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, 2^5 = 2 x 2 x 2 x 2 x 2 = 32

And 5^3 = 5 x 5 x 5 = 125

∴ 125 > 32

$\Longrightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3}$ x 9

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

= 2 x 10^5 + 7 x 10^4 + 4 x 10^2 + 4 x 10^0

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

= 2 x 10^5 + 3 x 10^4 + 6 x 10^2 + 1 x 10^0

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2\times2\times2\times2\times2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1} + 25\ x\ 5^n}{3\ X\ 5^{n+2} + 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5 + 5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5 + 2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2 + 5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3 + 5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times 2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3\ X\ 7^2 X\ 11^8}{21\ x\ 11^3}$

We know, 21 = 7 x 3

$= \frac{3\ X\ 7^2 X\ 11^8}{3X\ 7\ X\ 11^3}$

$=3^{\ 1\text{-}1} \times 7^{2\text{-}1} \times 11^{\ 8\text{-}3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1\text{-}1} \times 7^{2\text{-}1} \times 11^{\ 8\text{-}\ 3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \, \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a.\frac{12^4 \ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a.\ \frac{12^4\ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27} = \frac{(3\ X 2^2)^4\ X\ (3^2)^3\ X\ 2^2}{(2\ X\ 3)^3\ X\ (2^3)^2\ X\ 3^3}$

$\frac{3^4\ X 2^8 X 3^6 X 2^2}{2^3\ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2}\ X\ 3^{6+4}}{2^{6+3}\ X\ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Longrightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ as a rational number

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4\,X\,4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1} \qquad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} \quad = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

x = $3x\ 10^8$ x 48 x 10 [By cross multiplication]

x = $144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x $2=2^2$ = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x $2=2^3$ = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11}$ = $\left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x
b) Third power of x
c) Fifth power of x
d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) 2^2 x3^2 c) $2^3 x 3^3$ d) 2^2 x3^2

2. Value of$(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1)-1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}) x 4^0$ d)$(3^0 - 2^0) \times (3^0 + 2^{\,0})$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X \, (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b)72 x 10^8 c)7.2 x 10^8 d)7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^{m} \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^{m}\right]^{n}$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to $2^{6?}$

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $\quad [\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \ 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7
2. One hour = 60^2 seconds
3. $1^0 \times 0^1 = 1$
4. $(-3)^4 = -12$
5. $3^4 > 4^3$
6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$
7. $(10 + 10)^{10} = 10^{10} + 10^{10}$
8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.
9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.
10. 4^2 is greater than 2^4.
11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.
12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.
13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.
14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.
15. 4^9 is greater than 16^3.
16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$
17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$
18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$
19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$
20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10
21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$
22. $600060 = 6 \times 10^5 + 6 \times 10^2$
23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$
24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$
25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \, X \, 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^{5=}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = \quad a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573 x 10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

= $2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

= $2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2 \times 2 \times 2 \times 2 \times 2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1} + 25\ x\ 5^n}{3\ X\ 5^{n+2} + 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5 + 5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5 + 2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2 + 5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3 + 5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3   b) 128 as power of 2   c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} x 7^{2-1} x 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} x 7^{2-1} x 11^{8-3}$

$=3^6 x 7^1 x 11^5$

$= 1 x 7 x 11^5$

$= 7 x 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \; X \; 3^2 \; X \; 3^n - (27)^n)}{(3^3)^5 x \; 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \; 3^2 X 3^n - (3 \; x \; 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \; x \; 3 \; x \; 3}$$

$$\Longrightarrow \frac{(3^2)^n \; X \; 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \; X \; 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1} + (2\text{-}1 - 3\ \text{-}1)\text{-}1$

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27}$

b. 2^3 x a^3 x $5a^4$

$a. \; \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27} \; = \; \frac{(3 \; X 2^2)^4 \; X \; (3^2)^3 \; X \; 2^2}{(2 \; X \; 3)^3 \; X \; (2^3)^2 \; X \; 3^3}$

$\frac{3^4 \; X 2^8 X 3^6 X 2^2}{2^3 \; X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \; X \; 3^{6+4}}{2^{6+3} \; X \; 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x (5-1) =100

$\Longrightarrow 5^{2n-2}$ x 4 =100

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ $[\because (a \times b)^m = a^m \times b^m]$

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ $[\because a^m \times a^n = a^{m+n}]$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ $[\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ $[\because a^m \times a^n = a^{m+n}]$

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4}-\frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3\text{x } 10^8 = \frac{x}{8\ X\ 60}$

$x = 3\text{x } 10^8 \text{ x } 48 \text{ x } 10$ [By cross multiplication]

$x = 144\text{x } 10^8 = 144\text{x } 10^{11}$ metres.

∴ The distance of Sun from Earth is $1.44 \text{ x } 10^{11}$m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

$\Longrightarrow$ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \text{ x } 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \text{ x } 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0 \times (-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5 \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)x(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}) x 4^0$ d)$(3^0 - 2^0) \times (3^0 + 2^{\ 0})$

16 .Square of $\left(\frac{-2}{3}\right) is$:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \ X \ 3^2}{4 \ x \ 18}$ b) $[(-2)^3 X \ (-2)^4] \div (-2)^7$ c) $\frac{3^0 \ X \ 5^3}{5 \ X \ 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b)72×10^8 c)7.2×10^8 d)7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^{m} \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^{m}\right]^{n}$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to 2^{6}?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because\ a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because\ 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $\quad [\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore\ \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ... \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{......}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \ 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \times 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} = (-3) \times (-3) = 9$

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\because a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\because \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\because a^m \times a^n = a^{m+n})$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times 2 \times 2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times 2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\, X\, 5^{n+1}+25\, x\, 5^n}{3\, X\, 5^{n+2}+10\, X\, 5^{n+1}}$

$= \frac{2X5\, X\, 5^n X5+5x5\, x\, 5^n}{3\, X\, 5^n\, X5X5+2X5X5X\, 5^n}$

$= \frac{5X5\, X\, 5^n X2+5X5\, xX5^n}{5X\, 5\, X\, 5^n\, X3+5X5X5^n\, X\, 2}$

$= \frac{5X5\, X\, 5^n(2+1)}{5X\, 5\, X\, 5^n\, (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50 \times 2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3\ X\ 7^2 X\ 11^8}{21\ x\ 11^3}$

We know, 21 = 7 x 3

= $\frac{3\ X\ 7^2 X\ 11^8}{3X\ 7\ X\ 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [∴ $a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^5$.

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

∴ 729 x 64 = $3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \ X\ 3^2\ X\ 3^n - (27)^n)}{(3^3)\ ^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)\ ^n X\ 3^2 X 3^n - (3\ x\ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} x\ \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X \ 9^3 \ X \ 4}{6^3 \ X \ 8^2 \ X \ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X \ 9^3 \ X \ 4}{6^3 \ X \ 8^2 \ X \ 27} \ = \ \frac{(3 \ X 2^2)^4 \ X \ (3^2)^3 \ X \ 2^2}{(2 \ X \ 3)^3 \ X \ (2^3)^2 \ X \ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X \ 3^{6+4}}{2^{6+3} \ X \ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \text{ x } (5-1) = 100$

$\Longrightarrow 5^{2n-2} \text{ x } 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3\times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3 - 4 X 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^{2}\right]^{-1} \quad \left[\left\{\left(\frac{-1}{4}\right) \text{ x } \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \text{ x } 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2) x (3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 x3^2 c) 2^3x3^3 d) 2^2 x3^2

2. Value of$(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1)$-1^{100}?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995}$= k.$2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}) x 4^0$ d) $(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

   $\because\ a^0 = 1$

   So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

   Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

   $\because\ 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because a^m + a^n = a^{m-n}]$

   $(1)^{92} = 1.$ $\quad [\because (a)^{\text{even integer}} = 1]$

   $2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

   $\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

   Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

   $\because a^m + a^n = a^{m+n}$

   $\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

   $\because a^m \times a^n = a^{m+n}$

   $\therefore\ \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

   $\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

   $\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

   $\Rightarrow x = 8$

5. $432 = 2^4 x\ 3^{....}$

$\because 432 = 2\ x 2\ x 2 x 2 x 3 x 3 x 3 = 2^4 x\ 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. 88880000000 = ... x 10^{10} NCERT

$\because$ 88880000000 = 8.888 x 10^7 and 8888 = 8.888 x 10^3

So, 88880000000 = 8.888 x 10^7 x 10^3= **8.888**x 10^{10}

7. 340900000 = 3.409 x $10^{....}$

$\because$ 3409 = 3.409 x 10^3

$\Rightarrow$3.409 x 10^3 x 10^5 = 3.409 x 10^8

8. 53700000 = ... x 10^7

53700000 = 537 x 5.37 x 10^2

and = 5.37 x 10^2 x 10^5

= 5.37 x 10^7

9. 27500000 = 2.75 x $10^{......}$

27500000 =275 x 10^5

$\because$ 275 = 2.75 x 10^2

So, 2.75 x 10^2 x 10^5 =2.75 x 10^7

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \ 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2\,=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5\,=} 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

= $2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

= $2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2$ x $\left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2$ x $\left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2$ x $\left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2}$x 5^2 x $\frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2}$ x 5^{2-1}

= -2 x 5

= -10.

3. Find the values of n, when:

a) 5^{2n} x $5^3 = 5^9$ b) 8x 2^{n+2}=32

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

∴ 2n + 3 = 9

$\Longrightarrow$ 2n = 9-3

$\Longrightarrow$ 2n =6

Thus, n = $\frac{6}{2}$ = 3.

b) $\Longrightarrow$ 2x 2 x2 x2^{n+2}

=2x2x2x2x2

2^3 x2^{n+2}=2^5

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

∴ n + 5 = 5

$\Longrightarrow$ n = 5 – 5 = 0

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \, \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \, X \, 9^3 \, X \, 4}{6^3 \, X \, 8^2 \, X \, 27}$

b. 2^3 x a^3 x $5a^4$

$a. \quad \frac{12^4 \, X \, 9^3 \, X \, 4}{6^3 \, X \, 8^2 \, X \, 27} \quad = \quad \frac{(3 \, X 2^2)^4 \, X \, (3^2)^3 \, X \, 2^2}{(2 \, X \, 3)^3 \, X \, (2^3)^2 \, X \, 3^3}$

$\frac{3^4 \, X 2^8 X 3^6 X 2^2}{2^3 \, X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \, X \, 3^{6+4}}{2^{6+3} \, X \, 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4) X (-4) X (-4) X (-4) X (-4)}{3 X 3 X 3 X 3 X 3}$

$= \frac{(-4)^5}{(3)^5} = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x 6^{2n-4} = \frac{1}{12^4 X 2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4 X 2}$

$\Longrightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2 X 2 X 3)^4 X 2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4 X 2^4 X 3^4 X 2}$ $[\because (a \times b)^m = a^m \times b^m]$

$\Longrightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1} X 3^4}$ $[\because a^m \times a^n = a^{m+n}]$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9 X 3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9} X 3^{-4}$ $[\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ $[\because a^m \times a^n = a^{m+n}]$

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

3x 10^8 = $\frac{x}{8 X 60}$

x = 3x 10^8 x 48 x 10 [By cross multiplication]

x = 144x 10^8 = 144x 10^{11} metres.

∴ The distance of Sun from Earth is 1.44 x 10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x 2=2^2 = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x 2=2^3 = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

   a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

   a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

   a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

   a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x (-2)^0 \text{ x } (-1)^{202}$ is equal to

   a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5 \text{ x} \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

   a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2) x (3^6 \div 3^2)$ is equal to

   a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

   a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

   a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

    a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 x3^2 c) 2^3x3^3 d) 2^2 x3^2

2. Value of$(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d)$(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b)72 x 10^8 c)7.2 x 10^8 d)7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to 2^{6}?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (\text{.......})^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\cdots\cdots} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\dots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \dots\dots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\dots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \dots\dots\dots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\dots\dots}$

$27500000 = 275 \times 10^5$

$\because 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with $<$, $>$ or $=$ sign

a) 3^2 ……….. 15 b) 2^3 ……….. 3^2 c) 7^4 ……….. 5^4

d) 10000 ……….. 10^5 e) 6^3 ……….. 4^4

a) 3^2 ……….. 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) ∵ 2^3 = 2 x2 x 2 = 8 and

3^2 = 3 x 3 = 9,8< 9

So, $2^3 < 3^2$

c) ∵ 7^4 = 7 x 7 x7 x 7 = 2401

and5^4 = 5 x 5x 5 x 5 = 625

∴2401 > 625

So, 74 > 59

d) 10000=10 x 10 x 10 x 10 = 10^4

10^4 =10000, 10^5 =100000

∵ 10000 < 100000

So, 10000<10^5

e) ∵ 6^3 = 6 x 6 x6 = 216

and4^4 = 4 x 4 x 4 x 4 = 256

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x \, X \, y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2 =}$ (-3) x (-3) = 9

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\, X\, 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9\text{-}3$

$\Longrightarrow 2n =6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times2 \times2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ \text{X } 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 $= 7^3$

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^2 = 7^{50\times 2} = 7^{100}$ [As we know $(a^{m})^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

$$\begin{array}{r|l} 5 & 3125 \\ \hline 5 & 625 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

$$\begin{array}{r|l} 2 & 512 \\ \hline 2 & 256 \\ \hline 2 & 128 \\ \hline 2 & 64 \\ \hline 2 & 32 \\ \hline 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} x 7^{2-1} x 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} x 7^{2-1} x 11^{8-3}$

$=3^6 x 7^1 x 11^5$

$= 1 x 7 x 11^5$

$= 7 x 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n\ X\ 3^2\ X\ 3^n-(27)^n)}{(3^3)^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X\ 3^2 X 3^n-(3\ x\ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2}-(3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2}-3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2}-3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a.\ \frac{12^4\ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27} = \frac{(3\ X 2^2)^4\ X\ (3^2)^3\ X\ 2^2}{(2\ X\ 3)^3\ X\ (2^3)^2\ X\ 3^3}$

$\frac{3^4\ X 2^8 X 3^6 X 2^2}{2^3\ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2}\ X\ 3^{6+4}}{2^{6+3}\ X\ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x (5-1) =100

$\Longrightarrow 5^{2n-2}$ x 4 =100

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} \ = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $6^{2n-4} \ = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} \ = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} \ = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because$(a x b)^m = a^m x b^m]

$\Longrightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} \ = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m$ x a^n = a^{m+n}]

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} \ = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} \ = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5$ X $\left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} \ = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m$ x a^n = a^{m+n}]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} \ = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} \ = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4}-\frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 X 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1} \qquad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} \quad = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8\ x\ 48\ x\ 10$ [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is $1.44\ x\ 10^{11}$m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times.$

$\Longrightarrow$ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by $2 = 2\ x\ 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by $2 = 4\ x\ 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11}$ = $\left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054 x 10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5 x 10^1 b) 123.45 x 10^2 c) 12.345 x 10^3 d) 1.2345 x 10^4

7. Cube of $\left(\frac{-1}{4}\right)$is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27 x 10^4 b) 12.7 x 10^4 c) 127 x 10^2 d) 1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d)($3^0 - 2^0$) x ($3^0 + 2^{\,0}$)

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$x $\left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X\ (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b)72 x 10^8 c)7.2 x 10^8 d)7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to 2^{6}?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^{3}}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ... \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because 3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{......}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ---------
3. $\left[\left(\frac{7}{11}\right)^3\right]^4 = \left(\frac{7}{11}\right)$ ---------
4. $\left(\frac{6}{13}\right)^{10} \div \left[\left(\frac{6}{13}\right)^5\right]^2 = \left(\frac{6}{13}\right)$ ---------
5. $\left[\left(\frac{-1}{4}\right)^{16}\right]^2 = \left(\frac{-1}{4}\right)$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 x x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \, X \, 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5=} 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

$25730 = 2.573 \times 10{,}000$

$= 2.573 \times 10^4$

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

$270404 = 2{,}00{,}000 + 70{,}000 + 400 + 4$

$= 2 \times 1{,}00{,}000, + 7 \times 10{,}000 + 4 \times 100 \times 4 + 1$

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) $230061 = 2{,}00{,}000 + 30{,}000 + 60 + 1$

$= 2 \times 1{,}00{,}000, + 3 \times 10{,}000 + 6 \times 10 + 1$

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2 \div 1)^{-2} \div (5 \div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2 \times 2 \times 2 \times 2 \times 2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1} + 25\ x\ 5^n}{3\ X\ 5^{n+2} + 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5 + 5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5 + 2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2 + 5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3 + 5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 $= 7^3$

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

$$\begin{array}{r|l} 5 & 3125 \\ \hline 5 & 625 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

$$\begin{array}{r|l} 2 & 512 \\ \hline 2 & 256 \\ \hline 2 & 128 \\ \hline 2 & 64 \\ \hline 2 & 32 \\ \hline 2 & 16 \\ \hline 2 & 8 \\ \hline 2 & 4 \\ \hline 2 & 2 \\ \hline & 1 \end{array}$$

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3\ X\ 7^2 X\ 11^8}{21\ x\ 11^3}$

We know, 21 = 7 x 3

$= \frac{3\ X\ 7^2 X\ 11^8}{3X\ 7\ X\ 11^3}$

$=3^{\ 1-1}$ x 7^{2-1} x $11^{\ 8-3}$ [∴ $a^m \div a^n = a^{m-n}$]

$=3^{1-1}$ x 7^{2-1} x $11^{\ 8-\ 3}$

$=3^6$ x 7^1 x 11^5

= 1 x 7 x 11^5

= 7 x $11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

∴ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n\ X\ 3^2\ X\ 3^n - (27)^n)}{(3^3)^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X\ 3^2 X 3^n - (3\ x\ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4\ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27} = \frac{(3\ X 2^2)^4\ X\ (3^2)^3\ X\ 2^2}{(2\ X\ 3)^3\ X\ (2^3)^2\ X\ 3^3}$

$\frac{3^4\ X 2^8 X 3^6 X 2^2}{2^3\ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2}\ X\ 3^{6+4}}{2^{6+3}\ X\ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x (5-1) =100

$\Longrightarrow 5^{2n-2}$ x 4 =100

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2$.

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} \ = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $6^{2n-4} \ = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} \ = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} \ = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \text{ x } b)^m = a^m \text{ x } b^m$]

$\Longrightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} \ = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \text{ x } a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} \ = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} \ = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5$ x $\left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} \ = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \text{ x } a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} \ = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} \ = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^2\right\}^2\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

x = $3x\ 10^8$ x 48 x 10 [By cross multiplication]

x = $144x\ 10^8$ = $144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x $2=2^2$ = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x $2=2^3$ = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x (-2)^0 \text{ x } (-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5 \text{ x} \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2) x (3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x
c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 \times 3^0 \times 4^0$ c) $(3^0 - 2^{0)} \times 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \times 3^2}{4 \times 18}$ b) $[(-2)^3 \times (-2)^4] \div (-2)^7$ c) $\frac{3^0 \times 5^3}{5 \times 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b) 72×10^8 c) 7.2×10^8 d) 7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$ = ...

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96$.

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^{3}}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\dots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \dots\dots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\dots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \dots\dots\dots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\dots\dots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^8 \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} = (-3) \times (-3) = 9$

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = $3.186500000 \times 10^9 = 3.1865 \times 10^9$

10. Find the number from exponential form

$9 \times 10^{5} + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\,X\,2X\,2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\,X\,5^2}{2^2 X\,5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n =6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times2 \times2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\,X\,5^{n+1}+25\,x\,5^n}{3\,X\,5^{n+2}+10\,X\,5^{n+1}}$

$= \frac{2X5\,X\,5^n X5+5x5\,x\,5^n}{3\,X\,5^n\,X5X5+2X5X5X\,5^n}$

$= \frac{5X5\,X\,5^n X2+5X5\,xX5^n}{5X\,5\,X\,5^n\,X3+5X5X5^n\,X\,2}$

$= \frac{5X5\,X\,5^n(2+1)}{5X\,5\,X\,5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50x2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

= $\frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

=3^{1-1} x 7^{2-1} x 11^{8-3} [∴ $a^m \div a^n = a^{m-n}$]

=3^{1-1} x 7^{2-1} x 11^{8-3}

=3^6 x 7^1 x 11^5

= 1 x 7 x 11^5

= 7 x $11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

∴ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n X 3^2 X 3^n-(27)^n)}{(3^3)^5 x 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X 3^2 X 3^n-(3 x 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 x 3 x 3}$$

$$\Longrightarrow \frac{(3^2)^n X 3^{n+2}-(3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} X 3^{n+2}-3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27}$

b. 2^3 x a^3 x $5a^4$

$a. \; \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27} = \frac{(3 \; X 2^2)^4 \; X \; (3^2)^3 \; X \; 2^2}{(2 \; X \; 3)^3 \; X \; (2^3)^2 \; X \; 3^3}$

$\frac{3^4 \; X 2^8 X 3^6 X 2^2}{2^3 \; X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \; X \; 3^{6+4}}{2^{6+3} \; X \; 3^{3+3}} = 2^{10-9}$ x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x (5-1) =100

$\Longrightarrow 5^{2n-2}$ x 4 =100

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow$ n = $\frac{4}{2}$ = 2.

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3\times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Rightarrow 2^{(n-5)} \times 2n-4\ x3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3 - 4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

$\Longrightarrow$ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by $2 = 2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by $2 = 4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x (-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2) x (3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054 x 10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5 x 10^1 b) 123.45 x 10^2 c) 12.345 x 10^3 d) 1.2345 x 10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 \times 3^0 \times 4^0$ c) $(3^0 - 2^{0)} \times 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X\, (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to $2^{6?}$

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 ……….. 15 b) 2^3 ……….. 3^2 c) 7^4 ……….. 5^4

d) 10000 ……….. 10^5 e) 6^3 ……….. 4^4

a) 3^2 ……….. 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \ 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and 216 < 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2 =}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5 =} 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

$25730 = 2.573 \times 10{,}000$

$= 2.573 \times 10^4$

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

$270404 = 2{,}00{,}000 + 70{,}000 + 400 + 4$

$= 2 \times 1{,}00{,}000, + 7 \times 10{,}000 + 4 \times 100 \times 4 + 1$

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) $230061 = 2{,}00{,}000 + 30{,}000 + 60 + 1$

$= 2 \times 1{,}00{,}000, + 3 \times 10{,}000 + 6 \times 10 + 1$

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\text{x } 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\text{x } 2 \text{ x}2 \text{ x}2^{n+2}$

$=2\text{x}2\text{x}2\text{x}2\text{x}2$

$2^3 \text{ x}2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^2 = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 \, X \, 7^2 X \, 11^8}{21 \, x \, 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \, X \, 7^2 X \, 11^8}{3X \, 7 \, X \, 11^3}$

$=3^{\,1\text{-}1} \times 7^{2\text{-}1} \times 11^{\,8\text{-}3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1\text{-}1} \times 7^{2\text{-}1} \times 11^{\,8\text{-}\,3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \; X \; 3^2 \; X \; 3^n - (27)^n)}{(3^3)^5 x \; 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \; 3^2 X 3^n - (3 \; x \; 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \; x \; 3 \; x \; 3}$$

$$\Longrightarrow \frac{(3^2)^n \; X \; 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \; X \; 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1} + (2\text{-}1 – 3\ \text{-}1)\text{-}1$

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 X 9^3 X 4}{6^3 X 8^2 X 27}$

b. 2^3 x a^3 x $5a^4$

$a. \frac{12^4 X 9^3 X 4}{6^3 X 8^2 X 27} = \frac{(3 X 2^2)^4 X (3^2)^3 X 2^2}{(2 X 3)^3 X (2^3)^2 X 3^3}$

$\frac{3^4 X 2^8 X 3^6 X 2^2}{2^3 X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} X 3^{6+4}}{2^{6+3} X 3^{3+3}} = 2^{10-9} \times 3^{10-6}$

$= 2 \times 3^4 = 2 \times 81 = 162.$

b. 2^3 x a^3 x $5a^4$

$= 8 \times a^3 \times 5 \times a^4$

$= 40 \times a^{3+4}$

$= 40 \times a^7$

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Longrightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

3x 10^8 = $\frac{x}{8\,X\,60}$

x = 3x 10^8 x 48 x 10 [By cross multiplication]

x = 144x 10^8 = 144x 10^{11} metres.

∴ The distance of Sun from Earth is 1.44 x 10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x 2=2^2 = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x 2=2^3 = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 $x3^2$ c) 2^3x3^3 d) 2^2 $x3^2$

2. Value of $(-2)^3$ $x(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20}\div(2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27×10^4 b)12.7×10^4 c)127×10^2 d)1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)}$ x 4^0 d)($3^0 - 2^0$) x ($3^0 + 2^0$)

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$ x $\left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X \, (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b)72 x 10^8 c)7.2 x 10^8 d)7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $\quad [\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ... \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because 3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{.....}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15
$\because 3^2 = 3 \times 3 = 9$
$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ $600060 = 6 \times 105 + 6 \times 10$

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5=} 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573 x 10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, 2^5 = 2 x 2 x 2 x 2 x 2 = 32

And 5^3 = 5 x 5 x 5 = 125

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3}$ x 9

= $\frac{3^7}{3^{(3+4)}}$ x 9

= $\frac{3^7}{3^7}$ x 9 = 9

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

= $\frac{5^{6+4}}{5^7}$ = $\frac{5^{10}}{5^7}$

=5^{10-7}

=5^3

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

= 2 x 10^5 + 7 x 10^4 + 4 x 10^2 + 4 x 10^0

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

= 2 x 10^5 + 3 x 10^4 + 6 x 10^2 + 1 x 10^0

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times2 \times2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^2 = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

= $\frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \ X\ 3^2 \ X\ 3^n - (27)^n)}{(3^3)^5 x \ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \ 3^2 X 3^n - (3 \ x \ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \ x \ 3 \ x \ 3}$$

$$\Longrightarrow \frac{(3^2)^n \ X \ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \ X \ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \ \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4\ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a.\ \frac{12^4\ X\ 9^3\ X\ 4}{6^3\ X\ 8^2\ X\ 27} = \frac{(3\ X 2^2)^4\ X\ (3^2)^3\ X\ 2^2}{(2\ X\ 3)^3\ X\ (2^3)^2\ X\ 3^3}$

$\frac{3^4\ X 2^8 X 3^6 X 2^2}{2^3\ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2}\ X\ 3^{6+4}}{2^{6+3}\ X\ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ $[\because (a \times b)^m = a^m \times b^m]$

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ $[\because a^m \times a^n = a^{m+n}]$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ $[\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ $[\because a^m \times a^n = a^{m+n}]$

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1} \qquad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8 \times 48 \times 10$ [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times.$

$\Longrightarrow$ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)x(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) 2^2 x3^2 c) 2^3x3^3 d) 2^2 x3^2

2. Value of$(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b) 72×10^8 c) 7.2×10^8 d) 7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to $2^{6?}$

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16$ $[\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (.......)^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{.....} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \ 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ----------
3. $\left[\left(\frac{7}{11}\right)^3\right]^4 = \left(\frac{7}{11}\right)$ ----------
4. $\left(\frac{6}{13}\right)^{10} \div \left[\left(\frac{6}{13}\right)^5\right]^2 = \left(\frac{6}{13}\right)$ ----------
5. $\left[\left(\frac{-1}{4}\right)^{16}\right]^2 = \left(\frac{-1}{4}\right)$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

a x a x a x c x c x c x c x d = $a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2} =$ (-3) x (-3) = 9

$(-5)^2 = (-5) \times (-5) = 25$

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5} = 10^5$ $(\because a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\because a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4 \right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \text{ x } \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \text{ x } \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^{2} \text{ x } \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \text{x } 5^2 \text{ x } \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \text{ x } 5^{2-1}$

= -2 x 5

= -10.

3. Find the values of n, when:

a) $5^{2n} \text{ x } 5^3 = 5^9$ b) $8\text{x } 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore$ 2n + 3 = 9

$\Longrightarrow$ 2n = 9-3

$\Longrightarrow$ 2n =6

Thus, n = $\frac{6}{2}$ = 3.

b) $\Longrightarrow 2\text{x } 2 \text{ x}2 \text{ x}2^{n+2}$

=2x2x2x2x2

$2^3 \text{ x}2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore$ n + 5 = 5

$\Longrightarrow$ n = 5 – 5 = 0

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^{m})^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

= $\frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^5$.

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \: X \: 3^2 \: X \: 3^n - (27)^n)}{(3^3)^5 x \: 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \: 3^2 X 3^n - (3 \: x \: 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \: x \: 3 \: x \: 3}$$

$$\Longrightarrow \frac{(3^2)^n \: X \: 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \: X \: 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} \ = \ \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}} = 2^{10-9}$ x 3^{10-6}

$= 2$ x $3^4 = 2$ x $81 = 162$.

b. 2^3 x a^3 x $5a^4$

$= 8$ x a^3 x 5 x a^4

$= 40$ x a^{3+4}

$= 40$ x a^7

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2}$ x $(5-1) = 100$

$\Longrightarrow 5^{2n-2}$ x $4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2$.

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times (3x\ 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Longrightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left(\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right)^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left(\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right)^{-1} \qquad \left(\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right)^{-1}$

$= \left(\left\{\frac{1}{16}\right\}^{-2}\right)^{-1} = \left(\left\{\frac{1}{16}\right\}^{-2}\right)^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3.The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

$\Longrightarrow$ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by $2 = 2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by $2 = 4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x (-2)^0 \times (-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5 \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)x(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) 2^3x3^2 b) $2^2 x3^2$ c) 2^3x3^3 d) $2^2 x3^2$

2. Value of $(-2)^3$ x$(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b)2^3 c) 3^5 b)5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b)-576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a)1.27 x 10^4 b)12.7 x 10^4 c)127 x 10^2 d)1270 x 10

7. Which of following is the simplest form of 9 x 10^3 + 2 x 10^2?

a) 9000 b)9002 c)9200 d)209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b)-1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$is :

a) $-\left(\frac{2}{3}\right)^3$ b.$\left(\frac{-2}{3}\right)^3$ c)$-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$x $\left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c)$\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x,$x^8 \div x^2$ is equal to

a) x^4 b)x^6 c) x^{10} d)x^{16}

13.a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c)3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) x (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is …….. ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = ……$

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (…….)^5\ \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{…..} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Longrightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with $<, >$ or $=$ sign

a) 3^2 ……….. 15 b) 2^3 ……….. 3^2 c) 7^4 ……….. 5^4

d) 10000 ……….. 10^5 e) 6^3 ……….. 4^4

a) 3^2 ……….. 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000, \; 10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^{5} = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x X y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	**729**
3	**243**
3	**81**
3	**27**
3	**9**
3	**3**
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = $2^2 \times 3^3 \times 5$.

6. Simplify : $(-3)^2 \times (-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

$\therefore (-3)^2 \times (-5)^2 = 9 \times 25 = 225$.

7. Using law of exponents, simply and write in exponential form : $2^5 \times 5^5$

We have $2^5 \times 5^5 = (2 \times 5)^{5=} 10^5$ $(\therefore a^m \times b^m = (ab)^m)$

Thus, $2^5 \times 5^5 = 10^5$

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right) \times a^8$

We have $\left(\frac{a^5}{a^3}\right) \times a^8 = (a^{5-3}) \times a^8$ $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

$= a^2 \times a^8$ $(\therefore a^m \times a^n = a^{m+n}$

$= a^{2+8} = a^{10}$

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

$9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573 x 10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

= $2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

= $2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \times \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8 \times 2^{n+2} = 32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2 \times 2 \times 2 \times 2^{n+2}$

$= 2\times2\times2\times2\times2$

$2^3 \times 2^{n+2} = 2^5$

$\Longrightarrow 2^{n+2+3} = 2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 - 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1} + 25\ x\ 5^n}{3\ X\ 5^{n+2} + 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5 + 5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5 + 2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2 + 5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3 + 5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50x2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

$= \frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

$=3^{1-1} x 7^{2-1} x 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} x 7^{2-1} x 11^{8-3}$

$=3^6 x 7^1 x 11^5$

$= 1 x 7 x 11^5$

$= 7 x 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000×10^{8}

= 3.84×10^{8}

∴The distance between Earth and Moon is 3.84×10^{8} m

ii) 1,02,70,00,000 = $1.027000000 \times 10^{9}$

= 1.027×10^{9}

∴ The population of India was 1.027×10^{9} in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^{n} X\, 3^{2}\, X\, 3^{n} - (27)^{n})}{(3^{3})^{5} x\, 2^{3}} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^{n} X\, 3^{2} X 3^{n} - (3\,x\,3x3)^{n}}{3^{15} x 2^{3}} = \frac{1}{3\,x\,3\,x\,3}$$

$$\Longrightarrow \frac{(3^{2})^{n}\, X\, 3^{n+2} - (3^{3})^{n}}{3^{15} X 2^{3}} = \frac{1}{3^{3}}$$

$$\Longrightarrow \frac{3^{2n}\, X\, 3^{n+2} - 3^{3n}}{3^{15} X 2^{3}} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^{3}} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^{2}-1)}{3^{15} X 2^{3}} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^{3}} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27}$

b. 2^3 x a^3 x $5a^4$

$a. \; \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27} \; = \; \frac{(3 \; X 2^2)^4 \; X \; (3^2)^3 \; X \; 2^2}{(2 \; X \; 3)^3 \; X \; (2^3)^2 \; X \; 3^3}$

$\frac{3^4 \; X 2^8 X 3^6 X 2^2}{2^3 \; X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \; X \; 3^{6+4}}{2^{6+3} \; X \; 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \text{ x } (5-1) = 100$

$\Longrightarrow 5^{2n-2} \text{ x } 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right)$ x $\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$ x$\left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5}$ x $(3x\ 2)^{2n-4}$ x$2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5}$ x 3^{2n-4} x$2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because$(a x b)^m = a^m x b^m]

$\Longrightarrow 2^{(n-5)}$ x 2n-4 x$3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m$ x a^n = a^{m+n}]

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9}$ x $3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5$ x $\left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m$ x a^n = a^{m+n}]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}$.

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1} \quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11}$ = $\left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d)$(3^0 - 2^0) x (3^0 + 2^{ 0})$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b)$\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d)$\left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right) x \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d)$\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b)72 x 10^8 c)7.2 x 10^8 d)7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d)$\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d)$2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

   $\because\ a^0 = 1$

   So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

   Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

   $\because\ 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because\ a^m + a^n = a^{m-n}]$

   $(1)^{92} = 1.$ $\quad [\because\ (a)^{\text{even integer}} = 1]$

   $2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

   $\therefore (6)^1 x (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

   Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 x$ (.......)^5 $\left(\frac{11}{15}\right)^9$ NCERT

   $\because a^m + a^n = a^{m+n}$

   $\left(\frac{11}{15}\right)^4 x \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 x \left(\frac{-1}{4}\right)^{\cdots\cdots} = \left(\frac{-1}{4}\right)^{11}$

   $\because a^m \times a^n = a^{m+n}$

   $\therefore \left(\frac{-1}{4}\right)^3 x \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

   $\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

   $\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

   $\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = ... \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{.....}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 x 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 x x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. x^m x $x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 x \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. 5^0 x 25^0 x $125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. 876543 = 8 x 10^5 + 7x 10^4 + 6 x 10^3 + 5 x 10^2 + 4 x 10^1 +3 x 10^0

22. 600060 = 6 x 10^5+6 x 10^2

23. 4 x 10^5 + 3 x 10^4 +2 x 10^3 +1 x10^0 = 432010

24. 8 x 10^6 + 2 x 10^4 +5 x 10^2 + 9 x 10^0 = 8020509

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \times 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of $x^a \times x^b$?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$

2. Express in exponential form

$a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

3. Express 729 using exponential notation.

We have, $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2}$ = (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^5$ = 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

∴ 125 > 32

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$=5^{10-7}$

$=5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\,X\,2X\,2}{-5}\right)$

$= \frac{1}{2^2} x\, 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\,X\,5^2}{2^2 X\,5}$

$= -2^{3-2} \times 5^{2-1}$

= -2 x 5

= -10.

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8x\ 2^{n+2}$=32

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

∴ 2n + 3 = 9

⟹ 2n = 9-3

⟹ 2n =6

Thus, n = $\frac{6}{2}$ = 3.

b) $\Longrightarrow 2x\ 2\ x2\ x2^{n+2}$

=2x2x2x2x2

$2^3\ x2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

∴ n + 5 = 5

⟹ n = 5 – 5 = 0

4. Simplify :

$\frac{10\,X\,5^{n+1}+25\,x\,5^n}{3\,X\,5^{n+2}+\,10\,X\,5^{n+1}}$

$= \frac{2X5\,X\,5^n X5+5x5\,x\,5^n}{3\,X\,5^n\,X5X5+2X5X5X\,5^n}$

$= \frac{5X5\,X\,5^n X2+5X5\,xX5^n}{5X\,5\,X\,5^n\,X3+5X5X5^n\,X\,2}$

$= \frac{5X5\,X\,5^n(2+1)}{5X\,5\,X\,5^n\,(3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^{m} \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^{3}$

ii) We have $(7^{50})^{2} = 7^{50x2} = 7^{100}$ [As we know $(a^{m})^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 27{,}00{,}00{,}00{,}00{,}000$

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

$= 15{,}00{,}00{,}000$

Since $27{,}00{,}00{,}00{,}00{,}000 > 15{,}00{,}00{,}000$

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2\times2\times2\times2\times2\times2\times2\times2\times2 = 2^{9}$.

4. Simplify : $\frac{3 \ X \ 7^2 X \ 11^8}{21 \ x \ 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \ X \ 7^2 X \ 11^8}{3X \ 7 \ X \ 11^3}$

$=3^{\ 1-1} \times 7^{2-1} \times 11^{\ 8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{\ 8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ 729 x 64 = $3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \ X\ 3^2\ X\ 3^n - (27)^n)}{(3^3)^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X\ 3^2 X 3^n - (3\ x\ 3x3)^n}{3^{15} x 2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \, X \, 9^3 \, X \, 4}{6^3 \, X \, 8^2 \, X \, 27}$

b. 2^3 x a^3 x $5a^4$

$a. \quad \frac{12^4 \, X \, 9^3 \, X \, 4}{6^3 \, X \, 8^2 \, X \, 27} = \frac{(3 \, X 2^2)^4 \, X \, (3^2)^3 \, X \, 2^2}{(2 \, X \, 3)^3 \, X \, (2^3)^2 \, X \, 3^3}$

$\frac{3^4 \, X 2^8 X 3^6 X 2^2}{2^3 \, X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \, X \, 3^{6+4}}{2^{6+3} \, X \, 3^{3+3}} = 2^{10-9} \times 3^{10-6}$

$= 2 \times 3^4 = 2 \times 81 = 162.$

b. $2^3 \times a^3 \times 5a^4$

$= 8 \times a^3 \times 5 \times a^4$

$= 40 \times a^{3+4}$

$= 40 \times a^7$

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore 2n-2 = 2$

$\Longrightarrow 2n = 2 + 2$

$\Longrightarrow 2n = 4$

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ $[\because (a \times b)^m = a^m \times b^m]$

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ $[\because a^m \times a^n = a^{m+n}]$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ $[\because \frac{1}{a^m} = a^{-m}]$

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ $[\because a^m \times a^n = a^{m+n}]$

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ as a rational number

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3 - 4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8 X 60}$

x = $3x\ 10^8$ x 48 x 10 [By cross multiplication]

x = $144x\ 10^8$ = $144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20}$ = 18 $times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = 2 x $2=2^2$ = 4.

In 60 minutes 4 bacteria is multiplied by 2 = 4 x $2=2^3$ = 8.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4 x(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2) x (3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3 \times (-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2 \times (-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}] \times 2^3$?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) \times \left(\frac{-2}{3}\right) \times \left(\frac{-2}{3}\right)$

10. $(-7)^5 \times (-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. $a^m \times a^n$ is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^{0)} x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) - $\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \, X \, 3^2}{4 \, x \, 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 \, X \, 5^3}{5 \, X \, 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where $m > n$ is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is .... ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ......

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $[\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $[\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (\text{.......})^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\text{.....}} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\dots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \dots\dots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\dots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \dots\dots\dots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\dots\dots}$

$27500000 = 275 \times 10^5$

$\because \quad 275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15
$\because 3^2 = 3 \times 3 = 9$
$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ----------
2. $(-3)^8 \div (-3)^5 = (-2)$ ----------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ----------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$ ----------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ----------
6. $a^6 \times a^5 \times a^0 = a$ ----------
7. 1 lakh = 10 ----------
8. 1 million = 10 ----------
9. 729 = 3 ----------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \times 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2=}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^{5=}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2 \div 1)^{-2} \div (5 \div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2 X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\text{x } 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n =6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\text{x } 2 \text{ x}2 \text{ x}2^{n+2}$

$=2\text{x}2\text{x}2\text{x}2\text{x}2$

$2^3 \text{ x}2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\, X\, 5^{n+1}+25\, x\, 5^n}{3\, X\, 5^{n+2}+ 10\, X\, 5^{n+1}}$

$= \frac{2X5\, X\, 5^n X5+5x5\, x\, 5^n}{3\, X\, 5^n\, X5X5+2X5X5X\, 5^n}$

$= \frac{5X5\, X\, 5^n X2+5X5\, xX5^n}{5X\, 5\, X\, 5^n\, X3+5X5X5^n\, X\, 2}$

$= \frac{5X5\, X\, 5^n(2+1)}{5X\, 5\, X\, 5^n\, (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3   b) 128 as power of 2   c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50x2} = 7^{100}$ [As we know $(a^m)^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 X 7^2 X 11^8}{21 x 11^3}$

We know, 21 = 7 x 3

= $\frac{3 X 7^2 X 11^8}{3X 7 X 11^3}$

=3^{1-1} x 7^{2-1} x 11^{8-3} [∴ $a^m \div a^n = a^{m-n}$]

=3^{1-1} x 7^{2-1} x 11^{8-3}

=3^6 x 7^1 x 11^5

= 1 x 7 x 11^5

= 7 x $11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

∴ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n\ X\ 3^2\ X\ 3^n-(27)^n)}{(3^3)\ ^5 x\ 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)\ ^n X\ 3^2 X 3^n-(3\ x\ 3x3)^n}{3^{15}x2^3} = \frac{1}{3\ x\ 3\ x\ 3}$$

$$\Longrightarrow \frac{(3^2)^n\ X\ 3^{n+2}-(3^3)^n}{3^{15}X2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n}\ X\ 3^{n+2}-3^{3n}}{3^{15}X2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2}-3^{3n}}{3^{15}X2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2-1)}{3^{15}X2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} x\ \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a.\ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} = \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4\ X 2^8 X 3^6 X 2^2}{2^3\ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2}\ X\ 3^{6+4}}{2^{6+3}\ X\ 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Rightarrow 2^{n-5} \times (3\times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Rightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Rightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Rightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Rightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\quad\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} \quad = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x
c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054 x 10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5 x 10^1 b) 123.45 x 10^2 c) 12.345 x 10^3 d) 1.2345 x 10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270 x 10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 x 3^0 x 4^0$ c) $(3^0 - 2^0) x 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ is:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 X 3^2}{4 x 18}$ b) $[(-2)^3 X (-2)^4] \div (-2)^7$ c) $\frac{3^0 X 5^3}{5 X 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72 x 10^7 b) 72 x 10^8 c) 7.2 x 10^8 d) 7.2 x 10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is …….. ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ……

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ [$\because a^m + a^n = a^{m-n}$]

$(1)^{92} = 1.$ [$\because (a)^{\text{even integer}} = 1$]

$2^{36} \div 2^{32} = 2^4 = 16$ [$\because a^m + a^n = a^{m-n}$]

$\therefore (6)^1 x (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96$.

3. $\left(\frac{11}{15}\right)^4 x$ (…….)^5 $\left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 x \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 x \left(\frac{-1}{4}\right)^{\cdots\cdots} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 x \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^3}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{\cdots}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 = \ldots\ldots \times 10^{10}$ NCERT

$\because 88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{\cdots}$

$\because 3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = \ldots\ldots\ldots \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{\cdots\cdots}$

$27500000 = 275 \times 10^5$

$\because$ $275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15

$\because 3^2 = 3 \times 3 = 9$

$\therefore 15 > 9$

So, $3^2 < 15$

b) $\because 2^3 = 2 \times 2 \times 2 = 8$ and

$3^2 = 3 \times 3 = 9, 8 < 9$

So, $2^3 < 3^2$

c) $\because 7^4 = 7 \times 7 \times 7 \times 7 = 2401$

and $5^4 = 5 \times 5 \times 5 \times 5 = 625$

$\therefore 2401 > 625$

So, 74 > 59

d) $10000 = 10 \times 10 \times 10 \times 10 = 10^4$

$10^4 = 10000$, $10^5 = 100000$

$\because 10000 < 100000$

So, $10000 < 10^5$

e) $\because 6^3 = 6 \times 6 \times 6 = 216$

and $4^4 = 4 \times 4 \times 4 \times 4 = 256$

and $216 < 256$

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x \, X \, y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ [$\because a^0 = 1$]

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ [$\because a \times 0 = 0$]

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^{0}$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^{5} \div \left(\frac{6}{7}\right)^{3}$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^{2} = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is $\mathbf{3^6}$

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2 =}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \times 5)^{5 =}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$[[5^2]^3 \times 5^4] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \text{ x } \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^2 \text{ x } \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2}\ X\ 5\right)^2 \text{ x } \left(\frac{2\ X\ 2X\ 2}{-5}\right)$

$= \frac{1}{2^2} \text{x } 5^2 \text{ x } \frac{2^3}{-5}$

$= \frac{2^3\ X\ 5^2}{2^2 X\ 5}$

$= -2^{3-2} \text{ x } 5^{2-1}$

$= -2 \text{ x } 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \text{ x } 5^3 = 5^9$ b) $8\text{x } 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n = 6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\text{x } 2 \text{ x}2 \text{ x}2^{n+2}$

$=2\text{x}2\text{x}2\text{x}2\text{x}2$

$2^3 \text{ x}2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ \text{X } 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 =2^7

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times 2} = 7^{100}$ [As we know $(a^m)^n = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125   ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{9}$.

4. Simplify : $\frac{3 \; X \; 7^2 X \; 11^8}{21 \; x \; 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \; X \; 7^2 X \; 11^8}{3X \; 7 \; X \; 11^3}$

$=3^{\,1-1} \text{ x } 7^{2-1} \text{ x } 11^{\,8-3}$ [∴ $a^m \div a^n = a^{m-n}$]

$=3^{1-1} \text{ x } 7^{2-1} \text{ x } 11^{\,8-3}$

$=3^6 \text{ x } 7^1 \text{ x } 11^5$

$= 1 \text{ x } 7 \text{ x } 11^5$

$= 7 \text{ x } 11^{5.}$

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= 2 x 3^3 x 5

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

729 = 3 x3x 3 x3 x 3 x 3 = 3^6

64 = 2x2x2x2x 2x2 = 2^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

∴ 729 x 64 = 3^6 x 2^6

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \, \frac{8}{8} = 3^{-3}$$

$\Longrightarrow$ As base are same on both sides, so

3n-15 = -3

$\Longrightarrow$ 3n = -3 + 15

$\Longrightarrow$ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

$= 24 + 6 = 30$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27}$

b. 2^3 x a^3 x $5a^4$

$a. \quad \frac{12^4 \; X \; 9^3 \; X \; 4}{6^3 \; X \; 8^2 \; X \; 27} \quad = \quad \frac{(3 \; X 2^2)^4 \; X \; (3^2)^3 \; X \; 2^2}{(2 \; X \; 3)^3 \; X \; (2^3)^2 \; X \; 3^3}$

$\frac{3^4 \; X 2^8 X 3^6 X 2^2}{2^3 \; X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \; X \; 3^{6+4}}{2^{6+3} \; X \; 3^{3+3}}$ = 2^{10-9} x 3^{10-6}

= 2 x 3^4 =2 x 81 = 162.

b. 2^3 x a^3 x $5a^4$

= 8 x a^3 x 5 x a^4

= 40 x a^{3+4}

= 40 x a^7

= $40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \times (5-1) = 100$

$\Longrightarrow 5^{2n-2} \times 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore$ 2n-2 = 2

$\Longrightarrow$ 2n = 2 + 2

$\Longrightarrow$ 2n = 4

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x6^{2n-4} \;= \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times (3\times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Longrightarrow 2^{(n-5)} \times 2n\text{-}4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 X 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1}$ $\left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= [16 \times 16]^{-1} = [256]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8 X 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.

Grade VII

Lesson :13 Exponents and Powers

Objective Type Questions

I. Multiple choice questions

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ (NCERT)

a) $(X \div Y)^1$ b) $(X \div Y)^0$ c) $(X \div Y)^5$ d) $(X \div Y)^{10}$

2. The value of $\frac{10^{22}+10^{20}}{10^{20}}$ is

a) 10 b) 10^{42} c) 101 d) 10^{22}

3. $\left(\frac{2}{3}\right)^3$ x $\left(\frac{5}{7}\right)^3$ is equal to

a) $\left(\frac{10}{21}\right)^9$ b) $\left(\frac{10}{21}\right)^9$ c) $\left(\frac{10}{21}\right)^3$ d) $\left(\frac{10}{21}\right)^0$

4. The reciprocal of $\left(\frac{-5}{2}\right)^2$ is

a) $\left(\frac{-5}{2}\right)^2$ b) $\left(\frac{5}{2}\right)^2$ c) $\frac{4}{25}$ d) $\frac{25}{4}$

5. $(-4)^4$x$(-2)^0$ x $(-1)^{202}$ is equal to

a) 64 b) 1 c) 0 d) 256

6. If $\left(\frac{5}{3}\right)^5$ x $\left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$ then the value of x is

a) 3 b) $\frac{1}{2}$ c) 1 d) 2

7. $(5^7 \div 5^2)$x$(3^6 \div 3^2)$ is equal to

a) 1426 b) 1242 c) 253125 d) 101962

8. If, $\frac{p}{q} = \left(\frac{5}{6}\right)^2 \div \left(\frac{5}{6}\right)^0$ then the value of $\left(\frac{p}{q}\right)^2$ is (Ncert)

a) $\frac{125}{1290}$ b) $\frac{625}{1296}$ c) $\frac{164}{125}$ d) $\frac{169}{144}$

9. If $(3^{102} \div 3^{101}) \div 3^{101} = k.3^{100}$, then the value of k is

a) 9 b) 10 c) 11 d) 12

10. If $\frac{a}{b} = \left(\frac{625}{81}\right) \div \left(\frac{5^4}{3^4}\right)$ thenthe value of $\left(\frac{a}{b}\right)^5$ is

a) $\left(\frac{5}{3}\right)^8$ b) $\left(\frac{3}{5}\right)^8$ c) 1 d) $\left(\frac{3}{5}\right)$

1) c	2) c	3) c	4) d	5) a	6) d	7) d	8) c	9) b	10)c	11) c

II. Multiple choice questions

1. For any two non-zero integers c and y, $x^3 \div y^3$ (NCERT Exemplar)

a. $\left(\frac{x}{y}\right)^0$ b. $\left(\frac{x}{y}\right)^3$ c. $\left(\frac{x}{y}\right)^6$ d. $\left(\frac{x}{y}\right)^9$

2. $[((-3)^2)^3]$ is equal to

a. $(-3)^8$ b. $(-3)^6$ c. $(-3)^5$ d. $(-3)^{23}$

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the.

a) Second power of x b) Third power of x

c) Fifth power of x d) Sixth power of x

4. $(1^0 + 2^0 + 3^0)$ is equal to

a) 0 b) 1 c) 3 d) 6

5. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

a) 2 b) 3 c) 4 d) 5

6. The standard form of the number 12345 is

a) 1234.5×10^1 b) 123.45×10^2 c) 12.345×10^3 d) 1.2345×10^4

7. Cube of $\left(\frac{-1}{4}\right)$ is

a) $\frac{-1}{12}$ b) $\frac{1}{16}$ c) $\frac{-1}{64}$ d) $\frac{1}{64}$

8. Which of the following has the largest value ?

a) 0.0001 b) $\frac{1}{10000}$ c) $\frac{1}{10^6}$ d) $\frac{1}{10^6} + 0.1$

1. b	2. b	3. c	4. c	5.c	6. d	7. c	8. d

III. Multiple choice questions

1. 72 can be expressed as :

a) $2^3 x 3^2$ b) $2^2 x 3^2$ c) $2^3 x 3^3$ d) $2^2 x 3^2$

2. Value of $(-2)^3$ x $(-10)^3$ is :

a) 8,000 b) 9,000 c) -8,000 d) 12,000

3. Which of the following is the exponential form of '243'?

a) 3^2 b) 2^3 c) 3^5 b) 5^3

4. Which of the following is the simplest form of $(-3)^2$ x $(-4)^3$?

a) 576 b) -576 c) -64 d) -36

5. Which of the following is the simplest form of $[(2)^{20} \div (2)^{18}]$ x 2^3?

a) 8 b) -8 c) -32 d) 32

6. Which of the following is the standard form of 12700?

a) 1.27×10^4 b) 12.7×10^4 c) 127×10^2 d) 1270×10

7. Which of following is the simplest form of $9 \times 10^3 + 2 \times 10^2$?

a) 9000 b) 9002 c) 9200 d) 209

8. Which of the following is the value of $(-1)^{100} \div (-1) - 1^{100}$?

a) 20000 b) -1 c) 1 d) 2

9. Out of the following the number which is not equal to $\frac{-8}{24}$ is :

a) $-\left(\frac{2}{3}\right)^3$ b. $\left(\frac{-2}{3}\right)^3$ c) $-\left(\frac{-2}{3}\right)^3$ d) $\left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right) x \left(\frac{-2}{3}\right)$

10. $(-7)^5$ x $(-7)^3$ is equal to:

a) $(-7)^8$ b) $(-7)^8$ c) $(-7)^{15}$ d) $(-7)^2$

11. For any two non-zero integers x any y, $x^3 \div y^3$ is equal to:

a) $\frac{x^0}{y}$ b) $\left(\frac{x}{y}\right)^3$ c) $\frac{x^6}{y}$ d) $\frac{x^9}{y}$

12. For a non-zero rational number x, $x^8 \div x^2$ is equal to

a) x^4 b) x^6 c) x^{10} d) x^{16}

13. a^m x a^n is equal to :

a) $(a^2)^{mn}$ b) a^{m-n} c) a^{m+n} d) a^{mn}

14. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = k.2^{1995}$, then the value of k is :

a. 1 b) 2 c) 3 d) 4

15. Which of the following is equal to 1?

a) $2^0 + 3^0 + 4^0$ b) $2^0 \times 3^0 \times 4^0$ c) $(3^0 - 2^{0)} \times 4^0$ d) $(3^0 - 2^0) \times (3^0 + 2^0)$

16 .Square of $\left(\frac{-2}{3}\right)$ *is*:

a) $\left(\frac{-2}{3}\right)$ b) $\frac{2}{3}$ c) $\frac{-4}{9}$ d) $\frac{4}{9}$

17. Which of the following is not equal to $\left(\frac{-5}{4}\right)^4$?

a) $\frac{(-5)^4}{4^4}$ b) $\frac{5^4}{(-4)^4}$

c) $-\frac{5^4}{4^4}$ d) $\left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right) \times \left(-\frac{5}{4}\right)$

18. Which of the following is not equal to 1?

a) $\frac{2^2 \times 3^2}{4 \times 18}$ b) $[(-2)^3 \times (-2)^4] \div (-2)^7$ c) $\frac{3^0 \times 5^3}{5 \times 25}$ d) $\frac{2^4}{(7^0 + 3^0)3}$

19. In standard form, the number 829030000 is written as K x 10^8 where K is equal to:

a) 82903 b) 829.03 c) 82.903 d) 8.2903

20. In standard form 72 crore is written as :

a) 72×10^7 b) 72×10^8 c) 7.2×10^8 d) 7.2×10^7

22. For non- zero numbers a and b $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^{m-n}$ where m > n is equal to.

a) $\left(\frac{a}{b}\right)^{mn}$ b) $\left(\frac{a}{b}\right)^{m+n}$ c) $\left(\frac{a}{b}\right)^{m-n}$ d) $\left[\left(\frac{a}{b}\right)^m\right]^n$

21. Which of the following is not true?

a) $3^2 > 2^3$ b) $4^3 = 2^6$ c) $3^3 = 9$ d) $2^5 > 5^2$

22. Which power of 8 is equal to 2^6?

a) 3 b) 2 c) 1 d) 4

Hints / Solutions

I. Fill in the Blanks

1. If $a^x = 1$, then the value of X is …….. ; where $a \neq 1$

$\because a^0 = 1$

So, $a^x = 1$, then the value of x is 0.

2. $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} =$ ……

Given $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32}$

$\because 6^4 \div 6^3 = 6^{4-3} = 6^1$ $\quad [\because a^m + a^n = a^{m-n}]$

$(1)^{92} = 1.$ $\quad [\because (a)^{\text{even integer}} = 1]$

$2^{36} \div 2^{32} = 2^4 = 16 [\because a^m + a^n = a^{m-n}]$

$\therefore (6)^1 \times (1)^{92} \times 2^4 = 6 \times 1 \times 16 = 96$

Hence, $(6^4 \div 6^3) \times (1)^{92} \times 2^{36} \div 2^{32} = 96.$

3. $\left(\frac{11}{15}\right)^4 \times (\text{…….})^5 \left(\frac{11}{15}\right)^9$ NCERT

$\because a^m + a^n = a^{m+n}$

$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5} = \left(\frac{11}{15}\right)^9$

4. $\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\text{…..}} = \left(\frac{-1}{4}\right)^{11}$

$\because a^m \times a^n = a^{m+n}$

$\therefore \left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{-1}{4}\right)^{11}$

$\Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{\left(\frac{-1}{4}\right)^{11}}{\left(\frac{-1}{4}\right)^{3}}\right) \Rightarrow \left(\frac{-1}{4}\right)^x = \left(\frac{1}{4}\right)^{11-3} = \left(\frac{-1}{4}\right)^x$

$\Rightarrow x = 8$

5. $432 = 2^4 \times 3^{....}$

$\because 432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^4 \times 3^3$

2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

6. $88880000000 \;\; = ... \times 10^{10}$ NCERT

$\because$ $88880000000 = 8.888 \times 10^7$ and $8888 = 8.888 \times 10^3$

So, $88880000000 = 8.888 \times 10^7 \times 10^3 = \mathbf{8.888} \times 10^{10}$

7. $340900000 = 3.409 \times 10^{....}$

$\because$ $3409 = 3.409 \times 10^3$

$\Rightarrow 3.409 \times 10^3 \times 10^5 = 3.409 \times 10^8$

8. $53700000 = ... \times 10^7$

$53700000 = 537 \times 5.37 \times 10^2$

and $= 5.37 \times 10^2 \times 10^5$

$= 5.37 \times 10^7$

9. $27500000 = 2.75 \times 10^{.....}$

$27500000 = 275 \times 10^5$

$\because$ $275 = 2.75 \times 10^2$

So, $2.75 \times 10^2 \times 10^5 = 2.75 \times 10^7$

10. Fill in the blanks with <,> or = sign

a) 3^2 .... 15 b) 2^3 .... 3^2 c) 7^4 .... 5^4

d) 10000 .... 10^5 e) 6^3 .... 4^4

a) 3^2 15
$\because 3^2 = 3 \times 3 = 9$
$\therefore 15 > 9$

So, $3^2 < 15$

b) ∵ 2^3 = 2 x2 x 2 = 8 and

3^2 = 3 x 3 = 9,8< 9

So, $2^3 < 3^2$

c) ∵ 7^4 = 7 x 7 x7 x 7 = 2401

and5^4 = 5 x 5x 5 x 5 = 625

∴2401 > 625

So, 74 > 59

d) 10000=10 x 10 x 10 x 10 = 10^4

10^4 =10000, 10^5 =100000

∵ 10000 < 100000

So, 10000<10^5

e) ∵ 6^3 = 6 x 6 x6 = 216

and4^4 = 4 x 4 x 4 x 4 = 256

and 216< 256

So, $6^3 < 4^4$

II. Fill in the Blanks

1. $(-2)^{31} \times (-2)^{31} = (-2)$ ---------
2. $(-3)^{8} \div (-3)^5 = (-2)$ ---------
3. $[(\frac{7}{11})^3]^4 = (\frac{7}{11})$ ---------
4. $(\frac{6}{13})^{10} \div [(\frac{6}{13})^5]^2 = (\frac{6}{13})$---------
5. $[(\frac{-1}{4})^{16}]^2 = (\frac{-1}{4})$ ---------
6. $a^6 \times a^5 \times a^0 = a$ ---------
7. 1 lakh = 10 ---------
8. 1 million = 10 ---------
9. 729 = 3 ---------

1. 44	2. 3	3. 12	4. 0	5. 32	6. 11	7. 5	8. 6	9. 6

I. True or False

1. One million = 10^7

2. One hour = 60^2 seconds

3. $1^0 \times 0^1 = 1$

4. $(-3)^4 = -12$

5. $3^4 > 4^3$

6. $\left(\frac{-3}{5}\right)^{100} = \frac{(-3)^{100}}{(-5)^{100}}$

7. $(10 + 10)^{10} = 10^{10} + 10^{10}$

8. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

9. In the standard form, a large number can expressed a decimal number between 0 and 1, multiplied by a power of 10.

10. 4^2 is greater than 2^4.

11. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

12. $x^m + y^m = (x\ X\ y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer.

13. $x^m \div y^m = (x \div y)^m$, where x and y are rational non-zero numbers is m positive integer.

14. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m, n are a positive integer.

15. 4^9 is greater than 16^3.

16. $\left(\frac{2}{5}\right)^3 \div \left(\frac{2}{5}\right)^3 = 1$

17. $\left(\frac{4}{3}\right)^5 + \left(\frac{5}{7}\right)^3 = \left(\frac{4}{3} + \frac{5}{7}\right)^3$

18. $\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^4$

19. $\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{10}$

20. $5^0 \times 25^0 \times 125^0 = (5^0)^6$ 600060 = 6 x 105 + 6 x 10

21. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

22. $600060 = 6 \times 10^5 + 6 \times 10^2$

23. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

24. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

25. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

1. False	2. True	3. False	4. False	5. True	6. True	7. False	8. True	9. True	10 False
11.False	12.False	13.True	14.True	15.True	16.False	17.False	18.False	19.False	20. True
21. True	22.False	23.False	24.True	25.False					

II. True or False

1. $2^0 \times 3^0 \times 0^1 = 2^{136}$

False $2^0 \times 3^0 \times 0^1 = 2^{136}$ $[\because a^0 = 1]$

$\because 1 \times 1 \times 0 \times 2^{136} = 0$ $[\because a \, X \, 0 = 0]$

Hence $2^0 \times 3^0 \times 0^1 \times 2^{136} \neq 1$

I. Match the columns

Column A		Column B	
a)	$(a^m)^n$	i)	$(a)^{mn}$
b)	$a^m + b^m$	ii	$(ab)^m$
c)	a^0	iii	$\left(\frac{a}{b}\right)^m$
d)	$a^m \times b^m$	iv	1

a) i	b) iii	c) iv	d) ii

II. Match the columns

Column A		Column B	
a)	$2^0 \times 3^2 \times 4^6 \div 4^2$	i)	16
b)	$\left(\frac{2}{5}\right)^6 \div \left(\frac{2}{5}\right)^4$	ii	$\frac{3}{8}$
c)	$\left(\frac{3}{4}\right)^6 \div \left(\frac{3}{4}\right)^5 \times \frac{1}{2}$	iii	$\frac{4}{25}$
d)	$(1)^{200} \times (2)^{198} \div (2)^{194}$	iv	2304

a) iv	b) iii	c) ii	d) i

I. Very Short Answer Questions

1. What is the value of $\left(\frac{3}{4}\right)^0$?

1

2. What is the value of x^a x x^b?

x^{a+b}

3. Solve $\left(\frac{6}{7}\right)^5 \div \left(\frac{6}{7}\right)^3$

$\left(\frac{6}{7}\right)^{5-3} = \left(\frac{6}{7}\right)^2 = \frac{36}{49}$

4. Solve $\frac{x^3 \times x^5}{x^2}$

$x^{3+5-2} = x^6$.

5. Calculate $(2^3)^5$

2^{15}

II. Very Short Answer Questions

1. Find the value of 5^4?.

5^4 =5 x 5 x 5 x 5 x 5 = 625

2. Express in exponential form

a x a x a x c x c x c x c x d = a^3 x c^4 x d

3. Express 729 using exponential notation.

We have, 729 = 3 x 3 x 3 x 3 x 3 x 3 = 3^6

3	729
3	243
3	81
3	27
3	9
3	3
	1

∴ The exponential power of 729 is **3^6**

4. Identify the greater number 2^8 or 8^2

We have, $\mathbf{2^8}$ = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 = 256

and $\mathbf{8^2}$ = **8 x 8 = 64**

Since, 256 > 64 i.e., $2^8 > 8^2$

5. Express 540 as product of powers of their prime numbers.

We have = 2 x 270

= 2 x 2 =135 = 2 x 2 x 3 x 45

= 2 x 2 x 3 x 3 x 15

= 2 x 2 x 3 x 3 x 5

540 = 2^2 x 3^3 x 5.

6. Simplify : $(-3)^2$ x $(-5)^2$.

We have $(-3)^{2 =}$ (-3) x (-3) = 9

$(-5)^2$ = (-5) x (-5) = 25

∴ $(-3)^2$ x $(-5)^2$ = 9 x 25 = 225.

7. Using law of exponents, simply and write in exponential form : 2^5 x 5^5

We have 2^5 x 5^5 = $(2 \text{ x } 5)^{5 =}$ 10^5 (∴ a^m x b^m = $(ab)^m$)

Thus, 2^5 x 5^5 = 10^5

8. Simplify and write in exponential form.

$\left(\frac{a^5}{a^3}\right)$ x a^8

We have $\left(\frac{a^5}{a^3}\right)$ x a^8 =(a^{5-3}) x a^8 $\left[\therefore \frac{a^m}{a^n} = a^{m-n}\right]$

= a^2 x a^8 (∴ a^m x a^n = a^{m+n}

= a^{2+8} = a^{10}

9. Express in standard form :

3,18,65,00,000

we have 3,18,65,00,000 = 3.186500000 x 10^9 =3.1865 x 10^9

10. Find the number from exponential form

9 x 10^5 + 2 x 10^2 + 3 x 10^1

= 9 x 100000 + 2 x 100 + 3 x 10

900000 + 200 + 30 = 9,00,230.

I. Short Answer Questions

1. **Express the number 25730 in standard form.**

25730 = 2.573 x 10,000

= 2.573×10^4

2. Find the greater number in the following : 2^5 and 5^3

Since, $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

And $5^3 = 5 \times 5 \times 5 = 125$

$\therefore 125 > 32$

$\Rightarrow 5^3 > 2^5$

3. Find the value of $\frac{3^7}{3^4 \times 3^3} \times 9$

$= \frac{3^7}{3^{(3+4)}} \times 9$

$= \frac{3^7}{3^7} \times 9 = 9$

4. Simplify : $[(5^2)^3 \times 5^4] \div 5^7$

$\left[[5^2]^3 \times 5^4\right] \div 5^7 = \frac{5^6 \times 5^4}{5^7}$

$= \frac{5^{6+4}}{5^7} = \frac{5^{10}}{5^7}$

$= 5^{10-7}$

$= 5^3$

II. Short Answer Questions

1. Write the following numbers in expanded form :

a) 270404 b) 230061

270404 = 2,00,000 + 70,000 + 400 + 4

= 2 x 1,00,000, + 7 x 10,000 + 4 x 100 x 4 + 1

$= 2 \times 10^5 + 7 \times 10^4 + 4 \times 10^2 + 4 \times 10^0$

b) 230061= 2,00,000 + 30,000 + 60 + 1

= 2 x 1,00,000, + 3 x 10,000 + 6 x 10 + 1

$= 2 \times 10^5 + 3 \times 10^4 + 6 \times 10^2 + 1 \times 10^0$

2. $[(2\div1)^{-2} \div (5\div 1)^{-1}]^2 \times \left(\frac{-5}{8}\right)^{-1}$

$= \left(\frac{1}{2} \div \frac{1}{5}\right)^{2} \times \left(\frac{8}{-5}\right)$

$= \left(\frac{1}{2} X\, 5\right)^2 \times \left(\frac{2\, X\, 2X\, 2}{-5}\right)$

$= \frac{1}{2^2} \times 5^2 \times \frac{2^3}{-5}$

$= \frac{2^3\, X\, 5^2}{2^2 X\, 5}$

$= -2^{3-2} \times 5^{2-1}$

$= -2 \times 5$

$= -10.$

3. Find the values of n, when:

a) $5^{2n} \times 5^3 = 5^9$ b) $8\times 2^{n+2}=32$

a) $\Longrightarrow 5^{2n+3} = 5^9$

As base 5 is same on both sides.

$\therefore 2n + 3 = 9$

$\Longrightarrow 2n = 9-3$

$\Longrightarrow 2n =6$

Thus, $n = \frac{6}{2} = 3.$

b) $\Longrightarrow 2\times 2 \times2 \times2^{n+2}$

$=2\times2\times2\times2\times2$

$2^3 \times2^{n+2}=2^5$

$\Longrightarrow 2^{n+2+3}=2^5$

$\Longrightarrow 2^{n+5} = 2^5$

As base is same on both sides

$\therefore n + 5 = 5$

$\Longrightarrow n = 5 – 5 = 0$

4. Simplify :

$\frac{10\ X\ 5^{n+1}+25\ x\ 5^n}{3\ X\ 5^{n+2}+\ 10\ X\ 5^{n+1}}$

$= \frac{2X5\ X\ 5^n X5+5x5\ x\ 5^n}{3\ X\ 5^n\ X5X5+2X5X5X\ 5^n}$

$= \frac{5X5\ X\ 5^n X2+5X5\ xX5^n}{5X\ 5\ X\ 5^n\ X3+5X5X5^n\ X\ 2}$

$= \frac{5X5\ X\ 5^n(2+1)}{5X\ 5\ X\ 5^n\ (3+2)} = \frac{(2+1)}{(3+2)} = \frac{3}{5}$

5. Express :

a) 729 As A Power Of 3 b) 128 as power of 2 c) 343 as a power of 7

a) We have 729 = 3 x3x 3x 3x3x3 =36

3	729
3	243
3	81
3	27
3	9
3	3
	1

Here, base = 3 and exponent = 6, as 3 repeated 6 times.

b) We have, 128 = 2x2x2x 2x2x2x2 $=2^7$

3	128
3	64
3	32
3	16
3	8
3	4
2	2
	1

Here, base = 2 and exponent = 7, as 2 repeated 7 times.

c) 343 as a power of 7

We have, 343 = 7x7x7 = 7^3

7	343
7	49
7	7
	1

Here, base = 7 and exponent = 3, since 7 as 3 times.

III. Short Answer Questions

1. Simplify and write in exponential form.

i) $7^{13} \div 7^{10}$ ii) $(7^{50})^2$

i) As we know $a^m \div a^{m} = a^{m-n}$

$\therefore 7^{13} \div 7^{10} = 7^{13-10} = 7^3$

ii) We have $(7^{50})^{2} = 7^{50\times2} = 7^{100}$ [As we know $(a^m)^{n} = a^{mn}$

2. Compare the numbers:

2.7×10^{12}; 1.5×10^{8}

Since $2.7 \times 10^{12} = \frac{27}{10} \times 10^{12} = 27 \times 10^{12-1}$

$= 27 \times 10^{11}$

Also $1.5 \times 10^{8} = \frac{15}{10} \times 10^{8} = 15 \times 10^{8-1} = 15 \times 10^{7}$

Now $27 \times 10^{11} = 27 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 27,00,00,00,00,000

and $15 \times 10^{7} = 15 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

= 15 ,00,00, 000

Since 27,00,00,00,00,000 > 15 ,00,00, 000

$\therefore 2.7 \times 10^{12} > 1.5 \times 10^{8}$

3. Express in exponential notation

i) 3,125 ii) 512

i)

5	3125
5	625
5	125
5	25
5	5
	1

We have $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^{5}$

ii) 512

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

We have , $512 = 2x2x2x2x2x2x2x2x2 = 2^{9}$.

4. Simplify : $\frac{3 \, X \, 7^2 X \, 11^8}{21 \, x \, 11^3}$

We know, 21 = 7 x 3

$= \frac{3 \, X \, 7^2 X \, 11^8}{3X \, 7 \, X \, 11^3}$

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$ [$\therefore a^m \div a^n = a^{m-n}$]

$=3^{1-1} \times 7^{2-1} \times 11^{8-3}$

$=3^6 \times 7^1 \times 11^5$

$= 1 \times 7 \times 11^5$

$= 7 \times 11^5$.

5. Express the following as a product of prime factors only in exponential form.

i) 270 ii) 729 x 64

i) We have, 270 = 2x 3 x3x3 x5= $2 \times 3^3 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

ii) We have

$729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 729 \times 64 = 3^6 \times 2^6$

6. Express the number appearing in following statements in standard form.

i) The distance between Earth and Moon is 38,40,00,000 m.

ii) The population of India was about 1,02,70,00,000 in March, 2001.

i) ∴ 38,40,00,000 = 3.84000000 x 10^8

= 3.84 x 10^8

∴The distance between Earth and Moon is 3.84 x 10^8m

ii) 1,02,70,00,000 = 1.027000000 x 10^9

= 1.027 x 10^9

∴ The population of India was 1.027 x 10^9 in March 2001.

Long Answer Questions I

1. Find the value of n if :

$$\frac{9^n \, X \, 3^2 \, X \, 3^n - (27)^n)}{(3^3)^5 x \, 2^3} = \frac{1}{27}$$

$$\Longrightarrow \frac{(3x3)^n X \, 3^2 X 3^n - (3 \, x \, 3x3)^n}{3^{15} x 2^3} = \frac{1}{3 \, x \, 3 \, x \, 3}$$

$$\Longrightarrow \frac{(3^2)^n \, X \, 3^{n+2} - (3^3)^n}{3^{15} X 2^3} = \frac{1}{3^3}$$

$$\Longrightarrow \frac{3^{2n} \, X \, 3^{n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{2n+n+2} - 3^{3n}}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n}(3^2 - 1)}{3^{15} X 2^3} = 3^{-3}$$

$$\Longrightarrow \frac{3^{3n-15}(9-1)}{2^3} = 3^{-3}$$

$$\Longrightarrow 3^{3n-15} \text{x} \, \frac{8}{8} = 3^{-3}$$

⟹ As base are same on both sides, so

3n-15 = -3

⟹ 3n = -3 + 15

⟹ 3n = 12

thus, n= $\frac{12}{3}$ = 4.

2. By what number should $(-15)^{-1}$ be divided so that the quotient is $(-5)^{-1}$

Let the number $(-15)^{-1}$ should be divided by x to get the quotient $(-5)^{-1}$

$\Longrightarrow \frac{1}{-15} \div x = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15} \times \frac{1}{x} = \frac{1}{-5}$

$\Longrightarrow \frac{1}{-15x} = \frac{1}{-5}$

$\Longrightarrow -15\,x \times 1 = -5 \times 1$

$\Longrightarrow -15x = -5$

$\Longrightarrow x = -\frac{5}{-15}$

$\Longrightarrow x = -\frac{1}{-3}$

$\Longrightarrow x = \frac{1}{3}$.

3. Simplify the following :

a) $(6^{-1} - 8^{-1})^{-1} + (2^{-1} - 3^{-1})^{-1}$

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

a) $(6^{-1} - 8^{-1})^{-1}$ + (2-1 – 3 -1)-1

$= \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{4-3}{24}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$

= 24 + 6 = 30

b) $\left\{6^{-1} + \left(\frac{3}{2}\right)^{-1}\right\}^{-1}$

$= \left(\frac{1}{6} + \frac{2}{3}\right)^{-1}$

$= \left(\frac{1+4}{6}\right)^{-1} = \left(\frac{5}{6}\right)^{-1}$

$= \frac{6}{5}$.

4. $a. \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27}$

b. 2^3 x a^3 x $5a^4$

$a. \ \frac{12^4 \ X\ 9^3 \ X\ 4}{6^3 \ X\ 8^2 \ X\ 27} \ = \ \frac{(3\ X 2^2)^4 \ X\ (3^2)^3 \ X\ 2^2}{(2\ X\ 3)^3 \ X\ (2^3)^2 \ X\ 3^3}$

$\frac{3^4 \ X 2^8 X 3^6 X 2^2}{2^3 \ X 3^3 X 2^6 X 3^3}$

$= \frac{2^{8+2} \ X\ 3^{6+4}}{2^{6+3} \ X\ 3^{3+3}} = 2^{10-9} \text{ x } 3^{10-6}$

$= 2 \text{ x } 3^4 = 2 \text{ x } 81 = 162.$

b. 2^3 x a^3 x $5a^4$

$= 8 \text{ x } a^3 \text{ x } 5 \text{ x } a^4$

$= 40 \text{ x } a^{3+4}$

$= 40 \text{ x } a^7$

$= 40a^7$

5. If $(25)^{n-1} + 100 = 5^{(2n-1)}$, find the value of n

$\Longrightarrow (5^2)^{n-1} + 100 = 5^{(2n-1)}$

$\Longrightarrow 5^{2n-2} + 100 = 5^{2n-1}$

$\Longrightarrow 5^{2n-2} - 5^{2n-1} = -100$

$\Longrightarrow 5^{2n-1} - 5^{2n-2} = 100$

$\Longrightarrow 5^{2n-2} \text{ x } (5-1) = 100$

$\Longrightarrow 5^{2n-2} \text{ x } 4 = 100$

$\Longrightarrow 5^{2n-2} = \frac{100}{4} = 25$

Thus, $5^{2n-2} = 5^2$

As base is same on both sides

$\therefore 2n-2 = 2$

$\Longrightarrow 2n = 2 + 2$

$\Longrightarrow 2n = 4$

$\Longrightarrow n = \frac{4}{2} = 2.$

6. Write each of the following in power notation:

a) $\left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right) \times \left(-\frac{4}{3}\right)$

a) $\frac{(-4)X(-4)X(-4)X(-4)X(-4)}{3\ X3X3\ X3X3}$

$= \frac{(-4)^5}{(3)^5} \quad = \left(\frac{-4}{3}\right)^5$

7. Find the value of n, where n is an integer and 2^{n-5}

$x 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times 6^{2n-4} = \frac{1}{12^4\ X2}$

$\Longrightarrow 2^{n-5} \times (3 \times 2)^{2n-4} \times 2^{2n-4} = \frac{1}{(2\ X2X3)^4\ X2}$

$\Longrightarrow 2^{n-5} \times 3^{2n-4} \times 2^{2n-4} = \frac{1}{2^4\ X2^4X3^4X2}$ [$\because (a \times b)^m = a^m \times b^m$]

$\Longrightarrow 2^{(n-5)} \times 2n-4 \times 3^{2n-4} = \frac{1}{2^{4+4+1}\ X3^4}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9\ X3^4}$

$\Longrightarrow 2^{3n-9} \times 3^{2n-4} = 2^{-9}\ X3^{-4}$ [$\because \frac{1}{a^m} = a^{-m}$]

8. Find x such, that $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^{19} = \left(\frac{1}{5}\right)^{8x}$

$\Longrightarrow \left(\frac{1}{5}\right)^{5+19} = \left(\frac{1}{5}\right)^{8x}$ [$\because a^m \times a^n = a^{m+n}$]

$\Longrightarrow \left(\frac{1}{5}\right)^{24} = \left(\frac{1}{5}\right)^{8x}$

When bases are equal, then by equating their exponents, we get

$8x = 24$

$x = \frac{24}{8} = 3.$

Long Answer Questions II

1. Express $\left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **as a rational number**

$\left(\frac{4}{3}\right)^{-1} = \frac{3}{4}$

and $\left(\frac{1}{4}\right)^{-1} = \frac{4}{1}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \left[\frac{3}{4} - \frac{4}{1}\right]^{-1}$

$= \left[\frac{3-4 \times 4}{4}\right]^{-1}$

$= \left[\frac{3-16}{4}\right]^{-1} = \left[\frac{-13}{4}\right]^{-1} = \frac{-4}{13}$

$\therefore \left[\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = \frac{-4}{13}.$

2. Simplify :

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{-2}\right]^{-1}$

As we know

$a^{-1} = \frac{1}{a}$ and $\left(\frac{1}{a}\right)^{-1} = a$

$\left[\left\{\left(\frac{-1}{4}\right)^{2}\right\}^{2}\right]^{-1} \quad \left[\left\{\left(\frac{-1}{4}\right) \times \left(\frac{-1}{4}\right)\right\}^{-2}\right]^{-1}$

$= \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1} \quad = \left[\left\{\frac{1}{16}\right\}^{-2}\right]^{-1}$

$= \left[16 \times 16\right]^{-1} = \left[256\right]^{-1} = \frac{1}{256}$

3. The speed of light in vacuum is 3 x 108 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standards form.

Speed of light in vacuum is 3 x 108 m/s

Time taken by sunlight to reach the Earth = 8 minutes

Converting in seconds = 8 x 60 seconds

Let the distance of sun from Earth be x metre

As we know,

Speed = $\frac{Distance}{Time}$

$3x\ 10^8 = \frac{x}{8\ X\ 60}$

$x = 3x\ 10^8$ x 48 x 10 [By cross multiplication]

$x = 144x\ 10^8 = 144x\ 10^{11}$ metres.

∴ The distance of Sun from Earth is 1.44×10^{11}m.

4. Bacteria can divide in every 20 minutes. So, 1 bacterium can multiply to 2 in 20 minutes, 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Bacteria can divide in every 20 minutes.

So I bacterium multiplied to 2 in every 20 minutes and 4 in 40 minutes.

Converting 6 hours in minutes :

1 hour = 60 minutes

6 hours = 60 x 6 = 360 minutes.

In every 20 minutes is multiplied by 2,

So 360 minutes it is $\frac{360}{20} = 18\ times$.

⟹ In 20 minutes 1 bacteria is multiplied by 2 = 1 x 2

In 40 minutes 2 bacteria is multiplied by 2 = $2 \times 2 = 2^2 = 4$.

In 60 minutes 4 bacteria is multiplied by 2 = $4 \times 2 = 2^3 = 8$.

In 360 minutes multiplied by 2 bacteria = 2^{18}

Hence, In 6 hours, 2^{18} bacteria well be there.
