EXPONENTS AND POWERS

Learning Objectives:

- ♦ What is base and exponent
- ♦ Laws of exponents
- ♦ How to write the numbers in standard form
- ♦ Exponential equations
- ♦ Comparision of different exponents.

Real life Applications:

Φ Exponents are used in computer Games, physics, pH and Richter measuring scales,science, Engineering, Economics, Accounting, Finance and many other disciplines.

Φ Exponential Growth is a critically important aspect of Finance, Demographics, Biology,Economics, Resources, Electronics and many other areas.

Φ Exponential Decay is associated with light, sound, sporting fixtures, dangerous chemicals and radioactive waste.

Φ A large distances exponents are used to measure large distances. For example, the distance from earth to the moon is 3.85×10^5 km (approx).

Φ People who use exponents are economists, bankers, financial advisors, insurance risk assessors, biologists, engineers, computer programmers, chemists, physicists, geographers, sound engineers, statisticians, mathematicians, geologists and many other professions.

§§ **Exponent :**

For any rational number 'a' and natural number 'n' multiplication of 'a' n times symbolically written as a^n (read as a to the power of n)

i.e a.a.a.....(n times) = a^n

Here a is called base and 'n' is called exponent of a (or) power of a.

Note: a.a.a.....(n times) is called product form and a^n is called its exponential form.

§§ ***Exponential Equation :***

An equation which has an un-known quantity as an exponent is called an exponential equation.

Ex : i) $5^x = 625$ ii) $3^{x-5} = 1$

Ψ $a^{1/n}$ is called the nth root of a and may be written as $\sqrt[n]{a}$.

Ψ $\sqrt[n]{a}$ is called a radical of Index 'n' and 'a' is called the radicand.

§§ ***Laws of exponents :***

If 'a' and 'b' are any rational numbers different from zero and if m, n are any rational numbers then,

i) **Multiplication Property:**

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

ii) **Power of a power property:**

$(a^m)^n = a^{mn}$

iii) **Power of a product property :**

$$(a.b)^m = a^m.b^m$$

iv) **Division Property :**

$$\frac{a^m}{a^n} = a^{m-n} \quad \text{if} \quad m>n$$

$$= \frac{1}{a^{n-m}} \quad \text{if } m<n$$

$$= 1 \quad \text{if } m = n$$

v) **Power of a Quotient property :**

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

vi) **Power with exponent zero law :**

$a^0=1 \ (a \neq 0)$

vii) **Power with exponent being negative integer :**

$$a^{-m} = \frac{1}{a^{+m}} \text{ or } \frac{1}{a^{-m}} = a^{+m}$$

Note :

φ The product of 5 and n is written as 5 x n. It is also written as 5.n (or) 5n

φ "5n" means "5 times n"

φ a = 1.a = a

2a = 2.a = a+a

3a = 3.a=a+a+a

ma = m.a = a+a+a+.....+a (m times)

φ The coefficient of x is 1

φ The coefficient of -x is -1

§§ **Powers of (-1) :**

We have $(-1)^1 = -1$

$(-1)^2 = (-1).(-1) = 1$

$(-1)^3 = (-1).(-1).(-1) = -1$

$(-1)^4 = (-1).(-1).(-1).(-1) = 1$ and so-on

consequently we have

$(-1)^{\text{odd natural number}} = -1$

$(-1)^{\text{even natural number}} = 1$

§§ **Scientific notation of the numbers:**

Very large numbers or very small numbers can be expressed in simplest form by using scientific notation.

Ex : 39087.8 can be expressed as $3.90878 \times 10^4 \simeq 3.9 \times 10^4$

1 light year=9.46×10^{15}m

TEACHING TASK

I) MCQs with one option is correct:

1. a.a.a.a = ...

A) a B) a^2 C) a^4 D) a^3

2. p=2, q=4 then 2pq = ...

A) 32 B) 16 C) 8 D) 2

3. $\frac{1}{10000} =$

A) -10^{-4} B) $16a^4$ C) 10^{-4} D) 10^4

4. $3pq^2r^2 \div 9pqr$ =

A) 3pqr B) $\frac{1}{3}$pq C) $\frac{1}{3}$qr D) $\frac{1}{3}$pqr

5. $\left(a^3 - b^3\right) \div \left(a - b\right)$ =

A) $\left(a+b\right)^2 - ab$ B) $\left(a+b\right)^2 + ab$ C) 4ab D) a^2-b^2

6. $(4+9+1+3)^3$=

A) 4913 B) 4319 C) 4931 D) 4139

7. The simplified form of $\left(\frac{-2}{5}\right)^{-3}$ is

A) $\frac{-127}{8}$ B) $\frac{-125}{8}$ C) $\frac{125}{4}$ D) $\frac{125}{8}$

8. If $\frac{5x-3}{19x+2} = \frac{3}{5}$ then x =

A) $-\frac{21}{32}$ B) $-\frac{32}{21}$ C) $\frac{21}{32}$ D) $\frac{32}{21}$

9. If x+y=5 and $x^2+y^2=10$ then xy=

A) $7\frac{1}{2}$ B) $7\frac{2}{3}$ C) $2\frac{1}{7}$ D) $7\frac{2}{7}$

10. $(50.5)^2 - (49.5)^2$ =.....

A) 1000 B) 100 C) 10 D) 1

11. $\left(6^{-1} - 8^{-1}\right)^{-1}$ = ...

A) $-\frac{1}{2}$ B) -2 C) $\frac{1}{24}$ D) 24

12. $2^{-3}+2^{-2}+2^0+2+2^2=$ .....

A) 8 B) $\frac{1}{8}$ C) $\frac{59}{8}$ D) $\frac{1}{4}$

13. $\left(-n^2\right)^2\left(-n^2\right)^3 =$ .....

A)-n^{10} B)n^{10} C)n^9 D)n^{12}

14. If $x=\left(a^m\right)^n : y=\left(a^n\right)^m$ then the relation between x and y is .....

A)x=y B)xy=1 C) x+y=1 D) x>y

15. $\left[5\left(8^{\frac{1}{3}}+27^{\frac{1}{3}}\right)^3\right]^{\frac{1}{4}}$ = ...

A) 1 B) 5 C) 3 D) 9

16. what is the value of $2^{0.64}\times 2^{0.36}$

A) 1 B) 2 C) 16 D) 32

17. A boy was asked to write $2^5\times 9^2$ but he wrote 2592. what is the numerical difference between the two ?

A) 0 B) 1 C) 2 D) 3

18. If x = 2 and y = 3 then find the value of $\left[\frac{1}{x^x}+\frac{1}{y^y}\right]$

A) $-\frac{31}{108}$ B) $\frac{31}{108}$ C) $\frac{125}{171}$ D) $\frac{153}{222}$

II) ***MCQs with more than one option is correct:***

◆ *This section contains multiple choice questions. Each question has 4choices (A), (B), (C),(D), out of which* ***ONE or MORE*** *is correct. Choose the correct options*

1. $8^3\times 8^2\times 8^{-5}$ is equal to

A) 8^0 B) 1 C) 8 D) 1^8

2. If $\frac{9^n\times 3^5\times (27)^3}{3\times (81)^4}=27$, then the value of n is

A)2 B) 3 C) 9 D) $\sqrt[4]{81}$

3. The square root of $3^0+3^1+3^2+3^3+3^4$

A)1 B) 11 C) $\sqrt{11^2}$ D) 11^2

4. The value of $\sqrt[4]{\sqrt[3]{x^2}}$

A) x B) x^2 C) $x^{1/6}$ D) $x^{2/3\times 1/4}$

5. If $\frac{9^n\times 3^2\times (3^{-n/2})^{-2}-(27)^n}{3^{3m}\times 2^3}=\frac{1}{27}$ then the value of m-n is

A) 1 B) 3^0 C) 3 D) 3.3^{-1}

III) ***Match the following:***

♦ *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in* ***Column–I*** *have to be matched with statements (p, q, r, s) in* ***Column–II****. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

Column- I		**Column -II**
1. 5^{-5}	( )	(A) 6^{12}
2. $6^{-6} \times 6^{6}$	( )	(B) 1
3. If $x^3 = 7^3$, then x	( )	(C) 2
4. $2^{1^{2^3}}$	( )	(D) 7
		(E) $\frac{1}{5^5}$

IV) Solve the following:

1. Find the value of each of the following

a) $\left(-\frac{2}{3}\right)^5$ b) $\left(-\frac{1}{10}\right)^6$

2. Express the following in exponential form(scientific notation).

a)96326000000 b)0.000939478

3. Write each of the following as single notation.

a)$3^2 x 3^5 x 3^4$ b) $\left(\frac{1}{2}\right)^5 \cdot \left(\frac{1}{2}\right)^6 \cdot \left(\frac{1}{2}\right)^{-8} \cdot \left(\frac{1}{2}\right)^4$

c) $\left(-\frac{6}{5}\right)^2 \times \left(-\frac{6}{5}\right)^3 \times \left(-\frac{6}{5}\right)^2 \times \left(-\frac{6}{5}\right)^8 \times \left(-\frac{6}{5}\right)^3$

d) $\left(-\frac{1}{3}\right)^2 \times \left(-\frac{1}{3}\right)^3 \times \left(-\frac{1}{3}\right)^5 \times \left(-\frac{1}{3}\right)^4 \times \left(-\frac{1}{3}\right)^8$

4. Simplify

a) $27^4 \div 3^4$ b) $\frac{2^3 x 2^{-2}}{4^{-4} x 4^2}$

5. Simplify

a) $\left(\frac{81}{16}\right)^{-\frac{1}{2}}$ b) $\sqrt{361} - \sqrt[4]{256}$

6. Simplifly $\left\{(-8)^{-4} \div 2^{-8}\right\}^2$

7. Which is greater in each of the following.

a) $2^{12}, 3^8$ b) $7^8, 9^6$

8. Find the value of x when

a) $(2^3)^4=(2)^{2x}$ b) $\left(\frac{2}{3}\right)^2\times\left(\frac{2}{3}\right)^8=\left(\frac{2}{3}\right)^{5x}$ c) $3^x.4^x=1$

9. Solve the following.

a) $5^{3x+1}=25^{x+2}$ b) $27^{x+2}=9^{x+3}=3^4$

10. By what number 3^{-4} should multiply to get 729.

11. Simplify $\left[\left\{\left(\frac{2}{3}\right)^{-2}\right\}\div\left(\frac{3}{4}\right)^{-3}\right]\times\left(\frac{2}{3}\right)^{-2}$

12. Simplify the following.

a) $\left(\frac{-2p^2q}{3pq^2}\right)^{-2}\times\left(\frac{6p^2}{q^4}\right)^2$ b) $\frac{(5pqr)^{-2}}{25p^2q^2r}$

13. $\left(\frac{x^m}{x^n}\right)^p\left(\frac{x^n}{x^p}\right)^m\left(\frac{x^p}{x^m}\right)^n$ =?

14. Find the value of y when $\frac{x^{2y-3}\times\left(x^2\right)^{y+1}}{\left(x^4\right)^{-3}}=\left(x^3\right)^3\div\left(x^6\right)^{-3}$

15. Show that $\frac{a^{p+q}.a^{q+r}.a^{r+p}}{\left(a^p.a^q.a^r\right)^2}=1$

16. Show that $\left(a^{x+y}\right)^{x-y}\times\left(a^{y+z}\right)^{y-z}\times\left(a^{z+x}\right)^{z-x}=1$

17. Find the value of $\frac{1}{1+x^{-m}}+\frac{1}{1+x^m}$

18. Show that value of $\left(\frac{m^p}{m^{-q}}\right)^{p-q}\times\left(\frac{m^q}{m^{-r}}\right)^{q-r}\times\left(\frac{m^r}{m^{-p}}\right)^{r-p}$ =1.

19. Find the value of $\left[\frac{x^{2-3n}.x^{4+3n}}{x^3}\right]^2\ (x\neq 0)$

20. Find the value of $\frac{\left(x^{a+b}\right)^3.\left(x^{b+c}\right)^3.\left(x^{c+a}\right)^3}{\left(x^a.x^b.x^c\right)^6}\ (x\neq 0)$

21. Find the value of $\frac{3^a.4^{a-2}.25^{a+1}}{9^{a-1}.2^{a+1}.5^{a-2}}$

22. If m=2, n=-3, p=-2 than

a)mnp b)3mn-2np

c) $(m+n)^2-(n+p)^2$ d) $m^2+n^2+p^2-mnp$

23. Find the value of x when $\frac{3^{2x}.9^{4x+1}.27}{(81)^{2x}}=1$

24. Which is greater 10^{600} or 5^{900}.

25. Find the value of $\left(\frac{x^a}{x^b}\right)^{a^2+ab+b^2}\left(\frac{x^b}{x^c}\right)^{b^2+bc+c^2}\left(\frac{x^c}{x^a}\right)^{c^2+ac+a^2}$

26. Simplify $\frac{a^{2x+4}.a^{(x+2).(x+3)}}{\left(a^2\right)^{x+1}.a^{x(2x+1)}}$

27. Simplify the following $(64)^{2/3}+\sqrt[2]{100}+5^0+(81)^{-1/4}\times\left(\frac{25}{16}\right)^{-1/2}$

28. Find the value of x when

$$\left(-\frac{2}{7}\right)^{x+3}\div\left(-\frac{2}{7}\right)^{-2x+3}=\left(-\frac{2}{7}\right)^{2x+5}\times\left(\left(-\frac{2}{7}\right)^{-2}\right)^{x+4}$$

29. If $\frac{1}{2}x(3^x-3^{x-1})$ =81, then x=?

30. Find the value of $\left(x^{m+n}\right)^{m-n}.\left(x^{n+p}\right)^{n-p}.\left(x^{n+m}\right)^{n-m}$

31. Find the value of $a^{x-y}\times b^{y-z}\times a^{y-x}\times b^{z-y}\times 2^5$

32. $\frac{9^n\times 3^5\times(27)^3}{3\times(81)^4}=27$ *then the value of n is ?*

LEARNER'S TASK

BEGINNERS (Level - I)

I) MCQs with one option is correct:

1. Which of the following is constant?
A) 1 B) z C) p D) x

2. The coefficient of x in –5x is
A) 5 B) –5 C) x D) –x

3. A symbol which takes various numerical values is called
A) Constant B) Variable C) Term D) Coefficient

4. The product of 20 and fourth power of (x – y) is
A) 20 $(x-y)^4$ B) 20 + $(x-y)^4$ C) 20 $(x+y)^4$ D) 4 $(x-y)^{20}$

5. The exponential form of 2010 × 2010 × ... × 2010 (2010 times)
A) 2 × 2010^0 B) $(2010)^{2010}$ C) $(2010)^0$ D) 2010

6. In $5x^2$ index of the base x is
A) 5 B) 2 C) x^2 D) 1

7. The value of $(7^0 - 3^0) \times 6^0$ is

A) 1 B) $(7^0 - 3^0)$ C) 6 D) 0

8. The product of the two powers of the same base is a power of the same base with the index equal to the.....

A) Sum of bases B) Product of indices

C) Sum of the indices D) Product of the basses

9. $(x^{-1} + y^{-1})^{-1}$ = ...

A) xy B) x+y C) $\frac{xy}{x+y}$ D) $\frac{x+y}{xy}$

10. $\left(\frac{32}{243}\right)^{\frac{-3}{5}}$ = ...

A) $\frac{27}{8}$ B) $\frac{8}{27}$ C) $\frac{-8}{27}$ D) $\frac{-27}{8}$

11. $(-1)^{2014}$ = ...

A) 1 B) 0 C) -1 D) 2014

12. $3^0 \times (1 - 3^{-3}) =$

A) 1 B) 0 C) $\frac{26}{27}$ D) $\frac{27}{26}$

13. The value of $\frac{a^{10}}{a^{12}}$ =

A) a^2 B) a^{22} C) a^{-2} D) $a^{\frac{5}{6}}$

14. If a = 5 and b = 3, then $a^3 - b^5$ =

A) –120 B) 120 C) 108 D) –118

15. If $2^n = 64$, then 2^{n-3} =

A) 6 B) 8 C) 12 D) 10

16. $1^0.2^0.3^0.4^o$ ----------100^0= .....

A) 0 B)1 C)100 D)500

17. $4^{3^2} - 4^8 =$

A) $(3x2)^{16}$ B) $3x2^{16}$ C) $2x3^{16}$ D) 6^{16}

18. If 2^n=64, then 2^{n+2}=.....

A)2^{12} B)576 C)2^8 D) 2^{10}

19. If $3^{x-1} = 9$ and $4^{y+2} = 64$ then $\frac{x}{y}$ =.....

A) 0 B) 3 C) 1 D) -3

20. If 2^x=1 then x=.....

A) 0 B) 1 C) 2 D) $\frac{1}{2}$

21. $x^6 \div x^{-3} =$

A) x^{-9} B) x^3 C) x^9 D) x^{-3}

22. $8^x X 2^2 = 2^6$ then x=

A) $\frac{3}{4}$ B) $\frac{4}{3}$ C) 0 D) 4

23. If $8^{x-1} = 2^{x+3}$, then x =

A) 1 B) 2 C) 3 D) 4

24. If $27^{x+1} = 9^{x+3}$, then x =

A) 1 B) 2 C) 3 D) 4

25. $(-1)^1 + (-1)^2 + (-1)^3 + \ldots\ldots\ldots\ldots + (-1)^{2014}$

A)2014 B)2015 C)1 D)0

26. 0.000019 can be expressed as.....

A)1.9×10^{-5} B)1.9×10^{-8} C)0.19×10^{-7} D)1.9×10^5

27. If $x^{m-n}.x^{n-p}.x^{p-m}$ =

A) 0 B) 1 C) x^{p-m-n} D) x

28. If $x = (a^m)^n$ and $y = (a^n)^m$, then

A) x = y B) $x \neq y$ C) xy = 1 D) xy = 0

29. If $a \neq 0$ and $b \neq 0$, then $\frac{a^{15} b^4}{a^6 b^2}$ =

A) $a^2 b^9$ B) $a^9 b^2$ C) $a^{-9} b^2$ D) $a^9 b^{-2}$

30. $(a^{4n} a^{3n} a^{2n})^2$ =

A) a^{28n} B) a^{18n^3} C) a^{18n} D) a^{28n^3}

31. If $x \neq 0$, then $\left[\frac{x^{2-3n}.x^{4-3n}}{x^3}\right]^3$ =

A) x^2 B) 1 C) x^3 D) x^9

32. The value of $\left(\frac{-5}{6}\right)^5 \div \left(\frac{-5}{6}\right)^7$ is

A) $-\frac{36}{25}$ B) $-\frac{30}{25}$ C) $\frac{36}{25}$ D) $\frac{-25}{36}$

33. The value of $\left\{\left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right\} \div \left(\frac{1}{4}\right)^{-3}$ is

A) $\frac{19}{64}$ B) $\frac{64}{19}$ C) $\frac{27}{16}$ D) $\frac{5}{16}$

34. The value of $\left\{\left(\frac{3}{2}\right)^{-1} \div \left(\frac{-2}{5}\right)^{-1}\right\}$ is

A) $\frac{3}{5}$ B) $\frac{-3}{5}$ C) $\frac{2}{5}$ D) $-\frac{4}{15}$

35. $\left[\left(\frac{1}{4}\right)^2-\left(\frac{1}{4}\right)^3\right]\times 2^6$ =

A) 1 B) 2 C) 3 D) 4

36. If $4 \times 8^m = 2^5$, then $\left[\frac{1}{m^{-1}}\right]^{-1}$ =

A) 1 B) 2 C) 2 D) 4

37. The value of x such that $\left(\sqrt[3]{4}\right)^{2x+\frac{1}{2}}=\frac{1}{32}$ is

A) –4 B) 4 C) 5 D) –5

38. $\left(x^{a+b}\right)^{a-b}\times\left(x^{b-c}\right)^{b+c}\times\left(x^{c+a}\right)^{c-a}$ =

A) x^{a+b+c} B) $x^{2a+2b+2c}$ C) 0 D) 1

39. $\frac{6a^9b^4c^5}{2ab^2c^3}$ is simplified then the answer is

A) $3a^8b^2c$ B) $3a^5b^2c^2$ C) $3a^8b^3c^2$ D) $3a^8b^2c^2$

ACHIEVERS (Level - II)

I) Solve the following :

1. Find the value of each of the following

a) 2^4 b) 4^4

2. Find the value of each of the following

a) $\left(\frac{2}{3}\right)^4$ b) $\left(\frac{3}{5}\right)^3$

c) $\left(-\frac{3}{4}\right)^6$ d) $\left(\frac{-2}{5}\right)^6$

3. Write each of the following in exponential form

a) 5x5x5x5x5x5 b) $\left(\frac{-6}{5}\right)x\left(\frac{-6}{5}\right)x\left(\frac{-6}{5}\right)x\left(\frac{-6}{5}\right)$

4. Express the following in exponential form

a)625 b)169 c) $\frac{32}{243}$

5. Express the following in exponential form(scientific notation)

a)59370000000 b)0.06398521478

6. Write each of the following as single notation

a) 4^4x4^6 b) 6^2x6^{-3}

c) $(-2)^2x(-2)^3x(-2)^4x(-2)^6$ d) $\left(-\frac{1}{5}\right)^3\cdot\left(-\frac{1}{5}\right)^2\cdot\left(-\frac{1}{5}\right)^6$

7. Write each of the following with a single exponent

a) $(2^5)^6$ b) $(4^2)^3$

8. Find the value of each of the following

a) $\frac{1}{4^{-2}}$ b) 6^{-3} c) $64^3 \div 4^8$

9. Simplify the following

a) $2^2+2^0+2^1+2^{-2}$ b) $(-1)^1+(-1)^2+(-1)^3+(-1)^4+(-1)^5+(-1)^6$ c) $\frac{3^{-2}.5^{-3}.5^2}{3^{-4}.5^{-2}.3^3}$

10. Evaluate the following

a) $(64)^{1/4}$ b) $\sqrt[3]{125}+\sqrt{25}$

11. Simplify $(32)^{-\frac{2}{5}} \div (125)^{-\frac{2}{3}} = ?$

12. Which is greater in each of the following.

a) $5^{10}, 3^5$ b) $2^5, 8^3$

13. Find the value of x when

a) $9x3^x=3^{2x}$ b) $5^{-3} = \frac{1}{5^x}$ c) $((-3)^3)^x X(-3)^3 = (-3)^{2x}$

14. Solve the following.

a) $2^x=32$ b) $8^{x+2}=2^{4x-3}$

15. By what number 5^{-1} should multiply to get $\frac{1}{15}$.

16. Find the value of x when $2^{2(x+1)}.4^{x+1}.8^{2x+2} = 1$

17. If $9^{x+2} = 720 + 9^x$ then x = ?

18. Solve $3^{4x+2} = 27^{x+1}$.

19. Find the value of x, when $2^{-5} \times 2^{2x+1} = 2^{13} \div 2^7$

20. If $(81)^{-1} \times (3)^{-5} \times (27)^{5/6}.(81)^2 = 3^{2x}$ then x = ...

21. If $a^{mn} = a^m.a^n$ then find the value of $n(n-2) + n(m-2)$ in terms of n?

22. The population of Tamilnadu as per 2010 census is 6,50,00,000. Write in standard form?

23. $x^{p-q}.x^{q-r}.x^{r-p} = ?$

24. Simplify $a^{x+y-z} \times a^{y+z-x} \times a^{z+x-y}$

25. Simplify $\left(x^m\right)^{n-p}.\left(x^n\right)^{p-m}.\left(x^p\right)^{m-n}$

26. $\frac{x^{m+n} \times x^{m+\ell} \times x^{\ell+m}}{\left(x^m \times x^n \times x^\ell\right)^2}$ = ?

27. $(x^{a-b})^{a+b}.(x^{b-c})^{b+c}.(x^{c+a})^{c-a}$ =?

28. $\left[\frac{x^{3n+1}.x^{3n-1}}{x^{2n+1}}\right]^2 \ (x \neq 0) =$?

29. Simplify $\frac{\left(3^{-2}\right)^5 \times \left(5^{-3}\right)^4 \times \left(7^{-4}\right)^5}{\left(2^{-1}\right)^2 \times \left(7^2\right)^{-10} \times \left(3^4\right)^{-2} \times \left(5^2\right)^{-3}}$

30. Simplify the following.

a) $3pq^2r^2 \div 9rp^2q$ b) $\frac{6a^9b^4c^5}{2ab^2c^3}$

31. Simplify $(xy)^{b-c}.(yz)^{c-a}.(zx)^{a-b}$

32. Simplify $\frac{x^{4n+2}.x^{2(2n+3)}}{x^{2n+2}.x^{4n}}$

33. Simplify $\frac{p^{-4}.q^3.r^{-2}.s^6}{r^3p^{-2}.s^o.q^{-4}}$

34. Simplify $x^{m-n}.x^{n-p}.x^{p-m}$

EXPLORERS (Level - III)

I) Multiple choice questions more than one option :

◆ *This section contains multiple choice questions. Each question has 4 choices (A), (B), (C),(D),out of which* ***ONE or MORE*** *is correct. Choose the correct options*

1. $2.^{100}.2^{-100}$= .....

A) 0 B) 1 C) 2^0 D) 2^1

2. $\left(2^3\right)^3 \times \left(2^7\right)^2$ =

A) $2^9 \times 2^{14}$ B) 2^{23} C) $\left(2^7\right)^2$ D) 2^{14+9}

3. Which is the value of $8^{2/3}$

A) 2^2 B) $\sqrt[3]{64}$ C) 4 D) 2^3

4. $(-2)^6$ = ...

A)-64 B) 8^2 C) $\sqrt{4096}$ D) 64

5. If $x^5 = (5^5)^5$ then x =

A) 5^5 B) 5 C) 3125 D) 625

6. Fourth power of '2a' can be written as

A) $2a^4$ B) $16a^4$ C) 4^2a D) $(2a)^4$

II) Match the following :

♦ *This section contains Matrix-Match Type questions. Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **Column–I** have to be matched with statements (p, q, r, s) in **Column–II**. The answers to these questions have to be appropriately bubbled as illustrated in the following example.*

*If the correct matches are A-p,A-s,B-r,B-r,C-p,C-q and D-s,then the correct bubbled 4*4 matrix should be as follows:*

	Column - I	**Column - II**
A.	1. $\frac{2^{10}}{2^{-10}}$	( ) (A) 1
	2. 6^{18}	( ) (B) 0
	3. If $2^x = 16$, then x	( ) (C) $(6^{10})^8$
	4. $5^0 - 6^0$	( ) (D) 2^{20}
		(E) 4
		(F) $2^{18} \times 3^{18}$

	Column - I	**Column - II**
B.	1. $100^{2^{3^{0^{10}}}}$	( ) (A) 0
	2. $(12^0 - 11^0)(3^1 - 1^3)$	( ) (B) 12
	3. $(128)^{\frac{5}{7}}$	( ) (C) 32
	4. If $5^x = 25^y = 625$, then $x^2 - y^2$	( ) (D) 1
		(E) 100^2
		(F) 1

III) Fill in the blanks:

1. For $n \in I$, $(-1)^{4n}$ = ...

2. 3^6= .....

3. $\left(3^4\right)^2$ = ...

4. $\left(-\frac{2}{3}\right)^5$ = ...

5. The exponential notation of (-6)(-6)(-6)(-6)(-6) = ...

6. The exponential notation of 25= .....

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

8. $\left(\frac{5}{2}\right)^{-5} \cdot \left(\frac{2}{5}\right)^{-5}$ = ...

9. $2^7 - 7^2$ = ...

10. $\frac{1}{2^{-3}}$ = ...

11. $x^x . x^x . x^{2x}$ = ...

12. If $5^x = 50$ then 5^{x+1} =

13. If $3^x = \frac{1}{27}$ then x= .....

14. $(1000)^0$ = ...

15. If $3^{x+2} = 18$ then 3^x = ...

16. If $\left(x^{2/3}\right)^a = 1$ then a = ...

17. Exponential form of 5,97,80,069=.....

IV) State whether the following statements are true or false :

1. $(6^0 - 7^0)$ = 0.

2. $x^{2017} \times \frac{1}{x^{2016}}$ = 1.

3. If a^0 = 1 then a is any real number.

4. If $2^x = 4^2$, then x=2.

5. If $\frac{1}{3^x}$ = 3^2, then x=2.

6. $(-1)^{2016}$ = -1.

7. If $x^y = x^{2^3}$, then y=6 ($x \neq 0, x \neq 1$)

8. If $5^x = 7^x$, then x=2.

9. The value of 3($x^2 - 3x + 2$), when x=2, is 0.

RESEARCHERS (Level - IV)

I) MCQs with one option is correct:

1. If $4^x - 4^{x-1} = 24$ then $(2x)^x$ equals **[IMO - 2008]**

A) $5\sqrt{5}$ B) $\sqrt{5}$ C) $25\sqrt{5}$ D) 125

2. $(256)^{0.16} \times (256)^{0.09}$ = ... **[Ssc- 2004]**

A) 4 B) 16 C) 64 D) 256.25

3. Find the value of $\left[\left(\frac{1}{4}\right)^2 - \left(\frac{1}{4}\right)^3\right] \times 2^6$ **[SLSTSE-2013]**

A) 1 B) 2 C) 3 D) 4

4. Convert 400 grams per liter into milligrams per liter in proper scientific notation **[KWEST - 2012]**

A) 4×10^{5} B) 4×10^{2} C) 4×10^{-5} D) 4×10^{3}

5. The value of the expression $\frac{-2^5.6^3}{(-2)^7.(-3)^2}$ is equal to **[KWEST- 2012]**

A) 6 B) -6 C) 8 D) -8

6. Express the number 9587.3 in proper scientific notation with the correct amount of significant figures: **[KWEST - 2012]**

A) 9.5873×10^{3} B) 95.873×10^{3} C) 958.73×10^{3} D) 9.5873×10^{4}

7. If m= $(-1)^{2000}$ and n= $(-1)^{2002}$, then the value of $\frac{m}{n}$ is **[SLSTSE-2016]**

A) -1 B) 1 C) 2000 D) 2002

8. The value of $\frac{1}{1+x^{a-b}}+\frac{1}{1+x^{b-a}}$ is **[SLSTSE-2016]**

A) 0 B) -1 C) 1 D) x^{a+b}

9. If $3^x = 6561$, then 3^{x-3} is **[SLSTSE-2017]**

A) 81 B) 243 C) 729 D) 27

10. If $3^{x+5} = 81^{x-1}$ then x=? **[NIMO-2018]**

A) 8 B) 0 C) 12 D) 3

11. $4^3+4^3+4^3+4^3$ is not equal to **[NIMO-2019]**

A) 4^4 B) $4^2\times4^2$ C) 256 D) 4^6

KEY

ΦΦ TEACHING TASK :

I)

1) C	2) B	3) C	4) C	5) A	6) A
7) B	8) A	9) A	10) B	11) D	12) C
13) B	14) A	15) B	16) B	17) A	18) B

II) 1) A,B,D 2)B,D 3) B,C 4)C,D 5) A,B,D

III) 1) E 2) B 3) D 4) C

IV) 1) a) $-\frac{32}{243}$ b) $\frac{1}{1000000}$ 2) a) 9.6326×10^{10} b) 9.39478×10^{-4}

3) a) 3^{11} b) $\left(\frac{1}{2}\right)^7$ c) $\left(-\frac{6}{5}\right)^{18}$ d) $\left(-\frac{1}{3}\right)^{22}$ 4) a) 3^8 b) 2^5

5) a) $\frac{4}{9}$ b) 15 6) 2^{-8} 7) a) 3^8 b) 7^8

8) a) $x=6$ b) $x=2$ c) $x=0$ 9) a) $x=3$ b) $x=1,\frac{2}{3}$ 10) 3^{10}

11) $3^7.2^{-10}$ 12) a) $3^4.p^2q^{-6}$ b) $\frac{1}{625}p^{-4}.q^{-4}.r^{-3}$ 13) 1 14) $y=4$

17) 1 19) x^6 20) 1 21) $2^{a-5}.3^{-a+2}.5^{a+4}$

22) a) 12 b) -30 c) -24 d) 5 23) $x=-\frac{5}{2}$ 24) 5^{900} 25) 1

26) a^{-x^2+4x+8} 27) $\frac{409}{15}$ 28) $x=-1$ 29) $x=5$ 30) $x^{n^2-p^2}$

31) 32 32) $n=3$

ΦΦ LEARNER'S TASK :

☐ **BEGINNERS :**

1) A	2) B	3) B	4) A	5) B	6) B	7) D
8) C	9) C	10) A	11) A	12) C	13) C	14) D
15) B	16) B	17) B	18) C	19) B	20) A	21) C
22) B	23) C	24) C	25) D	26) A	27) B	28) A
29) B	30) C	31) D	32) C	33) A	34) D	35) C
36) A	37) A	38) D	39) D			

☐ **ACHIEVERS :**

1. a) 16 b) 256 2. a) $\frac{16}{81}$ b) $\frac{27}{125}$ c) $\frac{729}{4096}$ d) $\frac{64}{15625}$ 3. a) 5^6 b) $\left(-\frac{6}{5}\right)^4$

4. a) 5^4 b) 13^2 c) $\left(\frac{2}{3}\right)^5$ 5. a) 5.937×10^{10} b) 6.398521478×10^{-2}

6. a) 4^{10} (or) 2^{20} b) 6^{-1} (or) $\frac{1}{6}$ c) $(-2)^{15}$ d) $\left(-\frac{1}{5}\right)^{11}$ 7. a) 2^{30} b) 4^6

8. a) 16 b) $\frac{1}{216}$ c) 4 9. a) $\frac{29}{4}$ b) 0 c) $\frac{5}{3}$ 10. a) $\sqrt{8}$ (or) $2\sqrt{2}$ b) 10

11. $\frac{25}{4}$ 12. a) 5^{10} b) 8^3 13. a) $x=2$ b) $x=3$ c) $x=3$

14. a) $x=5$ b) $x=9$ 15. $\frac{1}{3}$ 16. $x=-1$ 17. $x=1$ 18. $x=1$

19. $x=\frac{3}{4}$ 20. $x=5$ 21. n^3-4n^2+4n (or) $n(n^2-4n+4)$

22. 6.5×10^7 23. 1 24. a^{x+y+z} 25. 1 26. x^{m-n} 27. 1

28. x^{8n-2} 29. $2^2\times3^{-2}\times5^{-6}$ 30. a) $\frac{qr}{3p}$ b) $3a^8b^2c^2$ 31. $x^{a-c}.y^{b-a}.z^{c-b}$ 32. x^{2n+6}

33. $p^{-2}q^{7}r^{-5}s^{6}$ 34. 1

☐ **EXPLORERS :**

I) 1. B,C 2. A,B,D 3. A,B,C 4. B,C,D 5. A,C 6. B,D

II) (**A:** 1. D 2. F 3. E 4. B) (**B:** 1.E 2. A 3.C 4. B)

III) 1. 1 2. 729 3. 6561 4. $-\frac{32}{243}$ 5. $(-6)^5$ 6. 5^2 7. $\left(\frac{1}{6}\right)^4$

8. 1 9. 79 10. 8 11. x^{4x} 12. 250 13. -3 14. 1

15. 2 16. 0 17. 5.9780069×10^7

IV) 1.T 2. F 3. T 4. F 5. F 6. F 7. F

8. F 9. T

☐ **RESEARCHERS :**

1. C 2. A 3. C 4. A 5. B 6. A 7. B

8. C 9. B 10. D 11. A, B, C