MATHEMATICS

Class-VIII

Topic-10

EXPONENTS AND POWERS

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CH-10

EXPONENTS AND POWERS

Exponential form, base, power, index, exponent, positive integral exponent, negative integral exponent, laws.

INTRODUCTION

In the previous class, we have learnt the laws of exponents and powers as whole numbers. Here, in this chapter, we will study about the laws of exponents and powers as rational number.

10.1 EXPONENTS AND POWERS

If a number is multiplied by itself a number of times, then it can be written in the exponential form.

For example :

$5 \times 5 = 5^2$, $(-8) \times (-8) \times (-8) = (-8)^3$

If 'a' be any rational number and n be any positive integer then we define :

a × a × a × a × ....a (n times) = a^n.

We read a^n as 'a' raised to the power 'n'. In a^n, the number 'a' is called the base and n is called the exponent, power or index.

In 5^2 and $(-8)^3$, the numbers 5 and – 8 are the bases and 2 and 3 are the exponents respectively.

(a) Positive Integral Exponents of a rational number

Let $\frac{a}{b}$ be any rational number and n be a positive integer, Then,

$$\left(\frac{a}{b}\right)^n = \frac{a}{b} \times \frac{a}{b} \times \frac{a}{b} \times \frac{a}{b} \times \text{......... up to n times} = \frac{a \times a \times a \times a \text{.......n times}}{b \times b \times b \times b \times \text{.......n times}} = \frac{(a)^n}{(b)^n}$$

Thus $\left(\frac{a}{b}\right)^n = \frac{(a)^n}{(b)^n}$ for every positive integer n.

(b) Negative Integral exponents of a rational number

Let $\frac{a}{b}$ be any rational number and n be a positive integer, Then, $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$

Illustration 10.1

Evaluate : **(i)** $\left(\frac{3}{7}\right)^{-2}$ **(ii)** $\left(\frac{-4}{9}\right)^{-3}$.

Sol. (i) $\left(\frac{3}{7}\right)^{-2} = \left(\frac{7}{3}\right)^2 = \frac{49}{9}$. **(ii)** $\left(\frac{-4}{9}\right)^{-3} = \left(\frac{-9}{4}\right)^3 = \frac{-729}{64}$.

Illustration 10.2

Expand the following numbers using exponents :

(i) 789.35 **(ii)** 2005.007

Sol. **(i)** $789.35 = 7 \times 100 + 8 \times 10 + 9 \times 1 + 3 \times \frac{1}{10} + 5 \times \frac{1}{100}$

$= 7 \times 10^2 + 8 \times 10^1 + 9 \times 10^0 + 3 \times 10^{-1} + 5 \times 10^{-2}$

(ii) $2005.007 = 2 \times 1000 + 5 \times 1 + 7 \times \frac{1}{1000} = 2 \times 10^3 + 5 \times 10^0 + 7 \times 10^{-3}$

Illustration 10.3

Evaluate :

(i) $\left(\frac{2}{3}\right)^4$ **(ii)** $\left(\frac{-5}{6}\right)^3$

Sol. **(i)** $\left(\frac{2}{3}\right)^4 = \frac{(2)^4}{(3)^4} = \frac{16}{81}$. **(ii)** $\left(\frac{-5}{6}\right)^3 = \frac{(-5)^3}{(6)^3} = \frac{-125}{216}$.

(c) Laws of Exponents

Let $\frac{a}{b}$ be any rational number, and m and n be any integers, then, we have :

(i) $\left(\frac{a}{b}\right)^m \times \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m+n}$ **(ii)** $\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m-n}$

(iii) $\left\{\left(\frac{a}{b}\right)^m\right\}^n = \left(\frac{a}{b}\right)^{m \times n}$ **(iv)** $\left(\frac{a}{b} \times \frac{c}{d}\right)^n = \left(\frac{a}{b}\right)^n \times \left(\frac{c}{d}\right)^n$ and $\left\{\frac{(a/b)}{(c/d)}\right\}^n = \frac{(a/b)^n}{(c/d)^n}$

(v) $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$ **(vi)** $\left(\frac{a}{b}\right)^0 = 1$

Illustration 10.4

Find the value of **:**

(i) 5^{-2} **(ii)** $\frac{1}{7^{-2}}$ **(iii)** 7^0 **(iv)** $\left(\frac{-3}{4}\right)^{-2}$

Sol. **(i)** $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$ **(ii)** $\frac{1}{7^{-2}} = 7^2 = 7 \times 7 = 49$

(iii) $7^0 = 1$. **(iv)** $\left(\frac{-3}{4}\right)^{-2} = \left(\frac{-4}{3}\right)^2 = \frac{(-4)^2}{(3)^2} = \frac{16}{9}$.

Illustration 10.5

Simplify :

(i) $\frac{\left(-\frac{2}{3}\right)^6}{\left(-\frac{2}{3}\right)^2}$ **(ii)** $\left(\frac{-5}{2}\right)^3 \times \left(\frac{5}{2}\right)^{-4}$ **(iii)** $\left\{\left(\frac{3}{2}\right)^3\right\}^{-2}$ **(iv)** $\left(\frac{8}{81}\right)^3 \times \left(\frac{27}{4}\right)^3$

Sol. **(i)** $\frac{\left(-\frac{2}{3}\right)^6}{\left(-\frac{2}{3}\right)^2} = \left(-\frac{2}{3}\right)^{6-2} = \left(-\frac{2}{3}\right)^4 = \frac{16}{81}$.

(ii) $\left(\frac{-5}{2}\right)^3 \times \left(\frac{-5}{2}\right)^{-4} = \left(\frac{-5}{2}\right)^{3-4} = \left(\frac{-5}{2}\right)^{-1} = \frac{-2}{5}$.

(iii) $\left\{\left(\frac{3}{2}\right)^3\right\}^{-2} = \left(\frac{3}{2}\right)^{3\times(-2)} = \left(\frac{3}{2}\right)^{-6} = \left(\frac{2}{3}\right)^6 = \frac{64}{729}$

(iv) $\left(\frac{8}{81}\right)^3 \times \left(\frac{27}{4}\right)^3 = \left(\frac{8}{81} \text{x} \frac{27}{4}\right)^3 = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$.

Illustration 10.6

Express 125^{-7} as a base of 5.

Sol. We have, $125 = 5 \times 5 \times 5 = 5^3$

Therefore, $125^{-7} = (5^3)^{-7} = 5^{3\times(-7)} = 5^{-21}$.

Illustration 10.7

Simplify :

(i) $(2^{-1} \times 5^{-1})^{-1} \div 4^{-1}$ **(ii)** $(4^{-1} + 8^{-1}) \div \left(\frac{2}{3}\right)^{-1}$

Sol. **(i)** We have :

$$(2^{-1} \times 5^{-1})^{-1} \div 4^{-1} = \left(\frac{1}{2} \times \frac{1}{5}\right)^{-1} \div \left(\frac{4}{1}\right)^{-1}$$

$$= \left(\frac{1}{10}\right)^{-1} \div \left(\frac{1}{4}\right) = \left(\frac{10}{1}\right) \div \left(\frac{1}{4}\right) = \left(10 \div \frac{1}{4}\right) = (10 \times 4) = 40$$

(ii) $(4^{-1} + 8^{-1}) \div \left(\frac{2}{3}\right)^{-1} = \left(\frac{1}{4} + \frac{1}{8}\right) \div \left(\frac{3}{2}\right) = \frac{(2+1)}{8} \div \frac{3}{2} = \left(\frac{3}{8} \div \frac{3}{2}\right) = \left(\frac{3}{8} \times \frac{2}{3}\right) = \frac{1}{4}$

Illustration 10.8

Simplify : $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$.

Sol. We have :

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

$= (2^2 + 3^2 + 4^2) = (4 + 9 + 16) = 29$.

Illustration 10.9

Evaluate :

(a) $\left[\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1}$ **(b)** $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$

Sol. **(a)** $\left[\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right]^{-1} = (3 - 4)^{-1} = (-1)^{-1} = \frac{1}{(-1)^1} = -1$

(b) $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}} = \frac{3^{-5} \times (5 \times 2)^{-5} \times 5^3}{5^{-7} \times (3 \times 2)^{-5}} = \frac{3^{-5} \times 5^{-5} \times 2^{-5} \times 5^3}{5^{-7} \times 3^{-5} \times 2^{-5}}$

$= 2^{-5+5} \times 3^{-5+5} \times 5^{-5+3+7} = 2^0 \times 3^0 \times 5^5 = 1 \times 1 \times 5^5 = 3125$.

Illustration 10.10

By what number should $\left(\frac{3}{5}\right)^{-2}$ be divided so that the quotient becomes 25 ?

Sol. Let the number be x.

$\therefore \quad \left(\frac{3}{5}\right)^{-2} \div x = 25 \quad \Rightarrow \quad \left(\frac{3}{5}\right)^{-2} \times \frac{1}{x} = 25$

$\Rightarrow \quad \left(\frac{5}{3}\right)^{2} \times \frac{1}{x} = 25 \quad \Rightarrow \quad \frac{25}{9} \times \frac{1}{x} = 25$

$\Rightarrow \quad \frac{25 \times 1}{9 \times x} = 25 \quad \Rightarrow \quad 9 \times x \times 25 = 25$

$\therefore \quad x = \frac{25}{9 \times 25} = \frac{1}{9}.$

Illustration 10.11

If $5^{x+3} = (25)^{3x-4}$, then find the value of x.

Sol. $5^{x+3} = (25)^{3x-4} = 5^{2(3x-4)} = 5^{6x-8}$

$5^{x+3} = 5^{6x-8}$

On both the sides power have the same base, so their exponents must be equal

$\Rightarrow \quad x + 3 = 6x - 8 \quad \Rightarrow \quad x = \frac{11}{5}.$

Illustration 10.12

If x and y are prime integers such that $x^y = 128$, then find the value of $(x + y)^2$.

Sol. $x^y = 128$, since 128 is an even number .

So, x is also an even number.

Since x is prime number and x^y is even therefore x = 2.

$2^y = 128$

$2^y = 2^7$

On both the sides power have the same base, so their exponents must be equal.

So, y =7

therefore $(x + y)^2 = (2 + 7)^2 = 81$.

(d) Standard form of small and large numbers

We can represent very large and very small number in standard form with the help of exponents.

For example :

Number	**Standard form**
325000000	$3.25\text{x}10^{8}$
0.000005086	$5.086\text{x}10^{-6}$

NOTE :

(i) The power of 10 is positive integer equal to the number of places the decimal point has been moved left, when the number is more than 1.

(ii) The power of 10 is negative integer equal to the number of places the decimal point has been moved right, when the given number is less than 1

(i) Comparing very large and very small numbers

The diameter of the Sun is 1.4×10^9 m and the diameter of the Earth is 1.2756×10^7 m.
If we want to compare the diameter of earth, with the diameter of the Sun.
Diameter of Sun = 1.4×10^9 m
Diameter of Earth = 1.2756×10^7 m

Therefore, $\dfrac{\text{Diameter of Sun}}{\text{Diameter of Earth}} = \dfrac{1.4 \times 10^9}{1.2756 \times 10^7} = \dfrac{1.4 \times 10^{9-7}}{1.2756} = \dfrac{1.4 \times 100}{1.2756}$

Which is approximately 100.
So, the diameter of the Sun is about 100 times the diameter of the earth
Mass of Earth is 5.97×10^{24} kg and mass of moon is 7.35×10^{22} kg. What is the total mass ?
Total mass = 5.97×10^{24} kg + 7.35×10^{22} kg
= $5.97 \times 100 \times 10^{22}$ kg + 7.35×10^{22} kg
= 597×10^{22} kg + 7.35×10^{22} kg
= $(597 + 7.35) \times 10^{22}$ kg
= 604.35×10^{22} kg.

Ask yourself

1. Evaluate :

(i) 6^{-2} **(ii)** $\left(\dfrac{1}{-3}\right)^3$

2. Simplify and express the result in power notation with positive exponent :

(i) $(-3)^4 \div (-3)^6$ **(ii)** $\left(\dfrac{-3}{-2}\right)^4 \times \dfrac{32}{27}$

3. Simplify

$\left(\dfrac{5}{7}\right)^3 \times \left(\dfrac{5}{7}\right)^{-6} \times \left(\dfrac{1}{3}\right)^{-2} \times \left(\dfrac{3}{5}\right)^{-2}$

4. Find the value of m for which

(i) $\left(\dfrac{1}{6}\right)^4 \times \left(\dfrac{1}{6}\right)^9 = 6^{m+1}$ **(ii)** $\left(\dfrac{4}{9}\right)^{-8} \times \left(\dfrac{4}{9}\right)^{15} = \left(\dfrac{4}{9}\right)^{2m-3}$

5. Express the following numbers in standard form :
(i) 57400 **(ii)** 0.00000000005678

6. Express the following numbers is standard form :
(i) 73200000 **(ii)** 0·000629561 **(iii)** 151236000

Answers

1. **(i)** $\dfrac{1}{36}$ **(ii)** $-\dfrac{1}{27}$ **2.** **(i)** $\left(\dfrac{-1}{3}\right)^2$ **(ii)** 6 **3.** $\dfrac{343}{5}$

4. **(i)** m = – 14 **(ii)** m = 5 **5.** **(i)** 5.74×10^4 **(ii)** 5.678×10^{-11}

6. **(i)** 7.32×10^7 **(ii)** 6.29561×10^{-4} **(iii)** 1.51236×10^8

Add your knowledge

1. If **'a'** is negative real number and **'n'** is an **even positive** integer, then the principal **n^th^** root of **a** is not defined, because an even power of a real number is always positive. Therefore $(-9)^{1/2}$ is a meaningless quantity, if we confine ourselves to the set of real number, only.

2. **Laws of Rational Exponents**

The following laws hold the rational exponents

(i) $a^m \times a^n = a^{m+n}$

(ii) $a^m \;\; a^n = a^{m-n}$

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

(iv) $a^{-n} = \dfrac{1}{a^n}$

(v) $a^{m/n} = (a^m)^{1/n} = (a^{1/n})^m$ i.e. $a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

(vi) $(ab)^m = a^m b^m$

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

(viii) $a^{bn} = a^{b + b + b.....n \text{ times}}$

where a, b are positive real numbers and m, n are rational numbers.

Concept Map

EXPONENTS & POWERS

Exponential Form

axax….. upto n times = a^n

base is a , exponent or power is n.

LAW'S OF EXPONENT

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{m \times n}$
- $a^{-m} = \frac{1}{a^m}$
- $a^\circ = 1$
- $a^1 = a$
- $a^m \times b^m = (a \times b)^m$
- $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$

Scientific Notation or Standard Form

$325000000 = 3.25 \times 10^8$

Comparison of Very Large & Very Small Numbers

Summary

1. If m is a positive integer and x and y are rational numbers such that $x^m = y$, then $y^{\frac{1}{m}} = x$.

2. $y^{\frac{1}{m}}$ is called the m^th^ root of y and is written as $\sqrt[m]{y}$.

3. If x is a positive rational number and m and n are any rational exponents, then

(i) $x^m \times x^n = x^{m+n}$ **(ii)** $x^m \div x^n = x^{m-n}$

(iii) $(x^m)^n = x^{m \times n}$

4. If x and y are positive rational numbers and m is any rational exponent, then $x^m \times y^m = (x \times y)^m$.

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. $\left[\left\{\left(-\frac{1}{2}\right)^{2}\right\}^{-2}\right]^{-1} = ?$

(A) $\frac{1}{16}$ (B) 16 (C) $\frac{-1}{16}$ (D) – 16

2. The value of $\left[(-2)^{(-2)}\right]^{(-3)}$ is :

(A) 64 (B) 32
(C) Can't determined (D) None of these

3. Simplify : $\left(\frac{1}{3}\right)^{3} \times \left(\frac{1}{3}\right)^{4} \div \left(\frac{1}{3}\right)^{7}$.

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

4. Which of the following statement is correct?
(A) $a^0 = 0$ (B) $a^3 + a^2 = a^5$ (C) $(a^7)^3 = a^{21}$ (D) $a^1 = 1$

5. By what number $\left(\frac{3}{4}\right)^{-3}$ should be divided so that quotient becomes 128 ?

(A) $\frac{1}{54}$ (B) $\frac{1}{72}$ (C) $\frac{1}{90}$ (D) $\frac{1}{108}$

6. If $2^a = 32$ and $3^b = 27$, then the value of $(a + b)^2$ is :
(A) 16 (B) 32 (C) 64 (D) 128

7. If $\left(\frac{a}{b}\right)^{x-1} = \left(\frac{b}{a}\right)^{x-3}$, then x is equal to :

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

8. The solution of $3^{3x-5} = \frac{1}{9^x}$ is :

(A) 5/2 (B) 5 (C) 1 (D) 7/3

9. If $\left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$, then x = ?

(A) $\frac{-1}{2}$ (B) – 2 (C) 2 (D) $\frac{3}{4}$

10. If $\frac{9^n \times 3^5 \times (27)^3}{3 \times (81)^4} = 27$, then n equals :
(A) 0 (B) 2 (C) 3 (D) 4

FILL IN THE BLANKS

1. By multiplying $(10)^5$ by $(10)^{-10}$ we get______

2. If $36 = 6 \times 6 = 6^2$, then $\frac{1}{36}$ expressed as a power with the base 6 is.

3. By multiplying $\left(\frac{5}{3}\right)^4$ by _________. we get 5^4.

4. By solving $(6^o - 7^o) \times (6^o + 7^o)$ we get.

5. The value of $\left[1^{-2} + 2^{-2} + 3^{-2}\right]$ x 6^2 is

TRUE / FALSE

1. $(a^{-1} + b^{-1})^{-1} = \frac{ab}{a+b}$

2. $x^y = 121$, where y is even, then $\sqrt{x-y}$ is 3.

3. The standard form of 0.00000356 is 3.56×10^{-7}

4. $\left(\frac{1}{2}\right)^m \times \left(2^{-n}\right) = 2^{m-n}$

5. $x^5 + x^2 = x^7$

MATCH THE COLUMN

1.

	Column-I		**Column-II**
(A)	$(10^{150} \div 10^{146})$	(p)	10^4
(B)	$36 \times 36 \times 36 \times 36 \times 36$	(q)	$-\frac{3}{5}$
(C)	$\left(\frac{a}{b}\right)^{x-1} = \left(\frac{b}{a}\right)^{x-3}$, then x is	(r)	2
(D)	$\left(-\frac{5}{3}\right)^{-1}$	(s)	6^{10}
(E)	$(3^{-1} + 4^{-1})\, 5^{-1}$	(t)	$\frac{35}{12}$

2.

	Column-I		**Column-II**
(A)	$\frac{3^{2n+4} - 5\left(3^{2(n+1)}\right)}{9^{n-1}}$	(p)	1
(B)	$\frac{2^{n+4} - 2\left(2^n\right)}{2(2)^{n+3}} + 2^{-3}$	(q)	324
(C)	$\frac{(0.6)^0 - (0.1)^{-1}}{\left(\frac{3}{2^3}\right)^{-1} \cdot \left(\frac{3}{2}\right)^3 + \left(-\frac{1}{3}\right)^{-1}}$	(r)	27
(D)	$\frac{9^3 \times 3^5 \times (27)^3}{3 \times (81)^4}$	(s)	$-\frac{3}{2}$

SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. Obtain the value of $2^3 \times \left(\frac{1}{2}\right)^5 \times 2^{-6} \times \left(\frac{1}{2}\right)^{-3}$

2. By what number should $\left(-\frac{3}{2}\right)^{-3}$ be divided so that the quotient is $\left(\frac{9}{4}\right)^{-2}$.

3. Find the value of x, if $(25)^{x+2} = 125$.

4. Compare the following number.
(i) 3.5×10^{10} and 0.478×10^{12} **(ii)** 2^3 and 3^2

5. Write the following number in the standard form :
(i) 0.0034378 **(ii)** 340008923

SHORT ANSWER TYPE

6. The value of $(27^{-2/3})^{1/2} \times (64^{1/3})^2 \times (81^{-3/2})^{1/6}$

7. If $\left(\frac{125}{8}\right)^5 \times \left(\frac{125}{8}\right)^x = \left(\frac{5}{2}\right)^{18}$. Then find the value of x.

8. Find the value of 'a' in the following equation :
$$\left[\frac{9}{2}\right]^{-3} \times \left[\frac{2}{9}\right]^{-6} = \left[\frac{2}{9}\right]^{2a-1} \left[\frac{9}{2}\right]^{0}$$

9. If $9^{x+2} = 240 + 9^x$, then find the value of x.

10. If $2^x - 2^{x-1} = 4$ then x^x is equal to

LONG ANSWER TYPE

11. Find the value of $\left(\frac{x^a}{x^b}\right)^c \times \left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^a}\right)^b$

12. Assuming that x is a positive real number and a, b, c are rational numbers, prove that :
$$\left(\frac{x^a}{x^b}\right)^{a^2+ab+b^2} . \left(\frac{x^b}{x^c}\right)^{b^2+bc+c^2} . \left(\frac{x^c}{x^a}\right)^{c^2+ca+a^2} = 1$$

13. Prove that $\frac{3^{-n}+3^{1-n}}{3^{-n}-3^{2-n}} = \frac{-1}{2}$

14. If $\frac{9^n \times 3^2 \times \left(3^{-n/2}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$, then prove that m – n = 1.

15. If $\frac{\left(a+\frac{1}{b}\right)^p \times \left(a-\frac{1}{b}\right)^q}{\left(b+\frac{1}{a}\right)^p \times \left(b-\frac{1}{a}\right)^q} = \left(\frac{a}{b}\right)^x$, then what is x ?

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

1. $\left(27^{\frac{1}{3}}\right)^{\frac{1}{2}}$ is equal to

(A) $\frac{1}{9}$ (B) $\frac{27}{54}$ (C) $\frac{2}{3}$ (D) $\sqrt{\frac{1}{3}}$

2. If 25 $\left(\sqrt{5}\right)^{x}\times\left(\sqrt{5}\right)^{3}=5\sqrt{5}$ then the value of x is

(A) – 4 (B) 3 (C) 4 (D) 5

3. $\sqrt[3]{3^{n+2}}$ = 9 then 2^{n-1}

(A) 2 (B) 4 (C) 16 (D) 8

4. $\left(\frac{5^{-1}\times7^{2}}{5^{2}\times7^{-4}}\right)^{-\frac{1}{3}}$ = ...

(A) $\frac{49}{5}$ (B) $\frac{5}{49}$ (C) $\frac{7}{25}$ (D) $\frac{5}{7}$

5. If $3^{-n+1}=\sqrt[4]{81^{-3}}$ then 2n – 1 = ...

(A) 4 (B) $\frac{1}{4}$ (C) – $\frac{1}{4}$ (D) 7

6. $\left[\left\{\left(\frac{4}{9}\right)^{2}\right\}^{0}\right]^{-\frac{1}{2}}$ equal to

(A) $\frac{4}{9}$ (C) $-\frac{4}{9}$ (C) $\frac{9}{4}$ (D) 1

7. The sixth power of the fifth root of 0.00032 is

(A) 0.000064 (B) $(0.00032)^{6}$ (C) 0.2 (D) 0.02

8. $x^{p/q}$ is the q^{th} root of

(A) x (C) x^{p} (C) $x^{1/q}$ (D) $x^{p/q}$

9. $\frac{5^{-1}+3^{-1}}{5^{-1}-3^{-1}}$ is equal to

(A) – 4 (B) 4 (C) $-\frac{1}{4}$ (D) $\frac{1}{4}$

10. Simplify : $\frac{(25)^{3/2}\times(243)^{3/5}}{(16)^{5/4}\times(8)^{4/3}}$

(A) $\frac{3375}{512}$ (B) 1 (C) 2 (D) –2

SECTION -B (TECHIE STUFF)

11. Simplify: $\frac{16\times2^{n+1}-4\times2^{n}}{16\times2^{n+2}-2\times2^{n+2}}$

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

12. Simplify . $\left(\frac{81}{16}\right)^{-3/4}\times\left[\left(\frac{25}{9}\right)^{-3/2}\div\left(\frac{5}{2}\right)^{-3}\right]$

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

Exercise-3

(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. Solve: $2^{x+1}=8^{x}$ **[NSTSE - 2009]**

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

2. If $4^x + 4^x + 4^x + 4^x + 4^x + 4^x + 4^x + 4^x = \frac{1}{512}$, then what is value of $\frac{-3}{x}$? **[NSTSE - 2009]**

(A) 0.50 (B) 0.75 (C) – 0.75 (D) – 4.25

3. Fill in the blank **[Aryabhatta - 2009]**

$\frac{x^{2p}}{x^{q+r}}\times\frac{x^{2q}}{x^{p+r}}\times\frac{x^{2r}}{x^{p+q}}=$ ....

4. Find the value of $\left(\frac{x^a}{x^b}\right)^{\frac{1}{ab}}\left(\frac{x^b}{x^c}\right)^{\frac{1}{bc}}\left(\frac{x^c}{x^a}\right)^{\frac{1}{ac}}$? **[Aryabhatta - 2009]**

5. Which of the following is not equal to y^6 ? **[NSTSE - 2010]**

(A) $[y^{2/3}]^9$ (B) $\left[\sqrt{y^6}\right]^2$ (C) $\sqrt[3]{y^{18}}$ (D) $[y^{1/3}]^{12}$

6. If $3^{x^2-6x+12}=27$, then x = **[Aryabhatta - 2010]**

(A) 3 (B) 1 (C) 2 (D) None of these

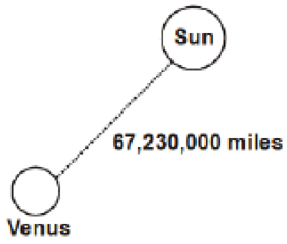
7. The value of $\frac{1}{(216)^{\frac{-2}{3}}}+\frac{1}{(256)^{\frac{-3}{4}}}+\frac{1}{(32)^{\frac{-1}{5}}}$ is ______________ **[IMO - 2010]**

(A) 102 (B) 104 (C) 103 (D) 105

8. Write $\frac{120m^2n^{-3}}{60\,m^5n^{-2}}$ in simplest form using only positive exponents. Assume that $m \neq 0$ and $n \neq 0$. **[IMO - 2010]**

(A) $\frac{2n}{m^3}$ (B) $\frac{2}{m^3n}$ (C) $\frac{2m^3}{n}$ (D) $\frac{1}{2m^3n}$

9. Manish saw the given figure while he was reading a book on astronomy. How is the distance from Venus to the sun written in scientific notation? **[IMO - 2010]**



(A) 67.23×10^6 miles (B) 0.6723×10^8 miles
(C) 6.723×10^4 miles (D) 6.723×10^7 miles

10. If $5^a \times 5^b = \frac{5^c}{5^d}$ what is 'd' in terms of a, b and c ? **[Aryabhatta - 2011]**

(A) $\frac{c}{ab}$ (B) c – a – b (C) a + b – c (D) c – ab

11. If $a^m \times a^n = a^{mn}$, then find m(n – 2) + n(m – 2) ? **[Aryabhatta - 2011]**
(A) 0 (B) 1 (C) m+n (D) None of these

12. If $2^{n-1} + 2^{n+1} = 320$, then n is equal to__________. **[IMO - 2011]**
(A) 6 (B) 8 (C) 5 (D) 7

13. If $x^{x^{\frac{3}{2}}} = \left(x^{\frac{3}{2}}\right)^x$ then the value of x is __________. **[IMO - 2011]**

(A) $\frac{3}{2}$ (B) $\frac{9}{4}$ (C) $\frac{16}{25}$ (D) $\frac{8}{27}$

14. It $3^{x-1} + 3^{x+1} = 90$, then x ¡s equal to _____. **[IMO - 2012]**
(A) 1 (B) 3 (C) 2 (D) 0

15. What is the value of the given expression? **[IMO - 2012]**

$$\frac{\left(\sqrt{16}^2\right)+\sqrt{64}}{\sqrt[3]{512}-\sqrt[3]{64}}$$

(A) 4 (B) 8 (C) 16 (D) 6

16. The population of a country is 3.2×10^6. There are 8×10^5 children. Find the number of adults. **[IMO - 2012]**
(A) 3×10^4 (B) 8×10^3 (C) 2.4×10^6 (D) 2.4×10^6

17. Given that $9^n + 9^n + 9^n = 3^{2013}$, what is the value of n ? **[NSTSE - 2013]**
(A) 1005 (B) 1006 (C) 2011 (D) 6019

Answer Key

Exercise-1

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10
Ans.	A	A	A	C	A	C	D	C	D	C

FILL IN THE BLANKS

1. 10^{-5} **2.** 6^{-2} **3.** 3^4 **4.** 0 **5.** 49

TRUE / FALSE

1. True **2.** True **3.** False **4.** False **5.** False

MATCH THE COLUMN

1. (A) – (p), (B) – (s), (C) – (r), (D) – (q), (E) – (t)

2. (A) – (q), (B) – (p), (C) – (s), (D) – (r)

SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. $\frac{1}{32}$ **2.** $\left(-\frac{3}{2}\right)$ **3.** $x = -1/2$

4. **(i)** $3.5 \times 10^{10} < 0.478 \times 10^{12}$ **(ii)** $2^3 < 3^2$

5. **(i)** 3.4378×10^{-3} **(ii)** 3.40008923×10^8

SHORT ANSWER TYPE

6. $\frac{16}{9}$ **7.** 1 **8.** (-1) **9.** $\frac{1}{2}$ **10.** 27

LONG ANSWER TYPE

11. 1 **15.** $p + q$

Exercise-2

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	D	A	D	B	D	D	A	C	A	A	D	A

Exercise-3

PREVIOUS YEAR EXAMINATION QUESTIONS

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