

गणित

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(अध्याय - 12) (घातांक और घात)

(कक्षा - 8)

प्रश्नावली 12.1

प्रश्न 1:

मान ज्ञात कीजिए:

(i) 3^{-2}

(ii) $(-4)^{-2}$

(iii) $\left(\frac{1}{2}\right)^{-5}$

उत्तर 1:

(i) $3^{-2} = \frac{1}{3^2}$
 $= \frac{1}{9}$

$\left[\because a^{-m} = \frac{1}{a^m} \right]$

(ii) $(-4)^{-2} = \frac{1}{(-4)^2}$
 $= \frac{1}{16}$

$\left[\because a^{-m} = \frac{1}{a^m} \right]$

(iii) $\left(\frac{1}{2}\right)^{-5} = \left(\frac{2}{1}\right)^5$
 $= (2)^5 = 32$

$\left[\because a^{-m} = \frac{1}{a^m} \right]$

प्रश्न 2:

सरल कीजिए और उत्तर को धनात्मक घातांक के रूप में व्यक्त कीजिए।

(i) $(-4)^5 \div (-4)^8$

(ii) $\left(\frac{1}{2^3}\right)^2$

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

(iv) $(3^{-7} \div 3^{-10}) \times 3^{-5}$

(v) $2^{-3} \times (-7)^{-3}$

उत्तर 2:

(i) $(-4)^5 \div (-4)^8 = (-4)^{5-8}$
 $= (-4)^{-3} = \frac{1}{(-4)^3}$

$\left[\because a^m \div a^n = a^{m-n} \right]$

$\left[\because a^{-m} = \frac{1}{a^m} \right]$

(ii) $\left(\frac{1}{2^3}\right)^2 = \frac{1^2}{(2^3)^2}$
 $= \frac{1}{2^{3 \times 2}} = \frac{1}{2^6}$

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

$\left[\because (a^m)^n = a^{m \times n} \right]$

(iii) $(-3)^4 \times \left(\frac{5}{3}\right)^4 = (-3)^4 \times \frac{5^4}{3^4}$
 $= \{(-1)^4 \times 3^4\} \times \frac{5^4}{3^4}$
 $= 3^{4-4} \times 5^4$
 $= 3^0 \times 5^4 = 5^4$

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

$\left[\because (ab)^m = a^m b^m \right]$

$\left[\because a^m \div a^n = a^{m-n} \right]$

$\left[\because a^0 = 1 \right]$

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$$\begin{aligned}
 \text{(iv)} \quad (3^{-7} \div 3^{-10}) \times 3^{-5} &= 3^{-7-(-10)} \times 3^{-5} & [\because a^m \div a^n = a^{m-n}] \\
 &= 3^{-7+10} \times 3^{-5} = 3^3 \times 3^{-5} = 3^{3+(-5)} & [\because a^m \times a^n = a^{m+n}] \\
 &= 3^{-2} = \frac{1}{3^2} & [\because a^{-m} = \frac{1}{a^m}] \\
 \text{(v)} \quad 2^{-3} \times (-7)^{-3} &= \frac{1}{2^3} \times \frac{1}{(-7)^3} & [\because a^{-m} = \frac{1}{a^m}] \\
 &= \frac{1}{\{2 \times (-7)\}^3} = \frac{1}{(-14)^3} & [\because (ab)^m = a^m b^m]
 \end{aligned}$$

प्रश्न 3:

मान ज्ञात कीजिए:

$$\begin{aligned}
 \text{(i)} \quad (3^0 + 4^{-1}) \times 2^2 & \quad \text{(ii)} \quad (2^{-1} \times 4^{-1}) \div 2^{-2} & \quad \text{(iii)} \quad \left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} \\
 \text{(iv)} \quad (3^{-1} + 4^{-1} + 5^{-1})^0 & \quad \text{(v)} \quad \left\{\left(\frac{-2}{3}\right)^{-2}\right\}^2
 \end{aligned}$$

उत्तर 3:

$$\begin{aligned}
 \text{(i)} \quad (3^0 + 4^{-1}) \times 2^2 &= \left(1 + \frac{1}{4}\right) \times 2^2 & [\because a^{-m} = \frac{1}{a^m}] \\
 &= \left(\frac{4+1}{4}\right) \times 2^2 = \frac{5}{4} \times 2^2 = \frac{5}{2^2} \times 2^2 \\
 &= 5 \times 2^{2-2} & [\because a^m \div a^n = a^{m-n}] \\
 &= 5 \times 2^0 = 5 \times 1 = 5 & [\because a^0 = 1] \\
 \text{(ii)} \quad (2^{-1} \times 4^{-1}) \div 2^{-2} &= \left(\frac{1}{2^1} \times \frac{1}{4^1}\right) \div 2^{-2} & [\because a^{-m} = \frac{1}{a^m}] \\
 &= \left(\frac{1}{2} \times \frac{1}{2^2}\right) \div 2^{-2} = \frac{1}{2^3} \div 2^{-2} & [\because a^m \times a^n = a^{m+n}] \\
 &= 2^{-3} \div 2^{-2} = 2^{-3-(-2)} = 2^{-3+2} = 2^{-1} & [\because a^m \div a^n = a^{m-n}] \\
 &= \frac{1}{2} & [\because a^{-m} = \frac{1}{a^m}] \\
 \text{(iii)} \quad \left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} &= (2^{-1})^{-2} + (3^{-1})^{-2} + (4^{-1})^{-2} & [\because a^{-m} = \frac{1}{a^m}] \\
 &= 2^{-1 \times (-2)} + 3^{-1 \times (-2)} + 4^{-1 \times (-2)} & [\because (a^m)^n = a^{m \times n}] \\
 &= 2^2 + 3^2 + 4^2 = 4 + 9 + 16 = 29 \\
 \text{(iv)} \quad (3^{-1} + 4^{-1} + 5^{-1})^0 &= \left(\frac{1}{3} + \frac{1}{4} + \frac{1}{5}\right)^0 & [\because a^{-m} = \frac{1}{a^m}]
 \end{aligned}$$

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$$= \left(\frac{20+15+12}{60} \right)^0 = \left(\frac{47}{60} \right)^0 = 1 \quad [\because a^0 = 1]$$

$$(v) \quad \left\{ \left(\frac{-2}{3} \right)^{-2} \right\}^2 = \left(\frac{-2}{3} \right)^{-2 \times 2} \quad [\because (a^m)^n = a^{m \times n}]$$

$$= \left(\frac{-2}{3} \right)^{-4} = \left(\frac{-3}{2} \right)^4 \quad [\because a^{-m} = \frac{1}{a^m}]$$

$$= \frac{81}{16}$$

प्रश्न 4:

मान ज्ञात कीजिए:

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

$$(ii) (5^{-1} \times 2^{-1}) \times 6^{-1}$$

उत्तर 4:

$$(i) \quad \frac{8^{-1} \times 5^3}{2^{-4}} = \frac{(2^3)^{-1} \times 5^3}{2^{-4}} = \frac{2^{-3} \times 5^3}{2^{-4}} \quad [\because (a^m)^n = a^{m \times n}]$$

$$= 2^{-3-(-4)} \times 5^3 = 2^{-3+4} \times 5^3 \quad [\because a^m \div a^n = a^{m-n}]$$

$$= 2 \times 125 = 250$$

$$(ii) \quad (5^{-1} \times 2^{-1}) \times 6^{-1} = \left(\frac{1}{5} \times \frac{1}{2} \right) \times \frac{1}{6} \quad [\because a^{-m} = \frac{1}{a^m}]$$

$$= \frac{1}{10} \times \frac{1}{6} = \frac{1}{60}$$

प्रश्न 5:

m का मान ज्ञात कीजिए जिसके लिए $5^m \div 5^{-3} = 5^5$.

उत्तर 5:

$$5^m \div 5^{-3} = 5^5$$

$$\Rightarrow 5^{m-(-3)} = 5^5 \quad [\because a^m \div a^n = a^{m-n}]$$

$$\Rightarrow 5^{m+3} = 5^5$$

दोनों पक्षों में तुलना करने पर

$$\Rightarrow m+3 = 5$$

$$\Rightarrow m = 5-3$$

$$\Rightarrow m = 2$$

प्रश्न 6:

मान ज्ञात कीजिए:

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

$$(ii) \left(\frac{5}{8} \right)^{-7} \times \left(\frac{8}{5} \right)^{-4}$$

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उत्तर 6:

$$(i) \quad \left\{ \left(\frac{1}{3} \right)^{-1} - \left(\frac{1}{4} \right)^{-1} \right\} = \left\{ \left(\frac{3}{1} \right)^1 - \left(\frac{4}{1} \right)^1 \right\} \quad \left[\because a^{-m} = \frac{1}{a^m} \right]$$

$$= \{3 - 4\} = -1$$

$$(ii) \quad \left(\frac{5}{8} \right)^{-7} \times \left(\frac{8}{5} \right)^{-4} = \frac{5^{-7}}{8^{-7}} \times \frac{8^{-4}}{5^{-4}}$$

$$= 5^{-7-(-4)} \times 8^{-4-(-7)}$$

$$= 5^{-7+4} \times 8^{-4+7} = 5^{-3} \times 8^3 = \frac{8^3}{5^3}$$

$$= \frac{512}{125}$$

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

$$\left[\because a^m \div a^n = a^{m-n} \right]$$

$$\left[\because a^{-m} = \frac{1}{a^m} \right]$$

प्रश्न 7:

सरल कीजिए।

$$(i) \quad \frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}} \quad (t \neq 0) \quad (ii) \quad \frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$$

उत्तर 7:

$$(i) \quad \frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}} = \frac{5^2 \times t^{-4}}{5^{-3} \times 5 \times 2 \times t^{-8}} = \frac{5^{2-(-3)-1} \times t^{-4-(-8)}}{2} \quad \left[\because a^m \div a^n = a^{m-n} \right]$$

$$= \frac{5^{2+3-1} \times t^{-4+8}}{2} = \frac{5^4 \times t^4}{2} = \frac{625}{2} t^4$$

$$(ii) \quad \frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}} = \frac{3^{-5} \times (2 \times 5)^{-5} \times 5^3}{5^{-7} \times (2 \times 3)^{-5}} = \frac{3^{-5} \times 2^{-5} \times 5^{-5} \times 5^3}{5^{-7} \times 2^{-5} \times 3^{-5}} \quad \left[\because (ab)^m = a^m b^m \right]$$

$$= \frac{3^{-5} \times 2^{-5} \times 5^{-5+3}}{5^{-7} \times 2^{-5} \times 3^{-5}} = \frac{3^{-5} \times 2^{-5} \times 5^{-2}}{5^{-7} \times 2^{-5} \times 3^{-5}} \quad \left[\because a^m \times a^n = a^{m+n} \right]$$

$$= 3^{-5-(-5)} \times 2^{-5-(-5)} \times 5^{-2-(-7)} \quad \left[\because a^m \div a^n = a^{m-n} \right]$$

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

$$= 1 \times 1 \times 3125 \quad \left[\because a^0 = 1 \right]$$

$$= 3125$$