CBSE Class –VIII Mathematics

NCERT Solutions

CHAPTER - 12

Exponents and Powers (Ex. 12.1)

1. Evaluate:

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

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

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

$= \frac{1}{9}$

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

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

$= \frac{1}{16}$

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

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

$= (2)^5 = 32$

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

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

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

Ans. (i) $(-4)^5 \div (-4)^8 = (-4)^{5-8}$ $\left[\because \ a^m \div a^n = a^{m-n}\right]$

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

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

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

$= \frac{1}{2^{3\times 2}} = \frac{1}{2^6}$ $\left[\because \ \left(a^m\right)^n = a^{m\times n}\right]$

(iii) $(-3)^4 \times \left(\frac{5}{3}\right)^4 = (-3)^4 \times \frac{5^4}{3^4}$ $\left[\because \ \left(\frac{a}{b}\right)^m = \frac{a^m}{a^n}\right]$

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

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

= $3^{4-4} \times 5^4$ $\left[\because \ a^m \div a^n = a^{m-n}\right]$

= $3^0 \times 5^4 = 5^4$ $\left[\because \ a^0 = 1\right]$

(iv) $\left(3^{-7} \div 3^{-10}\right) \times 3^{-5} = 3^{-7-(-10)} \times 3^{-5}$ $\left[\because \ a^m \div a^n = a^{m-n}\right]$

= $3^{-7+10} \times 3^{-5}$ = $3^3 \times 3^{-5}$ = $3^{3+(-5)}$ $\left[\because \ a^m \times a^n = a^{m+n}\right]$

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

(v) $2^{-3} \times (-7)^{-3} = \frac{1}{2^3} \times \frac{1}{(-7)^3}$ $\left[\because \ a^{-m} = \frac{1}{a^m}\right]$

= $\frac{1}{\{2 \times (-7)\}^3}$ = $\frac{1}{(-14)^3}$ $\left[\because \ (ab)^m = a^m b^m\right]$

3. Find the value of:

(i) $\left(3^0 + 4^{-1}\right) \times 2^2$

(ii) $\left(2^{-1} \times 4^{-1}\right) \div 2^{-2}$

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

(iv) $\left(3^{-1} + 4^{-1} + 5^{-1}\right)^0$

(v) $\left\{\left(\frac{-2}{3}\right)^{-2}\right\}^2$

Ans.

(i) $\left(3^0+4^{-1}\right)\times 2^2 = \left(1+\frac{1}{4}\right)\times 2^2 \quad \left[\because \ a^{-m}=\frac{1}{a^m}\right]$

$= \left(\frac{4+1}{4}\right)\times 2^2 = \frac{5}{4}\times 2^2 = \frac{5}{2^2}\times 2^2 = 5\times 2^{2-2} \quad \left[\because \ a^m \div a^n = a^{m-n}\right]$

$= 5\times 2^0 = 5\times 1 = 5 \quad \left[\because \ a^0 = 1\right]$

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

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

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

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

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

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

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

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

$= 2^2+3^2+4^2$ = 4 + 9 + 16 = 29

(iv) $\left(3^{-1}+4^{-1}+5^{-1}\right)^0 = \left(\frac{1}{3}+\frac{1}{4}+\frac{1}{5}\right)^0 \quad \left[\because \ a^{-m}=\frac{1}{a^m}\right]$

= $\left(\frac{20+15+12}{60}\right)^0 = \left(\frac{47}{60}\right)^0 = 1$

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

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

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

= $\frac{81}{16}$

4. Evaluate:

(i) $\frac{8^{-1}\times 5^3}{2^{-4}}$ **(ii)** $\left(5^{-1}\times 2^{-1}\right)\times 6^{-1}$

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

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

= $2\times 125 = 250$

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

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

5. Find the value of m for which $5^m \div 5^{-3} = 5^5$.

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

$\Rightarrow \quad 5^{m-(-3)} = 5^5$

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

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

Comparing exponents both sides, we get

$\Rightarrow \quad m+3=5$

$\Rightarrow \quad m=5-3$

$\Rightarrow \quad m=2$

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6. Evaluate:

(i) $\left\{\left(\frac{1}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right\}^{-1}$ **(ii)** $\left(\frac{5}{8}\right)^{-7}\times\left(\frac{8}{5}\right)^{-4}$

Ans.

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

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

(ii) $\left(\frac{5}{8}\right)^{-7}\times\left(\frac{8}{5}\right)^{-4}=\frac{5^{-7}}{8^{-7}}\times\frac{8^{-4}}{5^{-4}} \quad \left[\because \quad \left(\frac{a}{b}\right)^m=\frac{a^m}{b^m}\right]$

= $5^{-7-(-4)}\times 8^{-4-(-7)} \quad \left[\because \quad a^m \div a^n = a^{m-n}\right]$

= $5^{-7+4}\times 8^{-4+7}=5^{-3}\times 8^3$ = $\frac{8^3}{5^3} \quad \left[\because \quad a^{-m}=\frac{1}{a^m}\right]$

= $\frac{512}{125}$

7. **Simplify:**

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

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

Ans. (i) $\frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}}$

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

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

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

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

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

$= \frac{3^{-5} \times (2 \times 5)^{-5} \times 5^3}{5^{-7} \times (2 \times 3)^{-5}}$

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

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

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

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

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

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

= 3125