Exercise 10.1 (Revised) - Chapter 12 - Exponents & Powers - Ncert Solutions class 8 - Maths

Updated On 11-02-2025 By Lithanya

Chapter 10: Exponents & Powers - NCERT Solutions for Class 8 Maths

Ex 10.1 Question 1.

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

Answer.

(i) $3^{-2} = \frac{1}{3^2}$
$\left[\because a^{-m} = \frac{1}{a^m}\right]$
$= \frac{1}{9}$
(ii) $(-4)^{-2} = \frac{1}{(-4)}$
$\left[\because a^{-m} = \frac{1}{a^m}\right]$
$= \frac{1}{16}$
(iii) $\left(\frac{1}{2}\right)^{-5} = \left(\frac{2}{1}\right)^{5}$
$\left[\because a^{-m} = \frac{1}{a^m}\right]$
$= (2)^5 = 32$

Ex 10.1 Question 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) $2^{-3} \times (-7)^{-3}$

Answer.

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

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

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

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

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

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

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

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

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

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

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

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

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

Ex 10.1 Question 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) $\left\{\left(\frac{-2}{3}\right)^{-2}\right\}^2$

Answer.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$= \frac{81}{16}$

Ex 10.1 Question 4.

Evaluate:

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

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

Answer.

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

$= 2 \times 125 = 250$

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

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

Ex 10.1 Question 5.

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

Answer.

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

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

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

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

Comparing exponents both sides, we get

$\Rightarrow m + 3 = 5$

$\Rightarrow m = 5 - 3$

$\Rightarrow m = 2$

Ex 10.1 Question 6.

Evaluate:

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

Answer.

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

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

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

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

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

$= \frac{512}{125}$

Ex 10.1 Question 7. Simplify:

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

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

Answer.

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

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

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

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

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

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

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

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

$= 3125$

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Ex 10.2 Question 1.

Express the following numbers in standard form:
(i) 0.0000000000085
(ii) 0.00000000000942
(iii) 6020000000000000
(iv) 0.00000000837
(v) 31860000000

Answer.

(i) 0.0000000000085
$= 0.0000000000085 \times \frac{10^{12}}{10^{12}} = 8.5 \times 10^{-12}$
(ii) 0.00000000000942
$= 0.00000000000942 \times \frac{10^{12}}{10^{12}} = 9.42 \times 10^{-12}$
(iii) 6020000000000000
$= 6020000000000000 \times \frac{10^{15}}{10^{15}} = 6.02 \times 10^{15}$
(iv) 0.00000000837

$= 0.00000000837 \times \frac{10^{9}}{10^{9}} = 8.37 \times 10^{-9}$
(v) 31860000000

$= 31860000000 \times \frac{10^{10}}{10^{10}} = 3.186 \times 10^{10}$

Ex 10.2 Question 2.

Express the following numbers in usual form:
(i) 3.02×10^{-6}
(ii) 4.5×10^{4}
(iii) 3×10^{-8}
(iv) 1.0001×10^{9}
(v) 5.8×10^{12}
(vi) 3.61492×10^{6}

Answer.

(i)
(ii) $4.5 \times 10^{4} = 4.5 \times 10000 = 45000$
(iii) $3 \times 10^{-8} = \frac{3}{10^{8}} = 0.00000003$
(iv) $1.0001 \times 10^{9} = 1000100000$
(v) $5.8 \times 10^{12} = 5.8 \times 1000000000000$

$= 5800000000000$

(vi) $3.61492 \times 10^6 = 3.61492 \times 1000000$

$= 3614920$

Ex 10.2 Question 3.

Express the number appearing in the following statements in standard form:

(i)1 micron is equal to $\frac{1}{1000000}\mathrm{m}$.

(ii) Charge of an electron is $0.000,000,000,000,000,16$ coulomb.

(iii) Size of a bacteria is 0.0000005 m.

(iv) Size of a plant cell is

0.00001275 m.

(v) Thickness if a thick paper is 0.07 mm.

Answer.

(i) 1 micron

$= \frac{1}{1000000} = \frac{1}{10^6} = 1 \times 10^{-5}$ m

(ii)Charge of an electron is

0.00000000000000000016 coulombs.

$= 0.00000000000000000016 \times \frac{10^{19}}{10^{19}}$

$= 1.6 \times 10^{-19}$ coulomb

(iii) Size of bacteria $= 0.0000005$

$\frac{5}{10000000} = \frac{5}{10^7} = 5 \times 10^{-7}$ m

(iv) Size of a plant cell is 0.00001275 m

$= 0.00001275 \times \frac{10^5}{10^5} = 1.275 \times 10^{-5}$ m

(v) Thickness of a thick paper $= 0.07$ mm

$= \frac{7}{100}\mathrm{mm} = \frac{7}{10^2} = 7 \times 10^{-2}$ mm

Ex 10.2 Question 4.

In a stack there are 5 books each of thickness 20 mm and 5 paper sheets each of thickness 0.016 mm. What is the total thickness of the stack?

Answer.

Thickness of one book $= 20$ mm

Thickness of 5 books $= 20 \times 5 = 100$ mm

Thickness of one paper $= 0.016$ mm

Thickness of 5 papers $= 0.016 \times 5$

$= 0.08$ mm

Total thickness of a stack $= 100 + 0.08$

$= 100.08$ mm

$= 100.08 \times \frac{10^2}{10^2}$

$= 1.0008 \times 10^2$ mm