

## CBSE NCERT Solutions for Class 8 Mathematics Chapter 12

### Back of Chapter Questions

#### Exercise: 12.1

1. Evaluate:

(i)  $3^{-2}$

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

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

**Solution:**

(i)  $3^{-2} = \frac{1}{3^2} \quad \left[ \because a^{-m} = \frac{1}{a^m} \right]$   
 $= \frac{1}{9}$

Hence,  $3^{-2} = \frac{1}{9}$

(ii)  $(-4)^{-2} = \frac{1}{(-4)^2} \quad \left[ \because a^{-m} = \frac{1}{a^m} \right]$   
 $= \frac{1}{16}$

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

(iii)  $\left(\frac{1}{2}\right)^{-5} = \left(\frac{2}{1}\right)^5 \quad \left[ \because a^{-m} = \frac{1}{a^m} \right]$   
 $= (2)^5 = 32$

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

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

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

**Solution:**

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

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

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

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

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

Hence,  $\left(\frac{1}{2^2}\right)^2 = \frac{1}{2^6}$

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

$$= \{(-1)^4 \times 3^4\} \times \frac{5^4}{3^4} \quad [\because (ab)^m = a^m b^m]$$

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

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

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

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

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

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

Hence,  $(3^{-7} \div 3^{-10}) \times 3^{-5} = \frac{1}{3^2}$

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

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

Hence,  $2^{-3} \times (-7)^{-3} = \frac{1}{(-14)^3}$

3. Find the value of:

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

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

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

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

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

**Solution:**

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

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

$$= 5 \times 2^{2-2} \quad [\because a^m \div a^n = a^{m-n}]$$

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

Hence,  $(3^0 + 4^{-1}) \times 2^2 = 5$

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

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

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

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

Hence,  $(2^{-1} \times 4^{-1}) \div 2^{-2} = \frac{1}{2}$

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

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

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

Hence,  $\left( \frac{1}{2} \right)^{-2} + \left( \frac{1}{3} \right)^{-2} + \left( \frac{1}{4} \right)^{-2} = 29$

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

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

Hence,  $(3^{-1} + 4^{-1} + 5^{-1})^0 = 1$

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

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

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

$$\text{Hence, } \left\{ \left( -\frac{2}{3} \right)^{-2} \right\}^2 = \frac{81}{16}$$

4. Evaluate:

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

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

**Solution:**

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

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

$$= 2 \times 125 = 250$$

$$\text{Hence, } \frac{8^{-1} \times 5^3}{2^{-4}} = 250$$

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

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

$$\text{Hence, } (5^{-1} \times 2^{-1}) \times 6^{-1} = \frac{1}{60}$$

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

**Solution:**

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

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

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

Comparing exponents both sides, we get

$$\Rightarrow m + 3 = 5$$

$$\Rightarrow m = 5 - 3$$

$$\Rightarrow m = 2$$

Therefore, the value of  $m$  is 2

6. Evaluate:

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

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



**Solution:**

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

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

$$\text{Hence, } \left\{ \left( \frac{1}{3} \right)^{-1} - \left( \frac{1}{4} \right)^{-1} \right\}^{-1} = -1$$

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

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

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

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

$$\text{Hence, } \left( \frac{5}{8} \right)^{-7} \times \left( \frac{8}{5} \right)^{-4} = \frac{512}{125}$$

7. Simplify:

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

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

**Solution:**

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

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

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

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

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

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

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

$$= 3125$$

## Exercise 12.2

1. Express the following numbers in standard form:

- (i) 0.0000000000085
- (ii) 0.00000000000942
- (iii) 602000000000000
- (iv) 0.00000000837
- (v) 31860000000

**Solution:**

- (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)  $602000000000000 = 602000000000000 \times \frac{10^{15}}{10^{15}} = 6.02 \times 10^{15}$
- (iv)  $0.00000000837 = 0.00000000837 \times \frac{10^9}{10^9} = 8.37 \times 10^{-9}$
- (v)  $31860000000 = 31860000000 \times \frac{10^{10}}{10^{10}} = 3.186 \times 10^{10}$

2. Express the following numbers in usual form:

- (i)  $3.02 \times 10^{-6}$
- (ii)  $4.5 \times 10^4$
- (iii)  $3 \times 10^{-8}$
- (iv)  $1.0001 \times 10^9$
- (v)  $5.8 \times 10^{12}$
- (vi)  $3.61492 \times 10^6$

**Solution:**

- (i)  $3.02 \times 10^{-6} = \frac{3.02}{10^6} = 0.00000302$
- (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)  $3.61492 \times 10^6 = 3.61492 \times 1000000 = 3614920$

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

- (i) 1 micron is equal to  $\frac{1}{1000000}$  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 of a thick paper is 0.07 mm.

**Solution:**

- (i)  $1 \text{ micron} = \frac{1}{1000000} = \frac{1}{10^6} = 1 \times 10^{-6} \text{ m.}$
  - (ii) Charge of an electron is 0.000,000,000,000,000,16 coulomb =  $0.000,000,000,000,000,16 \times \frac{10^{19}}{10^{19}} = 1.6 \times 10^{-19} \text{ coulomb}$
  - (iii) Size of a bacteria =  $0.0000005 = \frac{5}{10000000} = \frac{5}{10^7} = 5 \times 10^{-7} \text{ m.}$
  - (iv) Size of a plant cell is  $0.00001275 \text{ m} = 0.00001275 \times \frac{10^5}{10^5} = 1.275 \times 10^{-5} \text{ m}$
  - (v) Thickness of a thick paper =  $0.07 \text{ mm} = \frac{7}{100} \text{ mm} = \frac{7}{10^2} = 7 \times 10^{-2} \text{ mm.}$
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?

**Solution:**

Thickness of one book = 20 mm

Thickness of 5 books =  $20 \times 5 = 100 \text{ mm}$

Thickness of one paper = 0.016 mm

Thickness of 5 papers =  $0.016 \times 5 = 0.08 \text{ mm}$

Total thickness of stack =  $100 + 0.08$

= 100.08 mm

=  $100.08 \times \frac{10^2}{10^2} = 1.0008 \times 10^2 \text{ mm}$

