

CHAPTER 12 EXPONENTS AND POWERS

CLASS 8 NCERT SOLUTION

Exercise 12.1 Page No: 197

1. Evaluate:

(i) 3^{-2} (ii) $(-4)^{-2}$ (iii) $(1/2)^{-5}$

Solution:

(i) $3^{-2} = (1/3)^2$

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

$$= 1/9$$

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

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

$$= 1/16$$

(iii) $(1/2)^{-5} = (2/1)^5$

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

$$= 2^5$$

$$= 32$$

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

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

(ii) $(1/2^3)^2$

(iii) $-(3)^4 \times (5/3)^4$

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

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

Solution:

(i)

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

$$= (-4)^5 / (-4)^8$$

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

$$= (-4)^{5-8}$$

$$= 1/(-4)^3$$

(ii) $(1/2^3)^2$

$$= 1^2 / (2^3)^2$$

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

$$= 1/2^{3 \times 2} = 1/2^6$$

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

(iii) $-(3)^4 \times (5/3)^4$

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

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

$$= (-1)^4 \times 3^4 \times (5^4/3^4)$$

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

$$= 3^{(4-4)} \times 5^4$$

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

$$= 3^0 \times 5^4 = 5^4$$

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

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

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

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

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

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

$$= 3^3 \times 3^{-5}$$

$$= 3^{(3-5)}$$

$$[\because a^m \times a^n = a^{m+n}]$$

$$= 3^{-2}$$

$$= 1/3^2$$

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

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

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

$$(Because a^m \times b^m = (ab)^m)$$

$$= 1/(2 \times -7)^3$$

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

$$= 1/(-14)^3$$

3. Find the value of :

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

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

$$(iii) (1/2)^{-2} + (1/3)^{-2} + (1/4)^{-2}$$

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

$$(v) \{(-2/3)^{-2}\}^2$$

Solution:

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

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

$$= ((4+1)/4) \times 2^2$$

$$= (5/4) \times 2^2$$

$$= (5/2^2) \times 2^2$$

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

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

$$= 5 \times 2^0$$

$$= 5 \times 1 = 5$$

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

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

$$= [(1/2) \times (1/4)] \div (1/4)$$

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

$$= (1/2 \times 1/2^2) \div 1/4$$

$$= 1/2^3 \div 1/4$$

$$= (1/8) \times (4)$$

$$= 1/2$$

$$(iii) (1/2)^{-2} + (1/3)^{-2} + (1/4)^{-2}$$

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

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

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

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

$$= 2^2 + 3^2 + 4^2$$

$$= 4 + 9 + 16$$

$$=29$$

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

$$= 1$$

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

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

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

$$= (-2/3)^{-4}$$

$$= (-3/2)^4$$

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

$$= 81/16$$

4. Evaluate

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

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

Solution:

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

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

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

=

$$2^{-3-(-4)} \times 5^3 = 2^{-3+4} \times 5^3$$

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

$$= 2 \times 125 = 250$$

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

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

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

$$= (1/10) \times 1/6$$

$$= 1/60$$

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

Solution:

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

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

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

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

Comparing exponents both sides, we get

$$m+3 = 5$$

$$m = 5-3$$

$$m = 2$$

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)

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

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

$$= 3-4$$

$$= -1$$

(ii)

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

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

=

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

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

=

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

$$= 5^{-3} \times 8^3 =$$

$$\frac{8^3}{5^3}$$

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

$$= 512/125$$

7. Simplify.

(i)

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

(ii)

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

Solution:

(i)

$$\frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}}$$
$$= \frac{5^2 \times t^{-4}}{5^{-3} \times 5 \times 2 \times t^{-8}}$$
$$= \frac{5^{2-(-3)-1} \times t^{-4-(-8)}}{2}$$

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

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

(ii)

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

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

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

$$[\because a^m \times a^n = a^{m+n}]$$

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

$$\begin{aligned}
&= \\
&3^{-5+5} \times 2^{-5+5} \times 5^{-2+7} = \\
&3^0 \times 2^0 \times 5^5 \\
&= 1 \times 1 \times 3125 \\
&[\because a^0 = 1] \\
&= 3125
\end{aligned}$$

Exercise 12.2 Page No: 200

1. Express the following numbers in standard form.

(i) 0.00000000000085

(ii) 0.000000000000942

(iii) 6020000000000000

(iv) 0.00000000837

(v) 31860000000

Solution:

$$(i) 0.00000000000085 = 0.00000000000085 \times (10^{12}/10^{12}) = 8.5 \times 10^{-12}$$

$$(ii) 0.000000000000942 = 0.000000000000942 \times (10^{12}/10^{12}) = 9.42 \times 10^{-12}$$

$$(iii) 6020000000000000 = 6020000000000000 \times (10^{15}/10^{15}) = 6.02 \times 10^{15}$$

$$(iv) 0.00000000837 = 0.00000000837 \times (10^9/10^9) = 8.37 \times 10^{-9}$$

$$(v) 31860000000 = 31860000000 \times (10^{10}/10^{10}) = 3.186 \times 10^{10}$$

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

Solution:

- (i) $3.02 \times 10^{-6} = 3.02/10^6 = 0.00000302$
- (ii) $4.5 \times 10^4 = 4.5 \times 10000 = 45000$
- (iii) $3 \times 10^{-8} = 3/10^8 = 0.00000003$
- (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 1/1000000 m.**
- (ii) Charge of an electron is 0.000, 000, 000, 000, 000, 000, 16 coulomb.**
- (iii) Size of 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 micron = $1/1000000$
 $= 1/10^6$
 $= 1 \times 10^{-6}$
- (ii) Charge of an electron is 0.00000000000000000016 coulombs.
 $= 0.00000000000000000016 \times 10^{19}/10^{19}$
 $= 1.6 \times 10^{-19}$ coulomb
- (iii) Size of bacteria = 0.0000005
 $= 5/10000000 = 5/10^7 = 5 \times 10^{-7}$ m
- (iv) Size of a plant cell is 0.00001275 m
 $= 0.00001275 \times 10^5/10^5$
 $= 1.275 \times 10^{-5}$ m
- (v) Thickness of a thick paper = 0.07 mm

$$0.07 \text{ mm} = 7/100 \text{ mm} = 7/10^2 = 7 \times 10^{-2} \text{ mm}$$

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 = $20 \times 5 = 100$ 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

= $100.08 \times 10^2 / 10^2$ mm

= 1.0008×10^2 mm