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NCERT Solution For Class 8 Maths Chapter 12 Exponents and Powers

Exercise 12.1 Page No: 197

Evaluate:

1.

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

Solution:

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

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

= 1/9

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

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

= 1/16

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

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

$= 2^{5}$ =

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

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

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

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

$= 1/ (-4)^3$

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

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

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

= 1/ 2 ^(3x2) = $1/2^6$

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

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(iii)

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

= (-1)^4 x 3^4 x (5^4 / 3^4)

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

= 3^(4-4) x 5^4

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

= 3^0 x 5^4 = 5^4

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

iv)

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

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

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

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

= 3^(-7 + 10) x 3 ^(-5)

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

= 3^(3 + (-5))

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

$= 3^{-2}$

$=$

$1/3^2$

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

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

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

(Because a^m x b^m = (ab)^m)

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

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

$= 1/ (-14)^3$

3. Find the value of :

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

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) x 2^2

= (5/4) x 2^2

= (5/2^2) x 2^2

= 5 x 2^(2 - 2)

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

= 5 x 2^0

= 5 x 1 = 5

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

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

= [(1/2) × (1/4)] ÷ (1/4)

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

= (1/2 x 1/ 2^2) ÷ 1/4

= 1/2 ^3 ÷ 1/4

= (1/8) × (4)
= 1/2

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

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

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

= 2^ (-1 x -2) + 3^ (-1 x -2) + 4^ (-1 x -2)

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

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

= 4 + 9 + 16

= 29

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

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

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

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

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

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

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

= 81/16

4. Evaluate

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

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

Solution:

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

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

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

= 2 x 125 = 250

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

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

= (1/10) x 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

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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)

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

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

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

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

= 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 7:

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(i)

$$\frac{25\times t^{-4}}{5^{-3}\times 10\times t^{-8}}$$

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

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

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

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

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(ii)

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

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

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

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

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

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

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

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

$$\times\quad\times$$

$$=1\qquad 1\quad 3125\qquad\left[\because\ a^{0}=1\right]$$

$$=3125$$

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Exercise 12.2 Page No: 200

1. Express the following numbers in standard form.

(i) 0.0000000000085
(ii) 0.00000000000942
(iii) 6020000000000000
(iv) 0.00000000837
(v) 31860000000

Solution:

(i) 0.0000000000085 = 0.0000000000085 x 10^12 / 10^12 = 8.5×10^{-12}

(ii) 0.00000000000942 = 0.00000000000942 x 10^12 / 10^12 = 9.42×10^{-12}

(iii) 6020000000000000 = 6020000000000000 x 10^15/ 10^15 = 6.02×10^{15}

(iv) 0.00000000837 = = 0.00000000837 x 10^9 / 10^9 = 8.37×10^{-9}

(v) 31860000000 = 31860000000 x 10^10/ 10^10 = 3.186×10^{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) $4.5 \times 10^{4} = 4.5 * 10000 = 45000$

(iii) $3 \times 10^{-8} =$ 3/10^8 = 0.00000003

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(iv) $1.0001 \times 10^9 = 1000100000$

(v) $5.8 \times 10^{12} = 5.8 * 1000000000000 = 5800000000000$

(vi) 6. $3.61492 \times 10^6 = 3.61492 \times 1000000 = 3614920$

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 0.0000000000000000016 coulombs.

= 0.0000000000000000016 x 10^19 / 10^19

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

(iii) Size of bacteria = 0.0000005

= 5/10000000 = 5/10^7 = 5 x 10^-7 m

(iii) Size of a plant cell is 0.00001275 m

= 0.00001275 x 10^5/ 10^5

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

(v) Thickness of a thick paper = 0.07 mm

0.07 mm = 7/100 mm = 7/10^2 = 7 x 10^{-2} 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 x 5 = 100 mm

Thickness of one paper = 0.016 mm

Thickness of 5 papers = 0.016 x 5 = 0.08 mm

Total thickness of a stack = 100 + 0.08 = 100.08 mm

= 100.08 × 10^2 / 10^2 mm

$= 1.0008 \times 10^{2}$ mm