

## Exponents Exercise 2A

Q1

**Answer :**

$$(i) 4^{-3} = \frac{1}{4^3} = \frac{1}{64}$$

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

$$(iii) \left(\frac{4}{3}\right)^{-3} = \left(\frac{3}{4}\right)^3 = \frac{3^3}{4^3} = \frac{27}{64}$$

$$(iv) (-3)^{-4} = \left(\frac{-1}{3}\right)^4 = \frac{(-1)^4}{3^4} = \frac{1}{81}$$

$$(v) \left(\frac{-2}{3}\right)^{-5} = \left(\frac{-3}{2}\right)^5 = \frac{(-3)^5}{2^5} = \frac{-243}{32}$$

Q2

**Answer :**

$$(i) \left(\frac{5}{3}\right)^2 \times \left(\frac{5}{3}\right)^2 = \left(\frac{5}{3}\right)^4 = \frac{5^4}{3^4} = \frac{625}{81}$$

$$(ii) \left(\frac{5}{6}\right)^6 \times \left(\frac{5}{6}\right)^{-4} = \left(\frac{5}{6}\right)^{(6+(-4))} = \left(\frac{5}{6}\right)^{(6-4)} = \left(\frac{5}{6}\right)^2 = \frac{5^2}{6^2} = \frac{25}{36}$$

$$(iii) \left(\frac{2}{3}\right)^{-3} \times \left(\frac{2}{3}\right)^{-2} = \left(\frac{2}{3}\right)^{(-3-2)} = \left(\frac{2}{3}\right)^{-5} = \left(\frac{3}{2}\right)^5 = \frac{3^5}{2^5} = \frac{243}{32}$$

$$(iv) \left(\frac{9}{8}\right)^{-3} \times \left(\frac{9}{8}\right)^2 = \left(\frac{9}{8}\right)^{(-3+2)} = \left(\frac{9}{8}\right)^{-1} = \frac{8}{9}$$

Q3

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**Answer :**

(i)

$$\begin{aligned} \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3} \times \left(\frac{3}{5}\right)^0 &= \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3+0} \\ &= \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3} = \left(\frac{9}{5}\right)^2 \times \left(\frac{5}{3}\right)^3 \\ &= \frac{9^2}{5^2} \times \frac{5^3}{3^3} \\ &= \frac{(3^2)^2}{5^2} \times \frac{5^3}{3^3} \\ &= \frac{3^4}{5^2} \times \frac{5^3}{3^3} = (3^{(4-3)}) \times (5^{(3-2)}) = 3 \times 5 = 15 \end{aligned}$$

(ii)

$$\begin{aligned} \left(\frac{-3}{5}\right)^{-4} \times \left(\frac{-2}{5}\right)^2 &= \left(\frac{5}{-3}\right)^4 \times \left(\frac{-2}{5}\right)^2 \\ &= \frac{5^4}{-3^4} \times \frac{-2^2}{5^2} = 5^{(4-2)} \times \frac{-2^2}{-3^4} = 5^2 \times \frac{-2^2}{-3^4} \\ &= 25 \times \frac{4}{81} = \frac{100}{81} \end{aligned}$$

(iii)

$$\begin{aligned} \left(\frac{-2}{3}\right)^{-3} \times \left(\frac{-2}{3}\right)^{-2} &= \left(\frac{3}{-2}\right)^3 \times \left(\frac{3}{-2}\right)^2 \\ &= \frac{3^3}{-2^3} \times \frac{3^2}{-2^2} = \frac{3^{(3+2)}}{-2^{(3+2)}} = \frac{3^5}{-2^5} = \frac{-243}{32} \end{aligned}$$

Q4

**Answer :**

$$\begin{aligned} \text{(i)} \left\{ \left(\frac{-2}{3}\right)^2 \right\}^{-2} &= \left(\frac{-2}{3}\right)^{2 \times (-2)} = \left(\frac{-2}{3}\right)^{-4} = \left(\frac{3}{-2}\right)^4 = \frac{3^4}{(-2)^4} = \frac{3^4}{2^4} = \frac{81}{16} \\ \text{(ii)} \left[ \left\{ \left(\frac{-1}{3}\right)^2 \right\}^{-2} \right]^{-1} &= \left[ \left(\frac{-1}{3}\right)^{2 \times (-2)} \right]^{-1} = \left[ \left(\frac{-1}{3}\right)^{-4} \right]^{-1} = \left(\frac{-1}{3}\right)^{-4 \times (-1)} = \left(\frac{-1}{3}\right)^4 = \frac{-1^4}{3^4} = \frac{1}{3^4} \\ &= \frac{1}{81} \\ \text{(iii)} \left\{ \left(\frac{3}{2}\right)^{-2} \right\}^2 &= \left(\frac{3}{2}\right)^{-2 \times 2} = \left(\frac{3}{2}\right)^{-4} = \left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4} = \frac{16}{81} \end{aligned}$$

Q5

**Answer :**

$$\left\{ \left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3} \right\} \div \left(\frac{1}{4}\right)^{-3} = \{3^3 - 2^3\} \div 4^3 = \{27 - 8\} \div 64 = \frac{19}{64}$$

Q6

**Answer :**

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

The L. C. M. of 4 and 1 is 4.

$$\begin{aligned} \therefore \left\{ \left(\frac{3 \times 1}{4 \times 1}\right) - \left(\frac{4 \times 4}{1 \times 4}\right) \right\}^{-1} \\ &= \left\{ \frac{3}{4} - \frac{16}{4} \right\}^{-1} = \left\{ \frac{3-16}{4} \right\}^{-1} = \left\{ \frac{-13}{4} \right\}^{-1} = \left\{ \frac{4}{-13} \right\}^1 = \frac{4}{-13} \\ &= \frac{4 \times -1}{-13 \times -1} = \frac{-4}{13} \end{aligned}$$

Q7

**Answer :**

$$\left[ (5^{-1} \times 3^{-1})^{-1} \div 6^{-1} \right] = \left[ \left(\frac{1}{5} \times \frac{1}{3}\right)^{-1} \div \frac{1}{6} \right] = \left[ \left(\frac{1}{15}\right)^{-1} \div \frac{1}{6} \right] = [15 \times 6] = 90$$

Q8

**Answer :**

$$\begin{aligned} \text{(i)} \\ (2^0 + 3^{-1}) \times 3^2 &= \left(1 + \frac{1}{3}\right) \times 3^2 \quad \left(\text{because } 2^0 = 1 \text{ and } 3^{-1} = \frac{1}{3}\right) \\ &= \left(\frac{1 \times 3}{1 \times 3} + \frac{1 \times 1}{3 \times 1}\right) \times 3^2 = \left(\frac{3}{3} + \frac{1}{3}\right) \times 3^2 = \left(\frac{4}{3}\right) \times 3^2 = 4 \times 3^{(2-1)} = 4 \times 3 = 12 \end{aligned}$$

**(ii)**

$$\begin{aligned} (2^{-1} \times 3^{-1}) \div 2^{-3} &= \left(\frac{1}{2} \times \frac{1}{3}\right) \div \left(\frac{1}{2}\right)^3 \\ \left(\frac{1}{6}\right) \div \frac{1^3}{2^3} &= \left(\frac{1}{6}\right) \div \left(\frac{1}{8}\right) = \frac{1}{6} \times 8 = \frac{8}{6} = \frac{4}{3} \end{aligned}$$

**(iii)**

$$\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} = \left(\frac{2}{1}\right)^2 + \left(\frac{3}{1}\right)^2 + \left(\frac{4}{1}\right)^2 = 2^2 + 3^2 + 4^2 = 4 + 9 + 16 = 29$$

**Q9**

**Answer :**

Consider the left side:

$$\left(\frac{5}{3}\right)^{-4} \times \left(\frac{5}{3}\right)^{-5} = \left(\frac{5}{3}\right)^{(-4+(-5))} = \left(\frac{5}{3}\right)^{-9}$$

Given:

$$\left(\frac{5}{3}\right)^{-9} = \left(\frac{5}{3}\right)^{3x}$$

Comparing the powers:

$$-9 = 3x \Rightarrow x = -3$$

**Q10**

**Answer :**

Given:

$$\left(\frac{4}{9}\right)^4 \times \left(\frac{4}{9}\right)^{-7} = \left(\frac{4}{9}\right)^{2x-1}$$

$$\therefore \left(\frac{4}{9}\right)^{(4-7)} = \left(\frac{4}{9}\right)^{-3} = \left(\frac{4}{9}\right)^{2x-1}$$

$$\Rightarrow 2x - 1 = -3$$

$$2x = -3 + 1 = -2$$

$$\Rightarrow x = -1$$

**Q11**

**Answer :**

Let the required number be  $x$ .

$$\therefore x \times (-6)^{-1} = 9^{-1}$$

$$x \times \frac{1}{-6} = \frac{1}{9} \Rightarrow \frac{x}{-6} = \frac{1}{9}$$

$$\text{or } x = \frac{-6}{9}$$

The greatest common divisor for the numerator and the denominator is 3.

$$\therefore x = \frac{-6}{9} = \frac{(-6) \div 3}{9 \div 3} = \frac{-2}{3}$$

**Q12**

**Answer :**

Let the number be  $x$ .

$$\begin{aligned}\therefore \left(\frac{-2}{3}\right)^{-3} \div x &= \left(\frac{4}{27}\right)^{-2} \\ \Rightarrow \left(\frac{3}{-2}\right)^3 \div x &= \left(\frac{27}{4}\right)^2 \\ \Rightarrow \left(\frac{-3}{2}\right)^3 \div x &= \left(\frac{27}{4}\right)^2 \\ \Rightarrow \left(\frac{-3}{2}\right)^3 \times \frac{1}{x} &= \left(\frac{27}{4}\right)^2 \\ \Rightarrow \frac{-3^3}{2^3} \times \frac{1}{x} &= \frac{27^2}{4^2} \\ \Rightarrow \frac{-27}{8} \times \frac{1}{x} &= \frac{27^2}{4^2} = \frac{27 \times 27}{4 \times 4} = \frac{27 \times 27}{4 \times 2 \times 2} = \frac{27 \times 27}{8 \times 2} \\ \therefore \frac{1}{x} &= \left(\frac{27 \times 27}{8 \times 2}\right) \div \left(\frac{-27}{8}\right) \\ \Rightarrow x &= \left(\frac{-27}{8}\right) \div \left(\frac{27 \times 27}{8 \times 2}\right) = \left(\frac{-27}{8}\right) \times \left(\frac{8 \times 2}{27 \times 27}\right) = \frac{-2}{27}\end{aligned}$$

Q13

**Answer :**

Given:

$$5^{2x+1} \div 25 = 125$$

We know :

$$25 = 5 \times 5 = 5^2$$

$$125 = 5 \times 5 \times 5 = 5^3$$

$$\therefore \frac{5^{2x+1}}{5^2} = 5^3 \Rightarrow 5^{[(2x+1)-2]} = 5^3$$

$$\text{or } 5^{[(2x+1)-2]} = 5^{[2x-1]} = 5^3$$

$$\Rightarrow 2x - 1 = 3$$

$$2x = 3 + 1 = 4$$

$$x = \frac{4}{2} = 2$$

$$\therefore x = 2$$

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## Exponents Exercise 2B

Q1

**Answer :**

- (i)  $57.36 = 5.736 \times 10$
- (ii)  $3500000 = 3.5 \times 10^6$
- (iii)  $273000 = 2.73 \times 10^5$
- (iv)  $168000000 = 1.68 \times 10^8$
- (v)  $4630000000000 = 4.63 \times 10^{12}$
- (vi)  $345 \times 10^5 = 3.45 \times 10^7$

Q2

**Answer :**

- (i)  $3.74 \times 10^5 = \frac{374}{100} \times 10^5 = \frac{374 \times 10^5}{10^2} = 374 \times 10^{(5-2)} = 374 \times 10^3 = 374000$
- (ii)  $6.912 \times 10^8 = \frac{6912}{1000} \times 10^8 = \frac{6912 \times 10^8}{10^3} = 6912 \times 10^{(8-3)} = 6912 \times 10^5 = 691200000$
- (iii)  $4.1253 \times 10^7 = \frac{41253}{10000} \times 10^7 = \frac{41253 \times 10^7}{10^4} = 41253 \times 10^{(7-4)} = 41253 \times 10^3 = 41253000$
- (iv)  $2.5 \times 10^4 = \frac{25}{10} \times 10^4 = \frac{25 \times 10^4}{10} = 25 \times 10^{(4-1)} = 25 \times 10^3 = 25000$
- (v)  $5.17 \times 10^6 = \frac{517}{100} \times 10^6 = \frac{517 \times 10^6}{10^2} = 517 \times 10^{(6-2)} = 517 \times 10^4 = 5170000$
- (vi)  $1.679 \times 10^9 = \frac{1679}{1000} \times 10^9 = \frac{1679 \times 10^9}{10^3} = 1679 \times 10^{(9-3)} = 1679 \times 10^6 = 1679000000$

Q3

**Answer :**

(i) The height of the Mount Everest is 8848 m.

In standard form, we have:

$$8848 = 8.848 \times 1000 \text{ m} = 8.848 \times 10^3 \text{ m}$$

(ii) The speed of light is 300000000 m/s.

In standard form, we have:

$$300000000 = 3 \times 100000000 \text{ m/s} = 3 \times 10^8 \text{ m/s}$$

(iii) The Sun—Earth distance is 149600000000 m.

In standard form, we have:

$$149600000000 = 1496 \times 100000000 = 1.496 \times 1000 \times 100000000 = 1.496 \times 10^3 \times 10^8 = 1.496 \times 10^{11} \text{ m}$$

Q4

**Answer :**

$$\text{Mass of the Earth} = 5.97 \times 10^{24} \text{ kg}$$

$$\text{Now, } 5.97 \times 10^{24} = 5.97 \times 10^{(2+22)} = 5.97 \times 10^2 \times 10^{22} = 597 \times 10^{22}$$

So, the mass of the Earth can also be written as  $597 \times 10^{22} \text{ kg}$ .

$$\text{Mass of the Moon} = 7.35 \times 10^{22} \text{ kg}$$

Sum of the masses of the Earth and the Moon:

$$= (597 \times 10^{22}) + (7.35 \times 10^{22}) = (597 + 7.35) \times 10^{22} = 604.35 \times 10^{22} \text{ kg}$$

$$= 6.0435 \times 100 \times 10^{22} = 6.0435 \times 10^2 \times 10^{22} = 6.0435 \times 10^{(2+22)} = 6.0435 \times 10^{24} \text{ kg}$$

Q5

**Answer :**

$$(i) 0.0006 = \frac{6}{10^4} = 6 \times 10^{-4}$$

$$(ii) 0.00000083 = \frac{83}{10^8} = \frac{8.3 \times 10}{10^8} = 8.3 \times 10^{(1-8)} = 8.3 \times 10^{-7}$$

$$(iii) 0.000000534 = \frac{534}{10^{10}} = \frac{5.34 \times 10^2}{10^{10}} = 5.34 \times 10^{(2-10)} = 5.34 \times 10^{-8}$$

$$(iv) 0.0027 = \frac{27}{10^4} = \frac{2.7 \times 10}{10^4} = 2.7 \times 10^{(1-4)} = 2.7 \times 10^{-3}$$

$$(v) 0.00000165 = \frac{165}{10^8} = \frac{1.65 \times 10^2}{10^8} = 1.65 \times 10^{(2-8)} = 1.65 \times 10^{-6}$$

$$(vi) 0.0000000689 = \frac{689}{10^{11}} = \frac{6.89 \times 10^2}{10^{11}} = 6.89 \times 10^{(2-11)} = 6.89 \times 10^{-9}$$

Q6

**Answer :**

$$(i) 1 \text{ micron} = \frac{1}{1000000} \text{ m} = 1 \times 10^{-6} \text{ m}$$

$$(ii) 0.0000004 \text{ m} = \frac{4}{10^7} \text{ m} = (4 \times 10^{-7}) \text{ m}$$

$$(iii) \text{Thickness of paper} = 0.03 \text{ mm} = \frac{3}{10^2} \text{ mm} = (3 \times 10^{-2}) \text{ mm}$$

Q7

**Answer :**

$$(i) 2.06 \times 10^{-5} = \frac{206}{100} \times \frac{1}{10^5} = \frac{206}{10^2 \times 10^5} = \frac{206}{10^{(2+5)}} = \frac{206}{10^7} = \frac{206}{10000000} = 0.0000206$$

$$(ii) 5 \times 10^{-7} = \frac{5}{10^7} = \frac{5}{10000000} = 0.0000005$$

$$(iii) 6.82 \times 10^{-6} = \frac{682}{100} \times \frac{1}{10^6} = \frac{682}{10^2 \times 10^6} = \frac{682}{10^{(2+6)}} = \frac{682}{10^8} = \frac{682}{100000000} = 0.00000682$$

$$(iv) 5.673 \times 10^{-4} = \frac{5673}{1000} \times \frac{1}{10^4} = \frac{5673}{10^3 \times 10^4} = \frac{5673}{10^{(3+4)}} = \frac{5673}{10^7} = \frac{5673}{10000000} = 0.0005673$$

$$(v) 1.8 \times 10^{-2} = \frac{18}{10} \times \frac{1}{10^2} = \frac{18}{10 \times 10^2} = \frac{18}{10^{(1+2)}} = \frac{18}{10^3} = \frac{18}{1000} = 0.018$$

$$(vi) 4.129 \times 10^{-3} = \frac{4129}{1000} \times \frac{1}{10^3} = \frac{4129}{10^3 \times 10^3} = \frac{4129}{10^{(3+3)}} = \frac{4129}{10^6} = \frac{4129}{1000000} = 0.004129$$

# Exponents Exercise 2C

Q1

**Answer :**

(c)  $\frac{125}{8}$

$$\left(\frac{2}{5}\right)^{-3} = \left(\frac{5}{2}\right)^3 = \frac{5^3}{2^3} = \frac{125}{8}$$

Q2

**Answer :**

(d)  $\frac{1}{81}$

$$(-3)^{-4} = \frac{1}{(-3)^4} = \frac{1}{(-1)^4 \times (3)^4} = \frac{1}{(3)^4} = \frac{1}{81}$$

Q3

**Answer :**

(b)  $\frac{-1}{32}$

$$(-2)^{-5} = \frac{1}{(-2)^5} = \frac{1}{-32} = \frac{1 \times (-1)}{-32 \times (-1)} = \frac{-1}{32}$$

Q4

**Answer :**

(d)  $\frac{1}{8}$

$$\left(2^{-5} \div 2^{-2}\right) = \left(\frac{1}{2^5} \div \frac{1}{2^2}\right) = \left(\frac{1}{32} \div \frac{1}{4}\right) = \left(\frac{1}{32} \times 4\right) = \frac{4}{32} = \frac{1}{8}$$

Q5

**Answer :**

(b)  $\frac{60}{7}$

$$\begin{aligned} \left(3^{-1} + 4^{-1}\right)^{-1} \div 5^{-1} &= \left(\frac{1}{3} + \frac{1}{4}\right)^{-1} \div \frac{1}{5} = \left(\frac{4+3}{12}\right)^{-1} \div \frac{1}{5} = \left(\frac{7}{12}\right)^{-1} \div \frac{1}{5} = \left(\frac{12}{7}\right) \div \frac{1}{5} = \frac{12}{7} \\ \times 5 &= \frac{60}{7} \end{aligned}$$

Q6

**Answer :**

(c) 29

$$\begin{aligned} \left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} &= \left(\frac{2}{1}\right)^2 + \left(\frac{3}{1}\right)^2 + \left(\frac{4}{1}\right)^2 \\ &= 2^2 + 3^2 + 4^2 \\ &= 4 + 9 + 16 \\ &= 29 \end{aligned}$$

Q7

**Answer :**

(a)  $\frac{19}{64}$

$$\begin{aligned} & \left\{ \left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3} \right\} \div \left(\frac{1}{4}\right)^{-3} \\ &= \{3^3 - 2^3\} \div 4^3 \\ &= \{27 - 8\} \div 64 \\ &= 19 \div 64 \\ &= \frac{19}{64} \end{aligned}$$

Q8

**Answer :**

(a)  $\frac{1}{16}$

$$\begin{aligned} & \left[ \left\{ \left(-\frac{1}{2}\right)^2 \right\}^{-2} \right]^{-1} \\ &= \left[ \left\{ -\frac{1}{2} \right\}^{-4} \right]^{-1} \\ &= \left(-\frac{1}{2}\right)^{(-4 \times -1)} \\ &= \left(-\frac{1}{2}\right)^4 \\ &= \frac{1}{16} \end{aligned}$$

Q9

**Answer :**

(d) 3

$$\begin{aligned} & \left(\frac{7}{12}\right)^{-4} \times \left(\frac{7}{12}\right)^{3x} = \left(\frac{7}{12}\right)^5 \\ \Rightarrow & \left(\frac{7}{12}\right)^{-4+3x} = \left(\frac{7}{12}\right)^5 \\ \Rightarrow & 3x - 4 = 5 \\ 3x &= 9 \\ \text{or } x &= \frac{9}{3} = 3 \end{aligned}$$

Q10

**Answer :**

(d) 2

$$\begin{aligned} & (2^{3x-1} + 10) \div 7 = 6 \\ \Rightarrow & \frac{2^{3x-1} + 10}{7} = \frac{6}{1} \end{aligned}$$

**On cross multiplying :**

$$(2^{3x-1} + 10) \times 1 = 6 \times 7 = 42$$

$$\Rightarrow 2^{3x-1} = 42 - 10$$

$$\Rightarrow 2^{3x-1} = 32$$

$$\Rightarrow 2^{3x-1} = 2^5$$

$$\Rightarrow 3x - 1 = 5$$

$$\Rightarrow 3x = 6$$

Therefore,  $x = 2$



Q11

**Answer :**

(c) 1

Using the law of exponents  $\left(\frac{a}{b}\right)^0 = 1$ :

$$\therefore \left(\frac{2}{3}\right)^0 = 1$$

Q12

**Answer :**

(c)  $\frac{-3}{5}$

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

Q13

**Answer :**

(d)  $\frac{-1}{8}$

$$\left(\frac{-1}{2}\right)^3 = \frac{-1^3}{2^3} = \frac{-1}{8}$$

Q14

**Answer :**

(b)  $\frac{9}{16}$

$$\left(\frac{-3}{4}\right)^2 = \frac{(-3)^2}{(4)^2} = \frac{9}{16}$$

Q15

**Answer :**

(c)  $3.67 \times 10^6$

$$3670000 = 367 \times 10^4 = 3.67 \times 100 \times 10^4 = 3.67 \times 10^2 \times 10^4 = 3.67 \times 10^{(2+4)} = 3.67 \times 10^6$$

Q16

**Answer :**

(b)  $4.63 \times 10^{-5}$

$$0.0000463 = \frac{463}{10^7} = \frac{4.63 \times 10^2}{10^7} = 4.63 \times 10^{(2-7)} = 4.63 \times 10^{-5}$$

Q17

**Answer :**

(a) 3.67

$$0.000367 \times 10^4 = \frac{367}{10^4} \times 10^4 = 367 \times 10^{(4-4)} = 367 \times 10^{-2} = \frac{367}{10^2} = \frac{367}{100} = 3.67$$