

## 2. Exponents

### Exercise 2A

#### 1. Question

Evaluate:

(i)  $4^{-3}$

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

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

(iv)  $(-3)^{-4}$

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

#### Answer

Some basic formulas are:

$$a^{-n} = \frac{1}{a^n}$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

Now, (i)

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

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

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

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

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

## 2. Question

Evaluate:

$$(i) \left(\frac{5}{3}\right)^2 \times \left(\frac{5}{3}\right)^2$$

$$(ii) \left(\frac{5}{6}\right)^6 \times \left(\frac{5}{6}\right)^{-4}$$

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

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

## Answer

As we know from the rule of exponents that powers of the same base adds up to acquire new power.

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

$$= \frac{5^4}{3^4} = \frac{625}{81}$$

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

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

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

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

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

## 3. Question

Evaluate:

$$(i) \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3} \times \left(\frac{3}{5}\right)^0$$

$$(ii) \left(\frac{-3}{5}\right)^{-4} \times \left(\frac{-2}{5}\right)^2$$

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

**Answer**

$$(i) \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3} \times \left(\frac{3}{5}\right)^0$$

First we add the power of the same base,

$$= \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3+0}$$

Convert the powers in to positive numbers,

$$= \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3} = \left(\frac{9}{5}\right)^2 \times \left(\frac{5}{3}\right)^3$$

$$= \frac{9^2}{5^2} \times \frac{5^3}{3^3}$$

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

By cross multiplying we get,

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

$$= (3^{(4-3)}) \times (5^{(3-2)}) = 3 \times 5 = 15$$

$$(ii) \left(\frac{-3}{5}\right)^{-4} \times \left(\frac{-2}{5}\right)^2 = \left(\frac{5}{-3}\right)^4 \times \left(\frac{-2}{5}\right)^2$$

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

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

$$= 25 \times \frac{4}{81} = \frac{100}{81}$$

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

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

$$= \frac{3^{(3+2)}}{-2^{(3+2)}} = \frac{3^5}{-2^5} = \frac{-243}{32}$$

#### 4. Question

Evaluate:

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

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

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

#### Answer

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

$$= \frac{3^4}{(-2)^4} = \frac{3^4}{2^4} = \frac{81}{16}$$

$$(ii) \left[ \left\{ \left( \frac{-1}{3} \right)^2 \right\}^{-2} \right]^{-1} = \left[ \left( \frac{1}{3} \right)^{2 \times (-2)} \right]^{-1} = \left[ \left( \frac{-1}{3} \right)^{-4} \right]^{-1}$$

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

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

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

$$= \left( \frac{3}{2} \right)^{-4} = \left( \frac{2}{3} \right)^4 = \frac{2^4}{3^4} = \frac{16}{81}$$

#### 5. Question

$$\text{Evaluate } \left\{ \left( \frac{1}{3} \right)^{-3} - \left( \frac{1}{2} \right)^{-3} \right\} \div \left( \frac{1}{4} \right)^{-3}$$

#### Answer

Consider  $\left\{ \left( \frac{1}{3} \right)^{-3} - \left( \frac{1}{2} \right)^{-3} \right\} \div \left( \frac{1}{4} \right)^{-3}$ ,

As we know,

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

### 6. Question

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

**Answer**

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

As we know,

$$\begin{aligned} a^{-m} &= \frac{1}{a^m} \\ &= \left\{ \left( \frac{4}{3} \right)^{-1} - \left( \frac{1}{4} \right)^{-1} \right\}^{-1} = \left\{ \left( \frac{3}{4} \right)^1 - \left( \frac{4}{1} \right)^1 \right\}^{-1} = \left\{ \left( \frac{3}{4} \right) - \left( \frac{4}{1} \right) \right\}^{-1} \end{aligned}$$

Now take the LCM of 4 and 1 which is 4.

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

### 7. Question

Evaluate  $[(5^{-1} \times 3^{-1})^{-1} \div 6^{-1}]$

## Answer

For any number  $a \neq 0$   $a^{-1} = 1/a$  So,  $[(5^{-1} \times 3^{-1})^{-1} \div 6^{-1}]$

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

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

$$= [15 \times 6]$$

$$= 90$$

## 8. Question

Find the value of:

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

(ii)  $(2^{-1} \times 3^{-1}) \div 2^{-3}$

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

## Answer

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

As we know that by the rule  $a^0 = 1$

So,

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

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

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

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

$$= 4 \times 3^{(2-1)} = 4 \times 3 = 12 \text{ Ans. (ii) } (2^{-1} \times 3^{-1}) \div 2^{-3}$$

$$= \left(\frac{1}{2} \times \frac{1}{3}\right) \div \left(\frac{1}{2}\right)^3$$

$$= \left(\frac{1}{6}\right) \div \frac{1^3}{2^3} = \left(\frac{1}{6}\right) \div \left(\frac{1}{8}\right)$$

$$= \frac{1}{6} \times 8 = \frac{8}{6} = \frac{4}{3}$$

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

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

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

$$= 4 + 9 + 16 = 29 \text{ Ans.}$$

### 9. Question

Find the value of x for which

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

**Answer**

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

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;

$$-9 = 3x$$

$$= x = \frac{-9}{3}$$

$$x = -3$$

### 10. Question

Find the value of x for which

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

**Answer**

Given,

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

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

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

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

$$= x = -1$$

### 11. Question

By what number should  $(-6)^{-1}$  be multiplied so that the product becomes  $9^{-1}$ ?

#### Answer

Let take that number be  $x$ ;

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

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

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

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

### 12. Question

By what number should  $\left(\frac{-2}{3}\right)^{-3}$  be divided so that the quotient may be  $\left(\frac{4}{27}\right)^{-2}$ ?

#### Answer

Let the number be  $x$ ,

$$\therefore \left(\frac{-2}{3}\right)^{-3} \div x = \left(\frac{4}{27}\right)^{-2}$$

$$\Rightarrow \left(\frac{3}{-2}\right)^3 \div x = \left(\frac{27}{4}\right)^2$$

$$\Rightarrow \left(\frac{-3}{2}\right)^3 \div x = \left(\frac{27}{4}\right)^2$$

$$\Rightarrow \left(\frac{-3}{2}\right)^3 \times \frac{1}{x} = \left(\frac{27}{4}\right)^2$$

$$\Rightarrow \frac{-3^3}{2^3} \times \frac{1}{x} = \frac{27^2}{4^2}$$



$$\Rightarrow \frac{27}{8} \times \frac{1}{x} = \frac{27^2}{4^2} = \frac{27 \times 27}{4 \times 4} = \frac{27 \times 27}{4 \times 2 \times 2} = \frac{27 \times 27}{8 \times 2}$$

$$\therefore \frac{1}{x} = \frac{\left(\frac{27 \times 27}{8 \times 2}\right)}{\left(\frac{-27}{8}\right)}$$

$$\Rightarrow x = \frac{\left(\frac{-27}{8}\right)}{\left(\frac{27 \times 27}{8 \times 2}\right)} = \left(\frac{-27}{8}\right) \times \left(\frac{8 \times 2}{27 \times 27}\right) = \frac{-2}{27}$$

### 13. Question

If  $5^{2x+1} \div 25 = 125$ , find the value of  $x$ .

#### Answer

Given,

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

We know that,

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

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

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

$$5[(2x+1)-2] = 5[2x-1] = 5^3$$

$$= 2x - 1 = 3$$

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

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

$$\therefore x = 2$$

### Exercise 2B

#### 1. Question

Write each of the following numbers in standard form:

(i) 57.36

(ii) 3500000

(iii) 273000

(iv) 168000000

(v) 4630000000000

(vi)  $345 \times 10^5$

**Answer**

(i)  $57.36 = 5.736 \times 10$

(ii)  $3500000 = 35 \times 10^5 = 3.5 \times 10^6$

(iii)  $273000 = 273 \times 10^3 = 2.73 \times 10^5$

(iv)  $168000000 = 168 \times 10^6 = 1.68 \times 10^8$

(v)  $4630000000000 = 463 \times 10^{10} = 4.63 \times 10^{12}$

(vi)  $345 \times 10^5 = 34500000 = 3.45 \times 10^7$

**2. Question**

Write each of the following numbers in usual form:

(i)  $3.74 \times 10^5$

(ii)  $6.912 \times 10^8$

(iii)  $4.1253 \times 10^7$

(iv)  $2.5 \times 10^4$

(v)  $5.17 \times 10^8$

(vi)  $1.679 \times 10^9$

**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)  $1.679 \times 10^9 = \frac{1679}{1000} \times 10^9 = \frac{1679 \times 10^9}{10^3} = 1679 \times 10^{(9-3)} = 1679 \times 10^6 = 1679000000$

**3 A. Question**

The height of Mount Everest is 8848 m. Write it in standard form.

**Answer**

Height of the Mount Everest = 8848m

If we write it in standard form we have,

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

### 3 B. Question

The speed of light is 300000000 m/sec. express it in standard form.

#### Answer

Speed of the light = 300000000 m/sec

In standard form we will get,

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

### 3 C. Question

The distance from the earth to the sun is 149600000000 m. Write it in standard form.

#### Answer

Distance from earth to sun = 149600000000 m

In standard form we have,

$$\begin{aligned} 149600000000 &= 1496 \times 100000000 \\ &= 1.496 \times 1000 \times 100000000 \\ &= 1.496 \times 10^3 \times 10^8 = 1.496 \times 10^{11} \text{ m.} \end{aligned}$$

### 4. Question

Mass of earth is  $(5.97 \times 10^{24})$  kg and mass of moon is  $(7.35 \times 10^{22})$  kg. What is the total mass of the two?

#### Answer

Given,

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

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

Now,

$$\text{Mass of the earth} = 5.97 \times 10^{24} = 5.97 \times 10^{(2+22)} = 5.97 \times 10^2 \times 10^{22} = 597 \times 10^{22}$$

So,

We can also write the mass of the earth as  $597 \times 10^{22}$  kg

Sum of the masses of the earth and the moon;

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

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

### 5. Question

Write each of the following numbers in standard form:

(i) 0.0006

(ii) 0.00000083

(iii) 0.0000000534

(iv) 0.0027

(v) 0.00000165

(vi) 0.00000000689

### 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)  $0.0000000534 = \frac{534}{10^{10}} = \frac{5.34 \times 10^2}{10^{10}} = 5.34 \times 10^{(2-10)} = 5.34 \times 10^{-8}$

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

(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)  $0.00000000689 = \frac{689}{10^{11}} = \frac{6.89 \times 10^2}{10^{11}} = 6.89 \times 10^{(2-11)} = 6.89 \times 10^{-9}$

### 6 A. Question

1 micron =  $\frac{1}{1000000}$  m. Express it in standard form.

### Answer

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

### 6 B. Question

Size of a bacteria = 0.0000004 m. Express it in standard form.

### Answer

Size of the bacteria =  $0.0000004 \text{ m} = \frac{4}{10^7} \text{ m} = (4 \times 10^{-7}) \text{ m}$

### 6 C. Question

Thickness of a paper = 0.03 mm. Express it in standard form.

**Answer**

$$\text{Thickness of paper} = 0.03 \text{ mm} = \frac{1}{10^2} \text{ mm} = (3 \times 10^{-2}) \text{ mm}$$

**7. Question**

Write each of the following numbers in usual form:

(i)  $2.06 \times 10^{-5}$

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

(iii)  $6.82 \times 10^{-6}$

(iv)  $5.673 \times 10^{-4}$

(v)  $1.8 \times 10^{-2}$

(vi)  $4.129 \times 10^{-3}$

**Answer**

(i)  $2.06 \times 10^{-5} = \frac{206}{100} \times \frac{1}{10^5}$

$$= \frac{206}{10^2 \times 10^5}$$

$$= \frac{206}{10^{(5+2)}}$$

$$= \frac{206}{10^7}$$

$$= \frac{206}{10000000} = 0.0000206$$

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

$$= \frac{5}{10000000} = 0.0000005$$

(iii)  $6.82 \times 10^{-6} = \frac{682}{100} \times \frac{1}{10^6}$

$$= \frac{682}{10^2 \times 10^6}$$

$$= \frac{682}{10^{(2+6)}} = \frac{682}{10^8}$$

$$= \frac{682}{100000000} = 0.00000682$$

$$(iv) 5.673 \times 10^{-4} = \frac{5673}{1000} \times \frac{1}{10^4}$$

$$= \frac{5673}{10^3 \times 10^4} = \frac{5673}{10^{(3+4)}}$$

$$= \frac{5673}{10^7} = \frac{5673}{10000000} = 0.0005673$$

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

$$= \frac{18}{10 \times 10^2} = \frac{18}{10^{(1+2)}}$$

$$= \frac{18}{10^3} = \frac{18}{1000} = 0.018$$

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

$$= \frac{4129}{10^3 \times 10^3} = \frac{4129}{10^{(3+3)}}$$

$$= \frac{4129}{10^6} = \frac{4129}{1000000} = 0.004129$$

## Exercise 2C

### 1. Question

The value of  $\left(\frac{2}{5}\right)^{-3}$  is

A.  $-\frac{8}{125}$

B.  $\frac{25}{4}$

C.  $\frac{125}{8}$

D.  $-\frac{2}{5}$

### Answer

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

### 2. Question

The value of  $(-3)^{-4}$  is

- A. 12
- B. 81
- C.  $-\frac{1}{12}$
- D.  $\frac{1}{81}$

**Answer**

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

### 3. Question

The value of  $(-2)^{-5}$  is

- A. -32
- B.  $-\frac{1}{32}$
- C. 32
- D.  $\frac{1}{32}$

**Answer**

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

### 4. Question

The value of  $(2^{-5} \div 2^{-2})$  is

- A.  $\frac{1}{128}$
- B.  $-\frac{1}{128}$
- C.  $-\frac{1}{8}$
- D.  $\frac{1}{8}$

**Answer**

Consider  $(2^{-5} \div 2^{-2})$ ,

We know, For any non zero number "a"

$$a^{-1} = \frac{1}{a}$$

So,

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

### 5. Question

The value of  $(3^{-1} + 4^{-1}) \div 5^{-1}$  is

- A.  $\frac{7}{10}$
- B.  $\frac{60}{7}$
- C.  $\frac{7}{5}$
- D.  $\frac{7}{15}$

### Answer

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

### 6. Question

Choose the correct answer:  $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} = ?$

- A.  $\frac{61}{144}$
- B.  $\frac{144}{61}$
- C. 29
- D.  $\frac{1}{29}$



**Answer**

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

**7. Question**

Choose the correct answer:  $\left\{\left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right\} \div \left(\frac{1}{4}\right)^{-3} = ?$

- A.  $\frac{19}{64}$
- B.  $\frac{27}{16}$
- C.  $\frac{64}{19}$
- D.  $\frac{16}{25}$

**Answer**

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

**8. Question**

Choose the correct answer:  $\left[\left\{\left(\frac{-1}{3}\right)^2\right\}^{-2}\right]^{-1} = ?$

- A.  $\frac{1}{16}$
- B. 16

C.  $-\frac{1}{16}$

D. -16

**Answer**

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

**9. Question**

The value of x for which  $\left(\frac{7}{12}\right)^{-4} \times \left(\frac{7}{12}\right)^{3x} = \left(\frac{7}{12}\right)^5$  is

A. -1

B. 1

C. 2

D. 3

**Answer**

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

$$3x = 9$$

$$x = \frac{9}{3} = 3$$

**10. Question**

If  $(2^{3x+1} + 10) \div 7 = 6$ , then x is equal to

A. -2

- B. 0
- C. 1
- D. 2

**Answer**

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

Now by cross multiplying,

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

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

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

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

$$3x - 1 = 5$$

$$3x = 6$$

$$x = \frac{6}{3} = 2$$

Therefore  $x = 2$

### 11. Question

Choose the correct answer:  $\left(\frac{2}{3}\right)^0 = ?$

- A.  $\frac{3}{2}$
- B.  $\frac{2}{3}$
- C. 1
- D. 0

**Answer**

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

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

### 12. Question

Choose the correct answer:  $\left(\frac{-5}{3}\right)^{-1} = ?$

- A.  $\frac{5}{3}$
- B.  $\frac{3}{5}$
- C.  $\frac{-3}{5}$
- D. None of these

**Answer**

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

**13. Question**

Choose the correct answer:  $\left(-\frac{1}{2}\right)^3 = ?$

- A.  $\frac{-1}{6}$
- B.  $\frac{1}{6}$
- C.  $\frac{1}{8}$
- D.  $\frac{-1}{8}$

**Answer**

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

**14. Question**

Choose the correct answer:  $\left(-\frac{3}{4}\right)^2 = ?$

- A.  $\frac{-9}{16}$
- B.  $\frac{9}{16}$
- C.  $\frac{16}{9}$
- D.  $\frac{-16}{9}$

**Answer**

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

**15. Question**

3670000 in standard form is

- A.  $367 \times 10^4$
- B.  $36.7 \times 10^5$
- C.  $3.67 \times 10^6$
- D. None of these

**Answer**

$$3670000 = 367 \times 10^4$$

The standard form is written as one decimal number with any integer power. Therefore,  $3670000 = 367 \times 10^4$

$$= 36.7 \times 10^5$$

$$= 3.67 \times 10^6$$

Thus,  $3.67 \times 10^6$  is the standard form.

**16. Question**

0.0000463 in standard form is

- A.  $463 \times 10^{-7}$
- B.  $4.63 \times 10^{-5}$
- C.  $4.63 \times 10^{-9}$
- D.  $46.3 \times 10^{-6}$

**Answer**

0.0000463 in standard form is written as:

$$0.0000463$$

$$= 0.463 \times 10^{-4}$$

$$= 4.63 \times 10^{-5}$$

**17. Question**

$0.000367 \times 10^4$  in usual form is

- A. 3.67

- B. 36.7
- C. 0.367
- D. 0.0367

**Answer**

The usual form of  $0.000367 \times 10^4$  is written as:

$$\begin{aligned} &0.000367 \times 10^4 \\ &= 0.00367 \times 10^3 \\ &= 0.0367 \times 10^2 \\ &= 0.367 \times 10^1 \\ &= 3.67 \end{aligned}$$

**CCE Test Paper-2**

**1. Question**

Evaluate

- (i)  $3^{-4}$
- (ii)  $(-4)^3$
- (iii)  $\left(\frac{3}{4}\right)^{-2}$
- (iv)  $\left(\frac{5}{7}\right)^0$

**Answer**

$$\begin{aligned} \text{(i)} \quad 3^{-4} &= \frac{1}{3^4} = \frac{1}{81} \\ \text{(ii)} \quad (-4)^3 &= (-1)^3 \times (4)^3 = -1 \times 64 = -64 \\ \text{(iii)} \quad \left(\frac{3}{4}\right)^{-2} &= \left(\frac{4}{3}\right)^2 = \frac{4^2}{3^2} = \frac{16}{9} \\ \text{(iv)} \quad \left(\frac{-2}{3}\right)^{-5} &= \left(\frac{3}{-2}\right)^5 = \frac{3^5}{-2^5} = \frac{243}{-32} = \frac{243 \times -1}{-32 \times -1} = \frac{-243}{32} \end{aligned}$$

(v) Using the property  $\left(\frac{a}{b}\right)^0 = 1$  we will get,

$$\left(\frac{5}{7}\right)^0 = 1$$

## 2. Question

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

### Answer

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

As we know  $(a^m)^n = a^{mn}$

$$\left\{\left(\frac{-2}{3}\right)^3\right\}^{-2} = \left(\frac{-2}{3}\right)^{-6} = \left(\frac{3}{-2}\right)^6 = \frac{3^6}{2^6} = \frac{729}{64}$$

## 3. Question

Simplify:  $(3^{-1} + 6^{-1}) \div \left(\frac{3}{4}\right)^{-1}$

### Answer

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

## 4. Question

By what number should  $\left(\frac{-2}{3}\right)^{-3}$  be divided so that the quotient is  $\left(\frac{4}{9}\right)^{-2}$ ?

### Answer

Suppose the number is x

So we have,

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

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

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

$$\Rightarrow \frac{3^3}{-2^3} = \frac{9^2}{4^2}$$

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

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

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

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

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

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

$$= \frac{2 \times -1}{-3 \times -1} = \frac{-2}{3}$$

### 5. Question

By what number should  $(-3)^{-1}$  be multiplied so that the quotient is  $6^{-1}$ ?

### Answer

Let's suppose the number is  $x$

$$(-3)^{-1} \times (x) = (6)^{-1}$$



$$\Rightarrow \frac{1}{-3} \times x = \frac{1}{6}$$

$$\Rightarrow \frac{1 \times -1}{-3 \times -1} \times x = \frac{1}{6}$$

$$\therefore \frac{x}{3} = \frac{1}{6}$$

On cross multiplying:

$$(-x) \times 6 = 1 \times 3$$

$$-6x = 3$$

$$6x = -3$$

$$\therefore x = \frac{-3}{6} = \frac{-1}{2}$$

### 6. Question

Express each of the following in standard form:

(i) 345

(ii) 180000

(iii) 0.000003

(iv) 0.000027

### Answer

$$(i) 345 = 3.45 \times 100 = 3.45 \times 10^2$$

$$(ii) 180000 = 18 \times 10000 = 18 \times 10^4 = 1.8 \times 10 \times 10^4 = 1.8 \times 10^{(1+4)} = 1.8 \times 10^5$$

$$(iii) 0.000003 = \frac{3}{1000000} = 3 \times 10^{-6}$$

$$(iv) 0.000027 = \frac{27}{1000000} = \frac{27}{10^6} = \frac{2.7 \times 10}{10^6} = 2.7 \times 10^{(1-6)} = 2.7 \times 10^{-5}$$

### 7. Question

The value of  $(-3)^{-3}$  is

A. -27

B. 9

C.  $\frac{-1}{27}$

D.  $\frac{1}{27}$

**Answer**

$$(-3)^{-3} = \left(\frac{1}{-3}\right)^3 = \frac{1^3}{-3^3} = \frac{1}{-27} = \frac{1 \times -1}{-27 \times -1} = \frac{-1}{27}$$

**8. Question**

The value of  $\left(\frac{3}{4}\right)^{-3}$  is

A.  $\frac{-27}{64}$

B.  $\frac{64}{27}$

C.  $\frac{-9}{4}$

D.  $\frac{27}{64}$

**Answer**

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

**9. Question**

Choose the correct answer:  $(3^{-6} \div 3^4) = ?$

A.  $3^{-2}$

B.  $3^2$

C.  $3^{-10}$

D.  $3^{10}$

**Answer**

$$3^{-6} \div 3^4 = \left(\frac{1}{3^6} \div 3^4\right)$$

$$= \frac{1}{3^6} \times \frac{1}{3^4} = \frac{1}{3^{(6+4)}}$$

$$= \frac{1}{3^{10}} = 3^{-10}$$

**10. Question**

If  $\left(\frac{5}{12}\right)^{-4} \times \left(\frac{5}{12}\right)^{3x} = \left(\frac{5}{12}\right)^5$ , then  $x = ?$

- A. -1
- B. 1
- C. 2
- D. 3

**Answer**

$$\left(\frac{5}{12}\right)^{-4} \times \left(\frac{5}{12}\right)^{3x} = \left(\frac{5}{12}\right)^5$$

$$\Rightarrow \left(\frac{5}{12}\right)^{-4+3x} = \left(\frac{5}{12}\right)^5$$

$$\Rightarrow -4 + 3x = 5$$

$$\Rightarrow 3x = 5 + 4 = 9$$

$$\Rightarrow x = \frac{9}{3} = 3$$

**11. Question**

Choose the correct answer:  $\left(\frac{3}{5}\right)^0 = ?$

- A.  $\frac{5}{3}$
- B.  $\frac{3}{5}$
- C. 1
- D. 0

**Answer**

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

We will get,

$$\left(\frac{3}{5}\right)^0 = 1$$

**12. Question**

Choose the correct answer:  $\left(\frac{-6}{5}\right)^{-1} = ?$

A.  $\frac{6}{5}$

B.  $\frac{-6}{5}$

C.  $\frac{5}{6}$

D.  $\frac{-5}{6}$

**Answer**

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

**13. Question**

Choose the correct answer:  $\left(\frac{-1}{5}\right)^3 = ?$

A.  $\frac{-1}{9}$

B.  $\frac{1}{9}$

C.  $\frac{-1}{27}$

D.  $\frac{1}{27}$

**Answer**

$$\left(\frac{-1}{3}\right)^3 = \frac{-1^3}{3^3} = \frac{-1}{27}$$

**14. Question**

Fill in the blanks.

(i) 360000 written in standard form is.....

(ii) 0.0000123 written in standard form is.....

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

(iv)  $3 \times 10^{-3}$  in usual form is.....

(v)  $5.32 \times 10^{-4}$  in usual form is.....

**Answer**

(i) 360000 written in standard form is  $3.6 \times 10^5$

$$360000 = 36 \times 10^4 = 3.6 \times 10 \times 10^4 = 3.6 \times 10^{(1+4)} = 3.6 \times 10^5$$

(ii) 0.0000123 written in standard form is  $1.23 \times 10^{-5}$

$$0.0000123 = \frac{123}{10000000} = \frac{123}{10^7}$$

$$= \frac{1.23 \times 100}{10^7} = \frac{1.23 \times 10^2}{10^7}$$

$$= 1.23 \times 10^{(2-7)} = 1.23 \times 10^{-5}$$

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

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

(iv)  $3 \times 10^{-3}$  in usual form is 0.003

$$3 \times 10^{-3} = \frac{3}{10^3} = \frac{3}{1000} = 0.003$$

(v)  $5.32 \times 10^{-4}$  in usual form is 0.000532

$$5.32 \times 10^{-4} = \frac{5.32}{10^4} = \frac{5.32}{10000} = 0.000532$$