

**EXERCISE 5B**

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**1. Fill in the blanks:**(i) In  $5^2 = 25$ , base = ..... and index = .....(ii) If index =  $3x$  and base =  $2y$ , the number = .....**Solution:**(i) In  $5^2 = 25$ , base = 5 and index = 2.(ii) If index =  $3x$  and base =  $2y$ , the number =  $2y^{3x}$ .**2. Evaluate:**(i)  $2^8 \div 2^3$ (ii)  $2^{3 \div 2^8}$ (iii)  $(2^6)^0$ (iv)  $(3^0)^6$ (v)  $8^3 \times 8^{-5} \times 8^4$ (vi)  $5^4 \times 5^3 \div 5^5$ (vii)  $5^4 \div 5^3 \times 5^5$ (viii)  $4^4 \div 4^3 \times 4^0$ (ix)  $(3^5 \times 4^7 \times 5^8)^0$ **Solution:**(i)  $2^8 \div 2^3$ 

It can be written as

$$= 2^8 / 2^3$$

On further calculation

$$= 2^{8-3}$$

$$= 2^5$$

(ii)  $2^{3 \div 2^8}$ 

It can be written as

$$= 2^3 / 2^8$$

On further calculation

$$= 2^{3-8}$$

So we get

$$= 2^{-5}$$

$$= 1/2^5$$

(iii)  $(2^6)^0$ 

It can be written as

$$= 2^{6 \times 0}$$

On further calculation

$$= 2^0$$

So we get

$$= 1$$

(iv)  $(3^0)^6$ 

It can be written as

$$= 3^{0 \times 6}$$

$$\begin{aligned} &\text{On further calculation} \\ &= 3^0 \\ &\text{So we get} \\ &= 1 \end{aligned}$$

$$\begin{aligned} &\text{(v) } 8^3 \times 8^{-5} \times 8^4 \\ &\text{It can be written as} \\ &= 8^{3+4-5} \\ &\text{On further calculation} \\ &= 8^{7-5} \\ &\text{So we get} \\ &= 8^2 \end{aligned}$$

$$\begin{aligned} &\text{(vi) } 5^4 \times 5^3 \div 5^5 \\ &\text{It can be written as} \\ &= (5^4 \times 5^3) / 5^5 \\ &\text{On further calculation} \\ &= 5^{4+3-5} \\ &\text{So we get} \\ &= 5^{7-5} \\ &= 5^2 \end{aligned}$$

$$\begin{aligned} &\text{(vii) } 5^4 \div 5^3 \times 5^5 \\ &\text{It can be written as} \\ &= 5^4 / 5^3 \times 5^5 \\ &\text{On further calculation} \\ &= 5^{4-3+5} \\ &\text{So we get} \\ &= 5^6 \end{aligned}$$

$$\begin{aligned} &\text{(viii) } 4^4 \div 4^3 \times 4^0 \\ &\text{It can be written as} \\ &= 4^4 / (4^3 \times 4^0) \\ &\text{On further calculation} \\ &= 4^4 / (4^3 \times 1) \\ &\text{So we get} \\ &= 4^4 / 4^3 \\ &= 4^{4-3} \\ &= 4^1 \\ &= 4 \end{aligned}$$

$$\begin{aligned} &\text{(ix) } (3^5 \times 4^7 \times 5^8)^0 \\ &\text{It can be written as} \\ &= 3^{5 \times 0} \times 4^{7 \times 0} \times 5^{8 \times 0} \\ &\text{On further calculation} \\ &= 3^0 \times 4^0 \times 5^0 \\ &\text{So we get} \\ &= 1 \times 1 \times 1 \\ &= 1 \end{aligned}$$

3. Simplify, giving answers with positive index:

(i)  $2b^6 \cdot b^3 \cdot 5b^4$

(ii)  $x^2y^3 \cdot 6x^5y \cdot 9x^3y^4$

(iii)  $(-a)^5 (a^2)$

(iv)  $(-y)^2 (-y)^3$

(v)  $(-3)^2 (3)^3$

(vi)  $(-4x) (-5x^2)$

(vii)  $(5a^2b) (2ab^2) (a^3b)$

(viii)  $x^{2a+7} \cdot x^{2a-8}$

(ix)  $3^y \cdot 3^2 \cdot 3^{-4}$

(x)  $2^{4a} \cdot 2^{3a} \cdot 2^{-a}$

(xi)  $4x^2y^2 \div 9x^3y^3$

(xii)  $(10^2)^3 (x^8)^{12}$

(xiii)  $(a^{10})^{10} (1^6)^{10}$

(xiv)  $(n^2)^2 (-n^2)^3$

(xv)  $-(3ab)^2 (-5a^2bc^4)^2$

(xvi)  $(-2)^2 \times (0)^3 \times (3)^3$

(xvii)  $(2a^3)^4 (4a^2)^2$

(xviii)  $(4x^2y^3)^3 \div (3x^2y^3)^3$

(xix)  $\left(\frac{1}{2x}\right)^3 \times (6x)^2$

(xx)  $\left(\frac{1}{4ab^2c}\right)^2 \div \left(\frac{3}{2a^2bc^2}\right)^4$

(xxi)  $\frac{(5x^7)^3 (10x^2)^2}{(2x^5)^7}$

(xxii)  $\frac{(7p^2q^9r^5)^2 (4pqr)^3}{(14p^6q^{10}r^4)^2}$

**Solution:**

(i)  $2b^6 \cdot b^3 \cdot 5b^4$

It can be written as

$$= 2 \times 5 \times b^{6+3+4}$$

On further calculation

$$= 10 b^{13}$$

(ii)  $x^2y^3 \cdot 6x^5y \cdot 9x^3y^4$

It can be written as

$$= 6 \times 9 \times x^{2+5+3} \times y^{3+1+4}$$

On further calculation

$$= 54 x^{10} y^8$$

(iii)  $(-a)^5 (a^2)$

It can be written as

$$= (-1 \times a)^5 \times a^2$$

On further calculation

$$= (-1)^5 \times a^{5+2}$$

So we get

$$= -1 \times a^7$$

$$= -a^7$$

(iv)  $(-y)^2 (-y)^3$

It can be written as

$$= (-1 \times y)^2 \cdot (-1 \times y)^3$$

On further calculation

$$= (-1)^2 \cdot y^2 \cdot (-1)^3 \times y^3$$

So we get

$$= 1^{2+3} \cdot y^{2+3}$$

$$= 1^5 y^5$$

$$= y^5$$

(v)  $(-3)^2 (3)^3$

It can be written as

$$= (-1 \times 3)^2 \cdot (3)^3$$

On further calculation

$$= (-1)^2 \times 3^2 \cdot 3^3$$

So we get

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

$$= 1 \cdot 3^5$$

$$= 3^5$$

(vi)  $(-4x) (-5x^2)$

It can be written as

$$= (-1 \times 4 \times x) \cdot (-1 \times 5 \times x^2)^1$$

On further calculation

$$= (-1 \times 4 \times x) \cdot (-1 \times 5 \times x^2)$$

So we get

$$= -1 \times -1 \times 4 \times 5 \times x^{1+2}$$

Here

$$= -1^{1+1} \cdot 4^1 \cdot 5^1 x^3$$

$$= 20 x^3$$

(vii)  $(5a^2b) (2ab^2) (a^3b)$

It can be written as

$$= 5 \times 2 \times a^{2+1+3} \times b^{1+2+1}$$

On further calculation

$$= 10 a^6 b^4$$

(viii)  $x^{2a+7} \cdot x^{2a-8}$

It can be written as

$$= x^{2a+7+2a-8}$$

On further calculation

$$= x^{4a-1}$$

(ix)  $3^y \cdot 3^2 \cdot 3^{-4}$

It can be written as

$$= 3^y \cdot 3^2/3^4$$

On further calculation

$$= 3^y \cdot (3 \times 3) / (3 \times 3 \times 3 \times 3)$$

So we get

$$= 3^y \times 1/3^2$$

$$= 3^{y-2}$$

$$(x) 2^{4a} \cdot 2^{3a} \cdot 2^{-a}$$

It can be written as

$$= 2^{4a+3a-a}$$

On further calculation

$$= 2^{7a-a}$$

So we get

$$= 2^{6a}$$

$$(xi) 4x^2y^2 \div 9x^3y^3$$

It can be written as

$$= 4x^2y^2/9x^3y^3$$

On further calculation

$$= 4x^{2-3}y^{2-3}/9$$

So we get

$$= 4x^{-1}y^{-1}/9$$

$$= 4/9xy$$

$$(xii) (10^2)^3 (x^8)^{12}$$

It can be written as

$$= 10^{2 \times 3} \cdot x^{8 \times 12}$$

On further calculation

$$= 10^6 x^{96}$$

$$(xiii) (a^{10})^{10} (1^6)^{10}$$

It can be written as

$$= a^{10 \times 10} \cdot 1^{6 \times 10}$$

On further calculation

$$= a^{100} \cdot 1^{60}$$

So we get

$$= a^{100}$$

$$(xiv) (n^2)^2 (-n^2)^3$$

It can be written as

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

On further calculation

$$= n^4 \cdot (-n)^6$$

So we get

$$= -n^4 - 1^6 n^6$$

$$= -n^{4+6}$$

$$= -n^{10}$$

$$(xv) - (3ab)^2 (-5a^2bc^4)^2$$

It can be written as

$$= - (3^2 a^2 b^2) \times (-1)^2 \times 5^2 a^{2 \times 2} b^2 c^{4 \times 2}$$

On further calculation

$$= - (3^2 a^2 b^2) (5^2 a^4 b^2 c^8)$$

So we get

$$= - 3^2 \cdot 5^2 \cdot a^{2+4} b^{2+2} c^8$$

$$= - 225 a^6 b^4 c^8$$

$$(xvi) (-2)^2 \times (0)^3 \times (3)^3$$

It can be written as

$$= 4 \times 0 \times 27$$

On further calculation

$$= 0$$

$$(xvii) (2a^3)^4 (4a^2)^2$$

It can be written as

$$= (2a^3)^4 (2^2 a^2)^2$$

On further calculation

$$= 2^4 a^{3 \times 4} \cdot 2^{2 \times 2} \cdot a^{2 \times 2}$$

So we get

$$= 2^4 a^{12} \cdot 2^4 a^4$$

Here

$$= 2^{4+4} \cdot a^{12+4}$$

$$= 2^8 a^{16}$$

We get

$$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times a^{16}$$

$$= 256 a^{16}$$

$$(xviii) (4x^2y^3)^3 \div (3x^2y^3)^3$$

It can be written as

$$= \frac{4^3 x^{2 \times 3} y^{3 \times 3}}{3^3 x^{2 \times 3} y^{3 \times 3}}$$

$$= \frac{4^3 x^6 y^9}{3^3 x^6 y^9}$$

On further calculation

$$= \frac{4^3 x^6 y^9}{3^3 x^6 y^9}$$

By further simplification

$$= \frac{4^3}{3^3}$$

$$= \frac{64}{27}$$

$$(xix) \left( \frac{1}{2x} \right)^3 \times (6x)^2$$

It can be written as

$$= \frac{1^3}{2^3 \times x^3} \times 6^2 \times x^2$$

On further calculation

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

By further simplification

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

So we get

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

$$= \frac{9}{2x}$$

$$(xx) \left( \frac{1}{4ab^2c} \right)^2 \div \left( \frac{3}{2a^2bc^2} \right)^4$$

It can be written as

$$= \left( \frac{1}{4ab^2c} \right)^2 \times \left( \frac{2a^2bc^2}{3} \right)^4$$

On further calculation

$$= \frac{1^2}{4^2 a^2 b^{2 \times 2} c^2} \times \frac{2^4 a^{2 \times 4} b^4 c^{2 \times 4}}{3^4}$$

By further simplification

$$= \frac{1^2}{3^4} \times a^{8-2} b^{4-4} c^{8-2}$$

So we get

$$= \frac{1}{3 \times 3 \times 3 \times 3} a^6 b^0 c^6$$

$$= \frac{1}{81} a^6 c^6$$

$$(xxi) \frac{(5x^7)^3 (10x^2)^2}{(2x^6)^7}$$

It can be written as

$$= \frac{5^3 x^{7 \times 3} 10^2 x^{2 \times 2}}{2^7 x^{6 \times 7}}$$

On further calculation

$$= 5^3 10^2 2^{-7} x^{21+4-42}$$

By further simplification

$$= \frac{5^3 \times 10^2}{2^7 x^{17}}$$

So we get

$$= \frac{5 \times 5 \times 5 \times 2 \times 5 \times 2 \times 5}{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times x^{17}}$$

$$= \frac{5^5}{2^5 x^{17}}$$

$$= \frac{3125}{32x^{17}}$$

$$(xxii) \frac{(7p^2q^9r^5)^2 (4pqr)^3}{(14p^6q^{10}r^4)^2}$$

It can be written as

$$= \frac{(7^2 p^{2 \times 2} q^{9 \times 2} r^{5 \times 2})(4^3 p^3 q^3 r^3)}{14^2 p^{6 \times 2} q^{10 \times 2} r^{4 \times 2}}$$

On further calculation

$$= \frac{7 \times 7p^4 q^{18} r^{10} 4 \times 4 \times 4p^3 q^3 r^3}{2 \times 7 \times 2 \times 7 \times p^{12} q^{20} r^8}$$

By further simplification

$$= p^{4-12+3} q^{18-20+3} r^{10-8+3} 4 \times 4$$

So we get



$$= 16p^{-5}qr^5$$

$$= \frac{16qr^5}{p^5}$$

4. Simplify and express the answer in the positive exponent form:

(i)  $\frac{(-3)^3 \times 2^6}{6 \times 2^3}$

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

(iii)  $\frac{36 \times (-6)^2 \times 3^6}{12^3 \times 3^5}$

(iv)  $-\frac{128}{2187}$

(v)  $\frac{a^{-7} \times b^{-7} \times c^5 \times d^4}{a^3 \times b^{-5} \times c^{-3} \times d^8}$

(vi)  $(a^3b^{-5})^{-2}$

**Solution:**

(i)  $\frac{(-3)^3 \times 2^6}{6 \times 2^3}$

It can be written as

$$= \frac{(-3)^3 \times 2^6}{2 \times 3 \times 2^3}$$

On further calculation

$$= \frac{(-3)^3 \times 2^6}{3 \times 2^{3+1}}$$

So we get

$$= -(3)^{3-1} 2^{6-4}$$

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

$$= -3^2 2^2$$

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

It can be written as

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

On further calculation

$$= \frac{2^{15} \times 5^4}{2^6 \times 5^2}$$

So we get

$$= 2^{15-6} \times 5^{4-2}$$

$$= 2^9 \times 5^2$$

$$(iii) \frac{36 \times (-6)^2 \times 3^6}{12^3 \times 3^5}$$

It can be written as

$$= \frac{6 \times 6 \times (-6)^2 \times 3^6}{3^3 \times 4^3 \times 3^5}$$

On further calculation

$$= \frac{6^2 \times (-6)^2 \times 3^{6-3-5}}{4^3}$$

So we get

$$= \frac{6^2 \times (-6)^2 3^{-2}}{4^3}$$

$$= \frac{6^2(-6)^2}{3^2 \times 4^3}$$

We can write it as

$$= \frac{6 \times 6 \times -6 \times -6}{3 \times 3 \times 4 \times 4 \times 4}$$

$$= \frac{9}{4}$$

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

(iv) – 128/2187

So we get

2	128
2	64
2	32
2	16
2	8
2	4
2	2
1	

3	2187
3	729
3	243
3	81
3	27
3	9
3	3
1	

It can be written as

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

$$= \frac{2^7}{3^7}$$

(v)  $\frac{a^{-7} \times b^{-7} \times c^5 \times d^4}{a^3 \times b^{-5} \times c^{-3} \times d^8}$

It can be written as

$$= a^{-7-3} \times b^{-7+5} \times c^{5-(-3)} \times d^{4-8}$$

So we get

$$= a^{-10} \times b^{-2} \times c^8 \times d^{-4}$$

$$= \frac{c^8}{a^{10} \times b^2 \times d^4}$$

(vi)  $(a^3b^{-5})^{-2}$

It can be written as

$$= a^{3 \times -2} b^{-5 \times -2}$$

So we get

$$= a^{-6} b^{10}$$

$$= b^{10} / a^6$$

**5. Evaluate:**

(i)  $6^{-2} \div (4^{-2} \times 3^{-2})$

(ii)  $\left[\left(\frac{5}{6}\right)^2 \times \frac{9}{4}\right] \div \left[\left(-\frac{3}{2}\right)^2 \times \frac{125}{216}\right]$

(iii)  $5^3 \times 3^2 + (17)^0 \times 7^3$

(iv)  $2^5 \times 15^0 + (-3)^3 - (2/7)^{-2}$

(v)  $(2^2)^0 + 2^{-4} \div 2^{-6} + (1/2)^{-3}$

(vi)  $5^n \times 25^{n-1} \div (5^{n-1} \times 25^{n-1})$

**Solution:**

(i)  $6^{-2} \div (4^{-2} \times 3^{-2})$

It can be written as

$$= (1/6)^2 \div (1/4)^2 \times (1/3)^2$$

On further calculation

$$= 1/36 \div 1/16 \times 1/9$$

So we get

$$= 1/36 \div 1/144$$

$$= 1/36 \times 144/1$$

$$= 4$$

$$\begin{array}{r} 36 \overline{) 144} \quad 4 \\ \underline{144} \\ 0 \end{array}$$

(ii)  $\left[\left(\frac{5}{6}\right)^2 \times \frac{9}{4}\right] \div \left[\left(-\frac{3}{2}\right)^2 \times \frac{125}{216}\right]$

It can be written as

$$= \left[\left(\frac{5 \times 5}{6 \times 6}\right) \times \frac{9}{4}\right] \div \left[\left(\frac{-3 \times -3}{2 \times 2}\right) \times \frac{125}{216}\right]$$

*On further calculation*

$$= \left[\frac{25}{36} \times \frac{9}{4}\right] \div \left[\frac{9}{4} \times \frac{125}{216}\right]$$

*So we get*

$$= \left[\frac{25}{4} \times \frac{1}{4}\right] \div \left[\frac{1}{4} \times \frac{125}{24}\right]$$

*By multiplication*

$$= \left[\frac{25}{16}\right] \div \left[\frac{125}{96}\right]$$

*We get*

$$= \frac{25}{16} \times \frac{96}{125}$$

*By simplification*

$$= \frac{1}{1} \times \frac{6}{5}$$

$$= 1\frac{1}{5}$$

(iii)  $5^3 \times 3^2 + (17)^0 \times 7^3$

It can be written as

$$= 5 \times 5 \times 5 \times 3 \times 3 + (17)^0 \times 7 \times 7 \times 7$$

On further calculation

$$= 125 \times 9 + 1 \times 343$$

So we get

$$= 1125 + 343$$

$$= 1468$$

(iv)  $2^5 \times 15^0 + (-3)^3 - (2/7)^{-2}$

It can be written as

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

By further calculation

$$= 32 \times 1 - 27 - 49/4$$

Here we get LCM = 4

$$= (32 \times 4)/(1 \times 4) - (27 \times 4)/(1 \times 4) - 49/(4 \times 1)$$

So we get

$$= (128 - 108 - 49)/4$$

By subtraction

$$= -29/4$$

$$= -7\frac{1}{4}$$

(v)  $(2^2)^0 + 2^{-4} \div 2^{-6} + (1/2)^{-3}$

It can be written as

$$= (4)^0 + (1/2)^4 \div (1/2)^6 + (2/1)^3$$

By further calculation

$$= 1 + (1/2 \times 1/2 \times 1/2 \times 1/2) \div (1/2 \times 1/2 \times 1/2 \times 1/2 \times 1/2 \times 1/2) + (2/1 \times 2/1 \times 2/1)$$

So we get

$$= 1 + (1/2 \times 1/2 \times 1/2 \times 1/2 \times 2 \times 2 \times 2 \times 2 \times 2) + 8$$

On further simplification

$$= 1 + 4 + 8$$

$$= 13$$

(vi)  $5^n \times 25^{n-1} \div (5^{n-1} \times 25^{n-1})$

It can be written as

$$= 5^n \times 25^{n-1} \times 1/(5^{n-1} \times 25^{n-1})$$

By further calculation

$$= 5^n \times 1/5^{n-1}$$

$$\begin{aligned} \text{So we get} \\ &= 5^{n-n+1} \\ &= 5^1 \end{aligned}$$

6. If  $m = -2$  and  $n = 2$ ; find the value of:

(i)  $m^2 + n^2 - 2mn$

(ii)  $m^n + n^m$

(iii)  $6m^{-3} + 4n^2$

(iv)  $2n^3 - 3m$

**Solution:**

(i)  $m^2 + n^2 - 2mn$

It is given that

$$m = -2 \text{ and } n = 2$$

Substituting the values we get

$$= (-2)^2 + 2^2 - 2(-2)(2)$$

By further calculation

$$= 4 + 4 - (-8)$$

So we get

$$= 8 + 8$$

$$= 16$$

$$= 2^4$$

2	16
2	8
2	4
2	2
1	1

(ii)  $m^n + n^m$

It is given that  $m = -2$  and  $n = 2$

Substituting the values we get

$$= (-2)^2 + (2)^{-2}$$

We can write it as

$$= 4 + 1/2 \times 1/2$$

We get the LCM = 4

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

So we get

$$= (16 + 1) / 4$$

$$= 17 / 4$$

$$= 4 \frac{1}{4}$$

(iii)  $6m^{-3} + 4n^2$

It is given that

$$m = -2 \text{ and } n = 2$$

Substituting the values

$$= 6(-2)^{-3} + 4(2)^2$$

It can be written as

$$= 6 \times 1 / -2 \times 1 / -2 \times 1 / -2 + 4 \times 2 \times 2$$

So we get  
 $= -3/4 + 16$   
Here the LCM = 4  
 $= (-3 + 16 \times 4)/4$   
By calculation  
 $= (-3 + 64)/4$   
 $= -61/4$   
 $= 15 \frac{1}{4}$

(iv)  $2n^3 - 3m$   
It is given that  
 $m = -2$  and  $n = 2$   
By substituting the values  
 $= 2(2)^3 - 3(-2)$   
It can be written as  
 $= 2 \times (2 \times 2 \times 2) - 3 \times (-2)$   
By further calculation  
 $= 16 - 3 \times (-2)$   
So we get  
 $= 16 + 6$   
 $= 22$

