EXERCISE 5B

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) $(3^o)^6$
(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) $(3^o)^6$
It can be written as
$= 3^{0 \times 6}$

On further calculation
$= 3^0$
So we get
$= 1$

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

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

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

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

(ix) $(3^5 \times 4^7 \times 5^8)^0$
It can be written as
$= 3^{5\times0} \times 4^{7\times0} \times 5^{8\times0}$
On further calculation
$= 3^0 \times 4^0 \times 5^0$
So we get
$= 1 \times 1 \times 1$
$= 1$

3. Simplify, giving answers with positive index:

(i) $2b^6 . b^3 . 5b^4$

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

(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) $x^{2a+7} . x^{2a-8}$

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

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

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

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

Solution:

(i) $2b^6 . b^3 . 5b^4$

It can be written as

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

On further calculation

$= 10\ b^{13}$

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

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
$= (-1 \times y)^2 . (-1 \times y)^3$
On further calculation
$= (-1)^2 . y^2 . (-1)^3 \times y^3$
So we get
$= 1^{2+3} . y^{2+3}$
$= 1^5 y^5$
$= y^5$

(v) $(-3)^2 (3)^3$
It can be written as
$= (-1 \times 3)^2 . (3)^3$
On further calculation
$= (-1)^2 \times 3^2 . 3^3$
So we get
$= (-1)^2 . 3^{2+3}$
$= 1 . 3^5$
$= 3^5$

(vi) $(-4x) (-5x^2)$
It can be written as
$= (-1 \times 4 \times x) . (-1 \times 5 \times x^2)^1$
On further calculation
$= (- 1 \times 4 \times x) . (-1 \times 5 \times x^2)$
So we get
$= - 1 \times - 1 \times 4 \times 5 \times x^{1+2}$
Here
$= - 1^{1+1} . 4^1 . 5^1 x^3$
$= 20 x^3$

(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) $x^{2a+7} . x^{2a-8}$
It can be written as
$= x^{2a+7+2a-8}$
On further calculation
$= x^{4a-1}$

(ix) $3^y . 3^2 . 3^{-4}$
It can be written as

$= 3^y . 3^2/3^4$
On further calculation
$= 3^y . (3 \times 3)/ (3 \times 3 \times 3 \times 3)$
So we get
$= 3^y \times 1/3^2$
$= 3^{y - 2}$

(x) $2^{4a} . 2^{3a} . 2^{-a}$
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
$= 10^{2 \times 3} . x^{8 \times 12}$
On further calculation
$= 10^6 x^{96}$

(xiii) $(a^{10})^{10} (1^6)^{10}$
It can be written as
$= a^{10 \times 10} . 1^{6 \times 10}$
On further calculation
$= a^{100} . 1^{60}$
So we get
$= a^{100}$

(xiv) $(n^2)^2 (-n^2)^3$
It can be written as
$= n^{2 \times 2} . (-n)^{2 \times 3}$
On further calculation
$= n^4 . (-n)^6$
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

$= -(3^2a^2b^2) \times (-1)^2 \times 5^2a^{2\times2}b^2c^{4\times2}$
On further calculation
$= -(3^2a^2b^2)(5^2a^4b^2c^8)$
So we get
$= -3^2.\ 5^2.\ a^{2+4}\ b^{2+2}\ c^8$
$= -225a^6b^4c^8$

(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
$= (2a^3)^4\ (2^2a^2)^2$
On further calculation
$= 2^4\ a^{3\times4}.\ 2^{2\times2}.\ a^{2\times2}$
So we get
$= 2^4\ a^{12}.\ 2^4\ a^4$
Here
$= 2^{4+4}.\ a^{12+4}$
$= 2^8\ a^{16}$
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

$$= \frac{4^3x^{2\times3}y^{3\times3}}{3^3x^{2\times3}y^{3\times3}}$$

On further calculation

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

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

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

On further calculation

$$= \frac{1^2}{4^2a^2b^{2\times2}c^2} \times \frac{2^4a^{2\times4}b^4c^{2\times4}}{3^4}$$

By further simplification

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

So we get

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

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

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

It can be written as

$= \frac{5^3 x^{7\times3} 10^2 x^{2\times2}}{2^7 x^{6\times7}}$

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

$= \frac{(7^2 p^{2\times2} q^{9\times2} r^{5\times2})(4^3 p^3 q^3 r^3)}{14^2 p^{6\times2} q^{10\times2} r^{4\times2}}$

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

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

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

$= -3^2 2^2$

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

It can be written as

$= \dfrac{2^{3\times5} \times 5^4}{2^3 \times 2^2 \times 5^2}$

On further calculation

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

So we get

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

$= 2^9 \times 5^2$

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

It can be written as

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

On further calculation

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

So we get

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

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

We can write it as

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

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

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

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

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

(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

$= 1/36 \div 1/144$

$= 1/36 \times 144/1$

$= 4$

36 | 144 | 4
144
0

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

It can be written as

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

On further calculation

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

So we get

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

By multiplication

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

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
$= -29/ 4$
$= - 7\ 1/4$

(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
$= 1 + (1/2 \times 1/2 \times 1/2 \times 1/2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2) + 8$
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
$= 5^n \times 1/ 5^{n-1}$

So we get
$= 5^{n-n+1}$
$= 5^1$

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 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

(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
$= (16 + 1)/ 4$
$= 17/ 4$
$= 4\ ¼$

(iii) $6m^{-3} + 4n^2$
It is given that
m = - 2 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 × 4)/ 4
By calculation
= (-3 + 64)/ 4
= - 61/4
= 15 ¼

(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 × (2 × 2 × 2) – 3 × (-2)
By further calculation
= 16 – 3 × (-2)
So we get
= 16 + 6
= 22