

Fundamental Operations

IMPORTANT POINTS

1. **Fundamental Operations :** In mathematics, the operations : addition (+), subtraction (-), multiplication (x) and division ($\div$) are called the four fundamental operations.
2. **Addition and Subtraction :**
 - **Addition of Like Terms :**
 - When all the terms are positive, add their coefficients.
 - When all the terms are negative, add their coefficients without considering their negative signs and then prefix the minus sign to the sum.
 - **Addition of Unlike Terms :** As discussed above, the sum of two or more like terms is a single like term ; but the two unlike terms cannot be added together to get a single term.
 - **Subtraction of Like Terms :** The same rules, as those for subtraction of integers, are applied for the subtraction of like terms. The result of subtraction of two like terms is also a like term.

Add the positive terms together and negative terms separately together. Then, find the result of two terms obtained.

EXERCISE 19(A)

Question 1.

Fill in the blanks :

- (i) $5 + 4 = \dots\dots\dots$ and $5x + 4x = \dots\dots\dots$
- (ii) $12 + 18 = \dots\dots\dots$ and $12x^2y + 18x^2y = \dots\dots\dots$
- (iii) $7 + 16 = \dots\dots\dots$ and $7a + 16b = \dots\dots\dots$
- (iv) $1 + 3 = \dots\dots\dots$ and $x^2y + 3xy^2 = \dots\dots\dots$
- (v) $7 - 4 = \dots\dots\dots$ and $7ab - 4ab = \dots\dots\dots$
- (vi) $12 - 5 = \dots\dots\dots$ and $12x - 5y = \dots\dots\dots$
- (vii) $35 - 16 = \dots\dots\dots$ and $35ab - 16ba = \dots\dots\dots$
- (viii) $28 - 13 = \dots\dots\dots$ and $28ax^2 - 13a^2x = \dots\dots\dots$

Solution:

- (i) $5 + 4 = \mathbf{9}$ and $5x + 4x = \mathbf{9x}$
- (ii) $12 + 18 = \mathbf{30}$ and $12x^2y + 18x^2y = \mathbf{30x^2y}$
- (iii) $7 + 16 = \mathbf{23}$ and $7a + 16b = \mathbf{7a + 16b}$
- (iv) $1 + 3 = \mathbf{4}$ and $x^2y + 3xy^2 = \mathbf{x^2y + 3xy^2}$
- (v) $7 - 4 = \mathbf{3}$ and $7ab - 4ab = \mathbf{3ab}$
- (vi) $12 - 5 = \mathbf{7}$ and $12x - 5y = \mathbf{12x - 5y}$
- (vii) $35 - 16 = \mathbf{19}$ and $35ab - 16ba = \mathbf{19ab}$
- (viii) $28 - 13 = \mathbf{15}$ and $28ax^2 - 13a^2x = \mathbf{28ax^2 - 13a^2x}$

Question 2.

Fill in the blanks :

- (i) The sum of -2 and $-5 = \dots\dots\dots$ and the sum of $-2x$ and $-5x = \dots\dots\dots$
 (ii) The sum of 8 and $-3 = \dots\dots\dots$ and the sum of $8ab$ and $-3ab = \dots\dots\dots$
 (iii) The sum of -15 and $-4 = \dots\dots\dots$ and the sum of $-15x$ and $-4y = \dots\dots\dots$
 (iv) $15 + 8 + 3 = \dots\dots\dots$ and $15x + 8y + 3x = \dots\dots\dots$
 (v) $12 - 9 + 15 = \dots\dots\dots$ and $12ab - 9ab + 15ba = \dots\dots\dots$
 (vi) $25 - 7 - 9 = \dots\dots\dots$ and $25xy - 7xy - 9yx = \dots\dots\dots$
 (vii) $-4 - 6 - 5 = \dots\dots\dots$ and $-4ax - 6ax - 5ay = \dots\dots\dots$

Solution:

- (i) The sum of -2 and $-5 = -7$ and the sum of $-2x$ and $-5x = -7x$
 (ii) The sum of 8 and $-3 = 5$ and the sum of $8ab$ and $-3ab = 5ab$
 (iii) The sum of -15 and $-4 = -19$ and the sum of $-15x$ and $-4y = -15x - 4y$
 (iv) $15 + 8 + 3 = 26$ and $15x + 8y + 3x = 18x + 8y$
 (v) $12 - 9 + 15 = 18$ and $12ab - 9ab + 15ba = 18ab$
 (vi) $25 - 7 - 9 = 9$ and $25xy - 7xy - 9yx = 9xy$
 (vii) $-4 - 6 - 5 = -15$ and $-4ax - 6ax - 5ay = -10ax - 5ay$

Question 3.

Add:

- (i) $8xy$ and $3xy$
 (ii) $2xyz$, xyz and $6xyz$
 (iii) $2a$, $3a$ and $4b$
 (iv) $3x$ and $2y$
 (v) $5m$, $3n$ and $4p$
 (vi) $6a$, $3a$ and $9ab$
 (vii) $3p$, $4q$ and $9q$
 (viii) $5ab$, $4ba$ and $6b$
 (ix) $50pq$, $30pq$ and $10pr$
 (x) $-2y$, $-y$ and $-3y$
 (xi) $-3b$ and $-b$
 (xii) $5b$, $-4b$ and $-10b$
 (xiii) $-2c$, $-c$ and $-5c$

Solution:

- (i) $8xy + 3xy = 11xy$
 (ii) $2xyz + xyz + 6xyz = (2 + 1 + 6) xyz = 9xyz$

$$(iii) \ 2a + 3a + 4b$$

$$= (2 + 3) a + 4b$$

$$= \mathbf{5a + 4b}$$

$$(iv) \ 3x + 2y = \mathbf{3x + 2y}$$

$$(v) \ 5m + 3n + 4p = \mathbf{5m + 3n + 4p}$$

$$(vi) \ 6a + 3a + 9ab$$

$$= (6 + 3) a + 9ab$$

$$= \mathbf{9a + 9ab}$$

$$(vii) \ 3p + 4q + 9q$$

$$= 3p + (4 + 9)q$$

$$= \mathbf{3p + 13q}$$

$$(viii) \ 5ab + 4ba + 6b$$

$$= (5 + 4) ab + 6b$$

$$= \mathbf{9ab + 6b}$$

$$(ix) \ 50pq + 30pq + 10pr$$

$$= (50 + 30).pq + 10 pr$$

$$= \mathbf{80pq + 10pr}$$

$$(x) \ (-2y) + (-y) + (-3y)$$

$$= -(2 + 1 + 3)y$$

$$= \mathbf{-6y}$$

$$(xi) \ (-3b) + (-b)$$

$$= -(3 + 1)b$$

$$= \mathbf{-4b}$$

$$(xii) \ 5b + (-4b) + (-10b)$$

$$= 5b - (4 + 10)b$$

$$= 5b - 14b = \mathbf{-9b}$$

$$(xiii) \ (-2c) + (-c) + (-5c)$$

$$= -(2 + 1 + 5)c = \mathbf{-8c}$$

Question 4.

Evaluate :

$$(i) \ 6a - a - 5a - 2a$$

$$(ii) \ 2b - 3b - b + 4b$$

$$(iii) \ 3x - 2x - 4x + 7x$$

$$(iv) \ \mathbf{5ab + 2ab - 6ab + ab}$$

$$(v) \ 8x - 5y - 3x + 10y$$

Solution:

$$(i) \ 6a - a - 5a - 2a = 6a - (1 + 5 + 2).a$$

$$= 6a - 8a = -2a$$

$$(ii) \ 2b - 3b - b + 4b$$

$$= 2b + 4b - (3 + 1).b$$

$$= 6b - 4b = 2b$$

$$(iii) \ 3x - 2x - 4x + 7x$$

$$= 3x + 7x - 2x - 4x$$

$$= (3 + 7).x - (2 + 4).x$$

$$= 10x - 6x = 4x$$

$$(iv) \ 5ab + 2ab - 6ab + ab$$

$$= 5ab + 2ab + ab - 6ab$$

$$= 8ab - 6ab = 2ab$$

$$(v) \ 8x - 5y - 3x + 10y$$

$$= 8x - 3x + 10y - 5y$$

$$= 5x + 5y$$

Question 5.

Evaluate :

$$(i) \ -7x + 9x + 2x - 2x$$

$$(ii) \ 5ab - 2ab - 8ab + 6ab$$

$$(iii) \ -8a - 3a + 12a + 13a - 6a$$

$$(iv) \ 19abc - 11abc - 12abc + 14abc$$

Solution:

$$(i) \ -7x + 9x + 2x - 2x$$

$$= 9x + 2x - 7x - 2x$$

$$= 11x - 9x = 2x$$

$$(ii) \ 5ab - 2ab - 8ab + 6ab$$

$$= 5ab + 6ab - 2ab - 8ab$$

$$= 11ab - 10ab = ab$$

$$(iii) \ -8a - 3a + 12a + 13a - 6a$$

$$= 12a + 13a - (8a + 3a + 6a)$$

$$= 25a - 17a = 8a$$

$$(iv) \ 19abc - 11abc - 12abc + 14abc$$

$$= abc (19 - 11 - 12 + 14)$$

$$= abc (33 - 23) = 10abc$$

Question 6.

Subtract the first term from the second :

(i) $4ab, 6ba$

(ii) $4 \cdot 8b, 6 \cdot 8b$

(iii) $3 \cdot 5abc, 10 \cdot 5abc$

(iv) $3\frac{1}{2}mn, 8\frac{1}{2}nm$

Solution:

(i) $6ba - 4ab = 2ab$

(ii) $6 \cdot 8b - 4 \cdot 8b = 2b$

(iii) $10 \cdot 5abc - 3 \cdot 5abc = 7abc$

(iv) $8\frac{1}{2}nm - 3\frac{1}{2}nm$

$$= \frac{17}{2}nm - \frac{7}{2}nm$$

$$= \frac{17mn - 7mn}{2} = \frac{10mn}{2} = 5mn$$

Question 7.

Simplify :

(i) $2a^2b^2 + 5ab^2 + 8a^2b^2 - 3ab^2$

(ii) $4a + 3b - 2a - b$

(iii) $2xy + 4yz + 5xy + 3yz - 6xy$

(iv) $ab + 15ab - 11ab - 2ab$

(v) $6a^2 - 3b^2 + 2a^2 + 5b^2 - 4a^2$

(vi) $8abc + 2ab - 4abc + ab$

(vii) $9xyz + 15yxz - 10zyx - 2zxy$

$$(viii) 13pqr + 2p + 4q - 6pqr + 5pqr$$

$$(ix) 4ab + 0 - 2ba$$

$$(x) 6x^2y - 2xy^2 + 5x^2y - xy^2$$

$$(xi) 6 \cdot 4a + 5 \cdot 3b - 2 \cdot 4a - 2 \cdot 2b$$

$$(xii) 2 \cdot 5a + 4 \cdot 6b + 1 \cdot 2a - 3 \cdot 6b$$

$$(xiii) 22m - 12\frac{1}{2}n - 15p + 16n$$

$$(xiv) 6p + \frac{2}{3}q - 1\frac{1}{2}p + \frac{1}{3}q + 2q$$

$$(xv) 2\frac{2}{3}xy - 3\frac{1}{2}xy + 3\frac{1}{3}xy - 2\frac{1}{2}xy$$

Solution:

$$\begin{aligned}(i) \quad & 2a^2b^2 + 5ab^2 + 8a^2b^2 - 3ab^2 \\ &= 2a^2b^2 + 8a^2b^2 + 5ab^2 - 3ab^2 \\ &= \mathbf{10a^2b^2 + 2ab^2}\end{aligned}$$

$$\begin{aligned}(ii) \quad & 4a + 3b - 2a - b \\ &= 4a - 2a + 3b - b \\ &= \mathbf{2a + 2b}\end{aligned}$$

$$\begin{aligned}(iii) \quad & 2xy + 4yz + 5xy + 3yz - 6xy \\ &= 2xy + 5xy - 6xy + 4yz + 3yz \\ &= 7xy - 6xy + 7yz \\ &= \mathbf{x + 7yz}\end{aligned}$$

$$\begin{aligned}(iv) \quad & ab + 15ab - 11ab - 2ab \\ &= 16ab - 13ab = \mathbf{3ab}\end{aligned}$$

$$\begin{aligned}(v) \quad & 6a^2 - 3b^2 + 2a^2 + 5b^2 - 4a^2 \\ &= 6a^2 + 2a^2 - 4a^2 + 5b^2 - 3b^2 \\ &= \mathbf{4a^2 + 2b^2}\end{aligned}$$

$$\begin{aligned}(vi) \quad & 8abc + 2ab - 4abc + ab \\ &= 8abc - 4abc + 2ab + ab \\ &= \mathbf{4abc + 3ab}\end{aligned}$$

$$\begin{aligned}(vii) \quad & 9xyz + 15yxz - 10zyx - 2zxy \\ &= 9xyz + 15xyz - 10xyz - 2xyz \\ &= 24xyz - 12xyz = \mathbf{12xyz}\end{aligned}$$

$$(viii) 13pqr + 2p + 4q - 6pqr + 5pqr$$

$$= 13pqr + 5pqr - 6pqr + 2p + 4q$$

$$= \mathbf{12pqr + 2p + 4q}$$

$$(ix) \quad 4ab + 0 - 2ba$$

$$= 4ab - 2ab + 0 = \mathbf{2ab}$$

$$(xii) \quad 6x^2y - 2xy^2 + 5x^2y - xy^2$$

$$= 6x^2y + 5x^2y - 2xy^2 - xy^2$$

$$= \mathbf{11x^2y - 3xy^2}$$

$$(xi) \quad 6 \cdot 4a + 5 \cdot 3b - 2 \cdot 4a - 2 \cdot 2b$$

$$= 6 \cdot 4a - 2 \cdot 4a + 5 \cdot 3b - 2 \cdot 2b$$

$$= \mathbf{4a + 3 \cdot 1b}$$

$$(xii) \quad 2 \cdot 5a + 4 \cdot 6b + 1 \cdot 2a - 3 \cdot 6b$$

$$= 2 \cdot 5a + 1 \cdot 2a + 4 \cdot 6b - 3 \cdot 6b$$

$$= \mathbf{3 \cdot 7a + b}$$

$$(xiii) \quad 22m - 12\frac{1}{2}n - 15p + 16n$$

$$= 22m - \frac{25}{2}n - 15p + 16n$$

$$= 22m + 16n - \frac{25}{2}n - 15p$$

$$= 22m + \frac{32n - 25n}{2} - 15p$$

$$= 22m + \frac{7n}{2} - 15p$$

$$= \mathbf{22m + 3\frac{1}{2}n - 15p}$$

$$(xiv) \quad 6p + \frac{2}{3}q - 1\frac{1}{2}p + \frac{1}{3}q + 2q$$

$$= 6p - \frac{3}{2}p + \frac{2}{3}q + \frac{1}{3}q + 2q$$

$$= \left(\frac{12p - 3p}{2} \right) + \left(\frac{2q + q + 6q}{3} \right)$$

$$= \frac{9}{2}p + 3q = \mathbf{4\frac{1}{2}p + 3q}$$

$$(xv) \quad 2\frac{2}{3}xy - 3\frac{1}{2}xy + 3\frac{1}{3}xy - 2\frac{1}{2}xy$$

$$\begin{aligned}
&= xy \left(2\frac{2}{3} - 3\frac{1}{2} + 3\frac{1}{3} - 2\frac{1}{2} \right) \\
&= xy \left(\frac{8}{3} - \frac{7}{2} + \frac{10}{3} - \frac{5}{2} \right) \\
&= xy \left(\frac{16 - 21 + 20 - 15}{6} \right) \\
&= xy \left(\frac{36 - 36}{6} \right) = 0 \times xy = 0
\end{aligned}$$

EXERCISE 19(B)

Question 1.

Find the sum of :

- (i) $3a + 4b + 7c$, $-5a + 3b - 6c$
and $4a - 2b - 4c$.
- (ii) $2x^2 + xy - y^2$, $-x^2 + 2xy + 3y^2$
and $3x^2 - 10xy + 4y^2$.
- (iii) $x^2 - x + 1$, $-5x^2 + 2x - 2$
and $3x^2 - 3x + 1$
- (iv) $a^2 - ab + bc$, $2ab + bc - 2a^2$
and $-3bc + 3a^2 + ab$.
- (v) $4x^2 + 7 - 3x$, $4x - x^2 + 8$
and $-10 + 5x - 2x^2$.
- (vi) $3x + 4xy - y^2$, $xy - 4x + 2y^2$
and $3y^2 - xy + 6x$.

Solution:

$$\begin{aligned}
 (i) \quad & (3a + 4b + 7c) + (-5a + 3b - 6c) \\
 & \quad + (4a - 2b - 4c) \\
 & = 3a + 4b + 7c - 5a + 3b - 6c \\
 & \quad + 4a - 2b - 4c \\
 & = 3a + 4a - 5a + 4b + 3b - 2b \\
 & \quad + 7c - 6c - 4c \\
 & = 7a - 5a + 7b - 2b + 7c - 10c \\
 & = \mathbf{2a + 5b - 3c}
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & (2x^2 + xy - y^2) + (-x^2 + 2xy + 3y^2) \\
 & \quad + (3x^2 - 10xy + 4y^2) \\
 & = 2x^2 + xy - y^2 - x^2 + 2xy + 3y^2 \\
 & \quad + 3x^2 - 10xy + 4y^2 \\
 & = 2x^2 + 3x^2 - x^2 + xy + 2xy - 10xy \\
 & \quad + 3y^2 + 4y^2 - y^2 \\
 & = 5x^2 - x^2 + 3xy - 10xy + 7y^2 - y^2 \\
 & = \mathbf{4x^2 - 7xy + 6y^2}
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad & (x^2 - x + 1) + (-5x^2 + 2x - 2) \\
 & \quad + (3x^2 - 3x + 1) \\
 & = x^2 - x + 1 - 5x^2 + 2x - 2 + 3x^2 \\
 & \quad - 3x + 1 \\
 & = x^2 + 3x^2 - 5x^2 + 2x - x - 3x + 1 + 1 - 2 \\
 & = 4x^2 - 5x^2 + 2x - 4x + 2 - 2 = \mathbf{-x^2 - 2x}
 \end{aligned}$$

$$\begin{aligned}
 (iv) \quad & (a^2 - ab + bc) + (2ab + bc - 2a^2) \\
 & \quad + (-3bc + 3a^2 + ab) \\
 & = a^2 - ab + bc + 2ab + bc - 2a^2 - 3bc \\
 & \quad + 3a^2 + ab \\
 & = a^2 + 3a^2 - 2a^2 + 2ab + ab - ab + bc \\
 & \quad + bc - 3bc \\
 & = 4a^2 - 2a^2 + 3ab - ab + 2bc - 3bc \\
 & = \mathbf{2a^2 + 2ab - bc}
 \end{aligned}$$

$$\begin{aligned}
 \text{(v)} \quad & (4x^2 + 7 - 3x) + (4x - x^2 + 8) \\
 & \quad + (-10 + 5x - 2x^2) \\
 & = 4x^2 + 7 - 3x + 4x - x^2 + 8 \\
 & \quad - 10 + 5x - 2x^2 \\
 & = 4x^2 - x^2 - 2x^2 + 7 + 8 - 10 \\
 & \quad + 4x + 5x - 3x \\
 & = 4x^2 - 3x^2 + 15 - 10 + 9x - 3x \\
 & = x^2 + 5 + 6x
 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad & (3x + 4xy - y^2) + (xy - 4x + 2y^2) \\
 & \quad + (3y^2 - xy + 6x) \\
 & = 3x + 4xy - y^2 + xy - 4x + 2y^2 \\
 & \quad + 3y^2 - xy + 6x \\
 & = 3x + 6x - 4x + 4xy + xy - xy \\
 & \quad + 2y^2 + 3y^2 - y^2 \\
 & = 9x - 4x + 5xy - xy + 5y^2 - y^2 \\
 & = 5x + 4xy + 4y^2
 \end{aligned}$$

Question 2.

Add the following expressions :

$$\begin{aligned}
 \text{(i)} \quad & -17x^2 - 2xy + 23y^2, -9y^2 + 15x^2 + 7xy \\
 & \text{and } 13x^2 + 3y^2 - 4xy
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad & -x^2 - 3xy + 3y^2 + 8, 3x^2 - 5y^2 - 3 + 4xy \\
 & \text{and } -6xy + 2x^2 - 2 + y^2
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & a^3 - 2b^3 + a, \quad b^3 - 2a^3 + b \\
 & \text{and } -2b + 2b^3 - 5a + 4a^3
 \end{aligned}$$

Solution:

$$\begin{aligned}
 (i) \quad & (-17x^2 - 2xy + 23y^2) + (-9y^2 + 15x^2 + 7xy) \\
 & \quad + (13x^2 + 3y^2 - 4xy) \\
 & = -17x^2 - 2xy + 23y^2 - 9y^2 + 15x^2 \\
 & \quad + 7xy + 13x^2 + 3y^2 - 4xy \\
 & = -17x^2 + 15x^2 + 13x^2 - 2xy - 4xy \\
 & \quad + 7xy + 23y^2 + 3y^2 - 9y^2 \\
 & = 11x^2 + xy + 17y^2
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & (-x^2 - 3xy + 3y^2 + 8) + (3x^2 - 5y^2 - 3 \\
 & \quad + 4xy) + (-6xy + 2x^2 - 2 + y^2) \\
 & = -x^2 - 3xy + 3y^2 + 8 + 3x^2 - 5y^2 - 3 \\
 & \quad + 4xy - 6xy + 2x^2 - 2 + y^2 \\
 & = -x^2 + 3x^2 + 2x^2 - 3xy - 6xy + 4xy \\
 & \quad + 3y^2 + y^2 - 5y^2 + 8 - 3 - 2 \\
 & = 4x^2 - 5xy - y^2 + 3
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad & (a^3 - 2b^3 + a) + (b^3 - 2a^3 + b) \\
 & \quad + (-2b + 2b^3 - 5a + 4a^3) \\
 & = a^3 - 2b^3 + a + b^3 - 2a^3 + b - 2b \\
 & \quad + 2b^3 - 5a + 4a^3 \\
 & = a^3 + 4a^3 - 2a^3 - 2b^3 + b^3 + 2b^3 \\
 & \quad + a - 5a + b - 2b \\
 & = 3a^3 + b^3 - 4a - b
 \end{aligned}$$

Question 3.

Evaluate :

- (i) $3a - (a + 2b)$
- (ii) $(5x - 3y) - (x + y)$
- (iii) $(8a + 15b) - (3b - 7a)$
- (iv) $(8x + 7y) - (4y - 3x)$
- (v) $7 - (4a - 5)$
- (vi) $(6y - 13) - (4 - 7y)$

Solution:

$$\begin{aligned}
 (i) \quad & 3a - (a + 2b) \\
 & = 3a - a - 2b = 2a - 2b \\
 & = 2(a - b) \\
 (ii) \quad & (5x - 3y) - (x + y) \\
 & = 5x - 3y - x - y
 \end{aligned}$$

$$= 5x - x - 3y - y$$

$$= 4x - 4y = 4(x - y)$$

$$(iii) (8a + 15b) - (3b - 7a)$$

$$= 8a + 15b - 3b + 7a$$

$$= 8a + 7a + 15b - 3b$$

$$= 15a + 12b$$

$$(iv) (8x + 7y) - (4y - 3x)$$

$$= 8x + 7y - 4y + 3x$$

$$= 8x + 3x + 7y - 4y$$

$$= 11x + 3y$$

$$(v) 7 - (4a - 5)$$

$$= 7 - 4a + 5 = 7 + 5 - 4a$$

$$= 12 - 4a$$

$$(vi) (6y - 13) - (4 - 7y)$$

$$= 6y - 13 - 4 + 7y$$

$$= 6y + 7y - 13 - 4$$

$$= 13y - 17$$

Question 4.

Subtract :

$$(i) 5a - 3b + 2c \text{ from } a - 4b - 2c.$$

$$(ii) 4x - 6y + 3z \text{ from } 12x + 7y - 21z.$$

$$(iii) 5 - a - 4b + 4c \text{ from } 5a - 7b + 2c.$$

$$(iv) -8x - 12y + 17z \text{ from } x - y - z.$$

$$(v) 2ab + cd - ac - 2bd \text{ from } ab - 2cd + 2ac + bd.$$

Solution:

$$\begin{aligned}
 (i) \quad & (a - 4b - 2c) - (5a - 3b + 2c) \\
 &= a - 4b - 2c - 5a + 3b - 2c \\
 &= a - 5a - 4b + 3b - 2c - 2c \\
 &= -4a - b - 4c.
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & (12x + 7y - 21z) - (4x - 6y + 3z) \\
 &= 12x + 7y - 21z - 4x + 6y - 3z \\
 &= 12x - 4x + 7y + 6y - 21z - 3z \\
 &= 8x + 13y - 24z.
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad & (5a - 7b + 2c) - (5 - a - 4b + 4c) \\
 &= 5a - 7b + 2c - 5 + a + 4b - 4c \\
 &= 5a + a - 7b + 4b + 2c - 4c - 5 \\
 &= 6a - 3b - 2c - 5.
 \end{aligned}$$

$$\begin{aligned}
 (iv) \quad & (x - y - z) - (-8x - 12y + 17z) \\
 &= x - y - z + 8x + 12y - 17z \\
 &= x + 8x + 12y - y - z - 17z \\
 &= 9x + 11y - 18z.
 \end{aligned}$$

$$\begin{aligned}
 (v) \quad & (ab - 2cd + 2ac + bd) \\
 & \quad - (2ab + cd - ac - 2bd) \\
 &= ab - 2cd + 2ac + bd - 2ab - cd \\
 & \quad \quad \quad + ac + 2bd \\
 &= ab - 2ab - 2cd - cd + 2ac \\
 & \quad \quad \quad + ac + bd + 2bd \\
 &= -ab - 3cd + 3ac + 3bd
 \end{aligned}$$

Question 5.

(i) Take $-ab + bc - ca$ from $bc - ca + ab$.

(ii) Take $5x + 6y - 3z$ from $3x + 5y - 4z$.

(iii) Take $\frac{-3}{2}p + q - r$ from $\frac{1}{2}p - \frac{1}{3}q - \frac{3}{2}r$.

(iv) Take $1 - a + a^2$ from $a^2 + a + 1$.

Solution:

$$\begin{aligned}(i) \quad & (bc - ca + ab) - (-ab + bc - ca) \\ &= bc - ca + ab + ab - bc + ca \\ &= bc - bc - ca + ca + ab + ab \\ &= \mathbf{2ab}\end{aligned}$$

$$\begin{aligned}(ii) \quad & (3x + 5y - 4z) - (5x + 6y - 3z) \\ &= 3x + 5y - 4z - 5x - 6y + 3z \\ &= 3x - 5x + 5y - 6y - 4z + 3z \\ &= \mathbf{-2x - y - z}\end{aligned}$$

$$\begin{aligned}(iii) \quad & \left(\frac{1}{2}p - \frac{1}{3}q - \frac{3}{2}r\right) - \left(-\frac{3}{2}p + q - r\right) \\ &= \frac{1}{2}p - \frac{1}{3}q - \frac{3}{2}r + \frac{3}{2}p - q + r \\ &= \frac{1}{2}p + \frac{3}{2}p - \frac{1}{3}q - q - \frac{3}{2}r + r \\ &= \frac{3p + 9p - 2q - 6q - 9r + 6r}{6} \\ &\quad \text{[Since L.C.M. = 6]} \\ &= \frac{12p}{6} - \frac{8q}{6} - \frac{3r}{6} \\ &= 2p - \frac{4}{3}q - \frac{1}{2}r \\ (iv) \quad & (a^2 + a + 1) - (1 - a + a^2) \\ &= a^2 + a + 1 - 1 + a - a^2 \\ &= a^2 - a^2 + a + a + 1 - 1 = \mathbf{2a}\end{aligned}$$

Question 6.

From the sum of $x + y - 2z$ and $2x - y + z$ subtract $x + y + z$.

Solution:

$$\begin{aligned}& (x + y - 2z) + (2x - y + z) - (x + y + z) \\ &= x + y - 2z + 2x - y + z - x - y - z \\ &= x + 2x - x + y - y - y - 2z - z + z \\ &= \mathbf{2x - y - 2z}\end{aligned}$$

Question 7.

From the sum of $3a - 2b + 4c$ and $3b - 2c$ subtract $a - b - c$.

Solution:

$$\begin{aligned}
& (3a - 2b + 4c) + (3b - 2c) - (a - b - c) \\
&= 3a - 2b + 4c + 3b - 2c - a + b + c \\
&= 3a - a + 3b + b - 2b + 4c + c - 2c \\
&= 2a + 2b + 3c
\end{aligned}$$

Question 8.

Subtract $x - 2y - z$ from the sum of $3x - y + z$ and $x + y - 3z$.

Solution:

$$\begin{aligned}
& (3x - y + z) + (x + y - 3z) - (x - 2y - z) \\
&= 3x - y + z + x + y - 3z - x + 2y + z \\
&= 3x + x - x - y + y + 2y + z + z - 3z \\
&= 3x + 2y - z
\end{aligned}$$

Question 9.

Subtract the sum of $x + y$ and $x - z$ from the sum of $x - 2z$ and $x + y + z$

Solution:

$$\begin{aligned}
& (x - 2z) + (x + y + z) - \{(x + y) + (x - z)\} \\
&= x - 2z + x + y + z - \{x + y + x - z\} \\
&= x - 2z + x + y + z - x - y - x + z \\
&= x + x - x - x + y - y + z + z - 2z \\
&= 0
\end{aligned}$$

Question 10.

By how much should $x + 2y - 3z$ be increased to get $3x$?

Solution:

$$\begin{aligned}
& 3x - (x + 2y - 3z) \\
&= 3x - x - 2y + 3z \\
&= 2x - 2y + 3z
\end{aligned}$$

Question 11.

The sum of two expressions is $5x^2 - 3y^2$. If one of them is $3x^2 + 4xy - y^2$, find the other.

Solution:

$$\begin{aligned}
& (5x^2 - 3y^2) - (3x^2 + 4xy - y^2) \\
&= 5x^2 - 3y^2 - 3x^2 - 4xy + y^2 \\
&= 5x^2 - 3x^2 - 4xy - 3y^2 + y^2 \\
&= 2x^2 - 4xy - 2y^2
\end{aligned}$$

Question 12.

The sum of two expressions is $3a^2 + 2ab - b^2$. If one of them is $2a^2 + 3b^2$, find the other.

Solution:

$$\begin{aligned}(3a^2 + 2ab - b^2) - (2a^2 + 3b^2) \\&= 3a^2 + 2ab - b^2 - 2a^2 - 3b^2 \\&= 3a^2 - 2a^2 + 2ab - b^2 - 3b^2 \\&= a^2 + 2ab - 4b^2\end{aligned}$$

EXERCISE 19(C)**Question 1.**

Fill in the blanks :

- (i) $6 \times 3 = \dots\dots\dots$ and $6x \times 3x = \dots\dots\dots$
- (ii) $6 \times 3 = \dots\dots\dots$ and $6x^2 \times 3x^3 = \dots\dots\dots$
- (iii) $5 \times 4 = \dots\dots\dots$ and $5x \times 4y = \dots\dots\dots$
- (iv) $4 \times 7 = \dots\dots\dots$ and $4ax \times 7x = \dots\dots\dots$
- (v) $6 \times 2 = \dots\dots\dots$ and $6xy \times 2xy = \dots\dots\dots$
- (vi) $12 \times 4 = \dots\dots\dots$ and $12ax^2 \times 4ax = \dots\dots\dots$
- (vii) $1 \times 8 = \dots\dots\dots$ and $a^2xy^2 \times 8a^3x^2y = \dots\dots\dots$
- (viii) $15 \times 3 = \dots\dots\dots$ and $15x \times 3x^5y^2 = \dots\dots\dots$

Solution:

(i) $6 \times 3 = 18$ and $6x \times 3x = 6 \times 3x \times x = 18x^2$

(ii) $6 \times 3 = 18$ and $6x^2 \times 3x^3$
 $= 6 \times 3 \times x^2 \times x^3 = 18x^5$

(iii) $5 \times 4 = 20$ and $5x \times 4y$
 $= 5 \times 4 \times x \times y = 20xy$

(iv) $4 \times 7 = 28$ and $4ax \times 7x$
 $= 4 \times 7 \times a \times x \times x = 28ax^2$

(v) $6 \times 2 = 12$ and $6xy \times 2xy$
 $= 6 \times 2 \times x \times x \times y \times y = 12x^2y^2$

(vi) $12 \times 4 = 48$ and $12ax^2 \times 4ax$
 $= 12 \times 4 \times a \times a \times x^2 \times x$
 $= 48a^2x^3$

(vii) $1 \times 8 = 8$ and $a^2xy^2 \times 8a^3x^2y$
 $= 1 \times 8 \times a^2 \times a^3 \times x \times x^2 \times y^2 \times y$
 $= 8a^5x^3y^3$

(viii) $15 \times 3 = 45$ and $15x \times 3x^5y^2$
 $= 15 \times 3 \times x \times x^5 \times y^2$
 $= 45x^6y^2$

Question 2.

- (i) $4x \times 6x \times 2 = \dots\dots\dots$
(ii) $3ab \times 6ax = \dots\dots\dots$
(iiii) $x \times 2x^2 \times 3x^3 = \dots\dots\dots$
(iv) $5 \times 5a^3 = \dots\dots\dots$
(v) $6 \times 6x^2 \times 6x^2y^2 = \dots\dots\dots$
(vi) $-8x \times -3x = - \dots\dots\dots$
(vii) $-5 \times -3x \times 5x^2 = \dots\dots\dots$
(viii) $8 \times -4xy^2 \times 3x^3y^2 = \dots\dots\dots$
(ix) $-4x \times 5xy \times 3z = \dots\dots\dots$
(x) $5x \times 2x^2y \times (-7y^3) \times 2x^3y^2 = \dots\dots\dots$

$$(i) \quad 4x \times 6x \times 2 = 4 \times 6 \times 2 \times x \times x \\ = 48x^2$$

$$(ii) \quad 3ab \times 6ax = 3 \times 6 \times a \times a \times b \times x \\ = 18a^2bx$$

$$(iii) \quad x \times 2x^2 \times 3x^3 = 1 \times 2 \times 3 \times x^{1+2+3} \\ = 6x^6$$

$$(iv) \quad 5 \times 5a^3 = 25a^3$$

$$(v) \quad 6 \times 6x^2 \times 6x^2y^2 = 6 \times 6 \times 6 \times x^{2+2} y^2 \\ = 216x^4y^2$$

$$(vi) \quad -8x \times -3x = -8 \times -3 \times x^{1+1} \\ = 24x^2$$

$$(vii) \quad -5 \times -3x \times 5x^2 = -5 \times -3 \times 5 \times x^{1+2} \\ = 75x^3$$

$$(viii) \quad 8 \times -4xy^2 \times 3x^3y^2 \\ = 8 \times -4 \times 3 \times x^{1+3} y^{2+2} \\ = -96x^4y^4$$

$$(ix) \quad -4x \times 5xy \times 3z \\ = -4 \times 5 \times 3 \times x^{1+1} \times y \times z \\ = -60x^2yz$$

$$(x) \quad 5x \times 2x^2y \times -7y^3 \times 2x^3y^2 \\ = 5 \times 2 \times -7 \times 2 \times x^{1+2+3} \times y^{1+3+2} \\ = -140x^6y^6$$

Question 3.

- (i) $3x^3 \times 5x^4$
- (ii) $5a^2 \times 7a^7$
- (iii) $3abc \times 6ac^3$
- (iv) $a^2b^2 \times 5a^3b^4$
- (v) $2x^2y^3 \times 5x^3y^4$
- (vi) $abc \times bcd$

Solution:

- (i) $3x^3 \times 5x^4 = 3 \times 5x^{3+4} = 15x^7$
- (ii) $5a^2 \times 7a^7 = 5 \times 7 \times a^{2+7} = 35a^9$
- (iii) $3abc \times 6ac^3 = 3 \times 6 \times a^{1+1} \times b \times c^{1+3}$
 $= 18a^2bc^4$
- (iv) $a^2b^2 \times 5a^3b^4 = 1 \times 5 \times a^{2+3} b^{2+4}$
 $= 5a^5b^6$
- (v) $2x^2y^3 \times 5x^3y^4 = 2 \times 5 \times x^{2+3} \times y^{3+4}$
 $= 10x^5y^7$
- (vi) $abc \times bcd = a \times b^{1+1} \times c^{1+1} \times d$
 $= ab^2c^2d$

Question 4.

Multiply :

- (i) $a + b$ by ab
- (ii) $3ab - 4b$ by $3ab$
- (iii) $2xy - 5by$ by $4bx$
- (iv) $4x + 2y$ by $3xy$
- (v) $x^2 - x$ by $2x$
- (vi) $1 + 4x$ by x

- (vii) $9xy^2 + 3x^2y$ by $5xy$
- (viii) $6x - 5y$ by $3axy$

Solution:

$$(i) (a + b) \times ab = a \cdot ab + b \cdot ab$$

$$= a^2b + ab^2$$

$$(ii) (3ab - 4b) \times 3ab = 3ab \times 3ab - 4b \times 3ab$$

$$= 3 \times 3a^{1+1}b^{1+1} - 4 \times 3 \times a \times b^{1+1}$$

$$= 9a^2b^2 - 12ab^2$$

$$(iii) (2xy - 5by) \times 4bx = 2xy \cdot 4bx - 5by \cdot 4bx$$

$$= 8bx^2y - 20b^2xy$$

$$(iv) (4x + 2y) \times 3xy = 4x \cdot 3xy + 2y \cdot 3xy$$

$$= 12x^2y + 6xy^2$$

$$(v) (x^2 - x) \times 2x = x^2 \cdot 2x - x \cdot 2x$$

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

$$(vi) (1 + 4x) \times x = 1 \cdot x + 4x \cdot x$$

$$= x + 4x^2$$

$$(vii) (9xy^2 + 3x^2y) \times 5xy$$

$$= 9xy^2 \cdot 5xy + 3x^2y \cdot 5xy$$

$$= 45x^2y^3 + 15x^3y^2$$

$$(viii) (6x - 5y) \times 3axy$$

$$= 6x \cdot 3axy - 5y \cdot 3axy$$

$$= 18ax^2y - 15axy^2$$

Question 5.

Multiply :

$$(i) -x + y - z \text{ and } -2x$$

$$(ii) xy - yz \text{ and } x^2yz^2$$

$$(iii) 2xyz + 3xy \text{ and } -2y^2z$$

$$(iv) -3xy^2 + 4x^2y \text{ and } -xy$$

$$(v) 4xy \text{ and } -x^2y - 3x^2y^2$$

Solution:

$$\begin{aligned}
 (i) \quad & (-x + y - z) \times -2x \\
 & = -x \cdot -2x + y \cdot -2x - z \cdot -2x \\
 & = 2x^2 - 2xy + 2xz
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & xy - yz \times x^2yz^2 \\
 & = xy \cdot x^2yz^2 - yz \cdot x^2yz^2 \\
 & = x^{2+1} \times y^{1+1} \times z^2 - x^2 \times y^{1+1} \times z^{2+1} \\
 & = x^3y^2z^2 - x^2y^2z^3
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad & 2xyz + 3xy \times -2y^2z \\
 & = 2xyz - 2y^2z + 3xy \cdot -2y^2z \\
 & = -4x \times y^{2+1} \times z^{1+1} - 6 \times x \times y^{2+1} \times z \\
 & = -4xy^3z^2 - 6xy^3z
 \end{aligned}$$

$$\begin{aligned}
 (iv) \quad & -3xy^2 + 4x^2y \times -xy \\
 & = -3xy^2 - xy + 4x^2y \cdot -xy \\
 & = 3x^2y^3 - 4x^3y^2
 \end{aligned}$$

$$\begin{aligned}
 (v) \quad & -x^2y - 3x^2y^2 \times 4xy \\
 & = -x^2y \cdot 4xy - 3x^2y^2 \cdot 4xy \\
 & = -4x^3y^2 - 12x^3y^3
 \end{aligned}$$

Question 6.

Multiply :

$$(i) \quad 3a + 4b - 5c \text{ and } 3a$$

$$(ii) \quad -5xy \text{ and } -xy^2 - 6x^2y$$

Solution:

$$\begin{aligned}
 (i) \quad & (3a + 4b - 5c) \times 3a \\
 & = (3a \times 3a) + (4b \times 3a) - (5c \times 3a) \\
 & = 9a^2 + 12ab - 15ac
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & (-xy^2 - 6x^2y) \times -5xy \\
 & = -xy^2 \times -5xy - 6x^2y \times -5xy \\
 & = 5x^2y^3 + 30x^3y^2
 \end{aligned}$$

Question 7.

Multiply :

$$(i) \quad x + 2 \text{ and } x + 10$$

$$(ii) \quad x + 5 \text{ and } x - 3$$

$$(iii) \quad x - 5 \text{ and } x + 3$$

$$(iv) \quad x - 5 \text{ and } x - 3$$

(v) $2x + y$ and $x + 3y$

(vi) $(3x - 5y)$ and $(x + 6y)$

(vii) $(x + 9y)$ and $(x - 5y)$

(viii) $(2x + 5y)$ and $(2x + 5y)$

Solution:

$$(i) (x + 2) \cdot (x + 10)$$

$$= x \cdot (x + 2) + 10 \cdot (x + 2)$$

$$= x^2 + 2x + 10x + 20$$

$$= x^2 + 12x + 20$$

$$(ii) (x + 5) \cdot (x - 3)$$

$$= x \cdot (x + 5) - 3 \cdot (x + 5)$$

$$= x^2 + 5x - 3x - 15$$

$$= x^2 + 2x - 15$$

$$(iii) (x - 5) \cdot (x + 3) = x \cdot (x - 5) + 3 \cdot (x - 5)$$

$$= x^2 - 5x + 3x - 15$$

$$= x^2 - 2x - 15$$

$$(iv) (x - 5) \cdot (x - 3) = x \cdot (x - 5) - 3 \cdot (x - 5)$$

$$= x^2 - 5x - 3x + 15$$

$$= x^2 - 8x + 15$$

$$(v) (2x + y) \cdot (x + 3y)$$

$$= x \cdot (2x + y) + 3y \cdot (2x + y)$$

$$= 2x^2 + xy + 6xy + 3y^2$$

$$= 2x^2 + 7xy + 3y^2$$

$$(vi) (3x - 5y) \cdot (x + 6y)$$

$$= x \cdot (3x - 5y) + 6y \cdot (3x - 5y)$$

$$= 3x^2 - 5xy + 18xy - 30y^2$$

$$= 3x^2 + 13xy - 30y^2$$

$$(vii) (x + 9y) \cdot (x - 5y)$$

$$= x \cdot (x + 9y) - 5y \cdot (x + 9y)$$

$$= x^2 + 9xy - 5xy - 45y^2$$

$$= x^2 + 4xy - 45y^2$$

$$(viii) (2x + 5y) \cdot (2x + 5y)$$

$$= 2x \cdot (2x + 5y) + 5y \cdot (2x + 5y)$$

$$= 4x^2 + 10xy + 10xy + 25y^2$$

$$= 4x^2 + 20xy + 25y^2$$

Question 8.

Multiply :

- (i) $3abc$ and $-5a^2b^2c$
- (ii) $x - y + z$ and $-2x$
- (iii) $2x - 3y - 5z$ and $-2y$
- (iv) $-8xyz + 10x^2yz^3$ and xyz
- (v) xyz and $-13xy^2z + 15x^2yz - 6xyz^2$
- (vi) $4abc - 5a^2bc - 6ab^2c$ and $-2abc^2$

Solution:

- (i) $3abc \times -5a^2b^2c$
 $= 3 \cdot -5 \cdot a^{1+2} \cdot b^{1+2} \cdot c^{1+1}$
 $= -15a^3b^3c^2$
- (ii) $(x - y + z) \cdot -2x$
 $= -2x^2 + 2xy - 2xz$
- (iii) $2x - 3y - 5z \cdot -2y$
 $= -4xy + 6y^2 + 10yz$
- (iv) $-8xyz + 10x^2yz^3 \cdot xyz$
 $= -8x^2y^2z^2 + 10x^3y^2z^4$
- (v) $-13xy^2z + 15x^2yz - 6xyz^2 \cdot xyz$
 $= -13x^2y^3z^2 + 15x^3y^2z^2 - 6x^2y^2z^3$
- (vi) $4abc - 5a^2bc - 6ab^2c \cdot -2abc^2$
 $= -8a^2b^2c^3 + 10a^3b^2c^3 + 12a^2b^3c^3$

Question 9.

Find the product of :

- (i) $xy - ab$ and $xy + ab$
- (ii) $2abc - 3xy$ and $2abc + 3xy$
- (iii) $a + b - c$ and $2a - 3b$
- (iv) $5x - 6y - 7z$ and $2x + 3y$
- (v) $5x - 6y - 7z$ and $2x + 3y + z$
- (vi) $2a + 3b - 4c$ and $a - b - c$

Solution:

$$(i) (xy - ab) \cdot (xy + ab)$$

$$= xy \cdot (xy - ab) + ab \cdot (xy - ab)$$

$$= x^2y^2 - abxy + abxy - a^2b^2$$

$$= x^2y^2 - a^2b^2$$

$$(ii) (2abc - 3xy) \cdot (2abc + 3xy)$$

$$= 2abc \cdot (2abc - 3xy) + 3xy \cdot (2abc - 3xy)$$

$$= 4a^2b^2c^2 - 6abcxy + 6abcxy - 9x^2y^2$$

$$= 4a^2b^2c^2 - 9x^2y^2$$

$$(iii) (a + b - c) \cdot (2a - 3b)$$

$$= 2a \cdot (a + b - c) - 3b \cdot (a + b - c)$$

$$= 2a^2 + 2ab - 2ac - 3ab - 3b^2 + 3bc$$

$$= 2a^2 - ab - 2ac - 3b^2 + 3bc$$

$$= 2a^2 - ab - 2ac + 3bc - 3b^2$$

$$(iv) (5x - 6y - 7z) \cdot (2x + 3y)$$

$$= 2x \cdot (5x - 6y - 7z) + 3y \cdot (5x - 6y - 7z)$$

$$= 10x^2 - 12xy - 14xz + 15xy - 18y^2 - 21yz$$

$$= 10x^2 + 3xy - 14xz - 18y^2 - 21yz$$

$$(v) (5x - 6y - 7z) \cdot (2x + 3y + z)$$

$$= 2x \cdot (5x - 6y - 7z) + 3y \cdot (5x - 6y - 7z)$$

$$+ z \cdot (5x - 6y - 7z)$$

$$= 10x^2 - 12xy - 14xz + 15xy - 18y^2$$

$$- 21yz + 5xz - 6yz - 7z^2$$

$$= 10x^2 - 12xy + 15xy - 14xz + 5xz$$

$$- 18y^2 - 21yz - 6yz - 7z^2$$

$$= 10x^2 + 3xy - 9xz - 18y^2 - 27yz - 7z^2$$

$$(vi) (2a + 3b - 4c) \cdot (a - b - c)$$

$$= a \cdot (2a + 3b - 4c) - b \cdot (2a + 3b - 4c)$$

$$- c \cdot (2a + 3b - 4c)$$

$$= 2a^2 + 3ab - 4ac - 2ab - 3b^2 + 4bc$$

$$- 2ac - 3bc + 4c^2$$

$$= 2a^2 + 3ab - 2ab - 4ac - 2ac - 3b^2$$

$$+ 4bc - 3bc + 4c^2$$

$$= 2a^2 + ab - 6ac - 3b^2 + bc + 4c^2$$

EXERCISE 19(D)

Question 1.

Divide :

- (i) $3a$ by a
- (ii) $15x$ by $3x$
- (iii) $16m$ by 4
- (iv) $20x^2$ by $5x$
- (v) $30p^2$ by $10p^2$
- (vi) $14a^3b^3$ by $2a^2$
- (vii) $18pqr^2$ by $3pq$
- (viii) 100 by $50b$

Solution:

$$(i) 3a \div a = \frac{3 \times a}{a} = 3$$

$$(ii) 15x \div 3x = \frac{3 \times 5 \times x}{3 \times x} = 5$$

$$(iii) 16m \div 4 = \frac{4 \times 4 \times m}{4} = 4m$$

$$(iv) 20x^2 \div 5x = \frac{4 \times 5 \times x^{2-1}}{5} = 4x$$

$$(v) 30p^2 \div 10p^2 = \frac{3 \times 10p^2}{10p^2} = 3$$

$$(vi) 14a^3b^3 \div 2a^2 = \frac{2 \times 7a^{3-2}b^3}{2} = 7ab^3$$

$$(vii) 18pqr^2 \div 3pq = \frac{3 \times 6 \cdot p \times q \times r^2}{3 \times p \times q} = 6r^2$$

$$(viii) 100 \div 50b = \frac{2 \times 50}{50 \times b} = \frac{2}{b}$$

Question 2.

Simplify :

- (i) $2x^5 \div x^2$
- (ii) $6a^8 \div 3a^3$
- (iii) $20xy \div -5xy$
- (iv) $-24a^2b^2c^2 \div 6ab$
- (v) $-5x^2y \div xy^2$
- (vi) $40p^3q^4r^5 \div 10p^3q$
- (vii) $-64x^4y^3z \div 4x^3y^2z$
- (viii) $35xy^5 \div 7x^2y^4$

Solution:

$$(i) 2x^5 \div x^2 = \frac{2x^5}{x^2}$$

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

$$(ii) 6a^8 \div 3a^3 = \frac{2 \times 3 \times a^{8-3}}{3} = 2a^5$$

$$(iii) 20xy \div -5xy = \frac{4 \times 5 \times x \times y}{-5 \times x \times y} = -4$$

$$(iv) -24a^2b^2c^2 \div 6ab$$

$$= \frac{-4 \times 6 \times a^{2-1}b^{2-1}c^2}{6} = -4abc^2$$

$$(v) -5x^2y \div xy^2 = \frac{-5x^{2-1}}{y^{2-1}} = -\frac{5x}{y}$$

$$(vi) 40p^3q^4r^5 \div 10p^3q$$

$$= \frac{4 \times 10 \times p^{3-3} \cdot q^{4-1} \cdot r^5}{10}$$

$$= 4 \times q^{4-1} \times r^5 = 4q^3r^5$$

$$(vii) -64x^4y^3z \div 4x^3y^2z$$

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

$$= -16x^{4-3}y^{3-2} = -16xy$$

$$(viii) 35xy^5 \div 7x^2y^4$$

$$= \frac{5 \times 7 \times y^{5-4}}{7 \times x^{2-1}} = \frac{5y}{x}$$

Question 3.

Divide :

$$(i) -\frac{3m}{4} \text{ by } 2m$$

$$(ii) -15p^6q^8 \text{ by } -5p^6q^7$$

$$(iii) -21m^5n^7 \text{ by } 14m^2n^2$$

$$(iv) 36a^4x^5y^6 \text{ by } 4x^2a^3y^2$$

$$(v) 20x^3a^6 \text{ by } 5xy$$

$$(vi) \frac{28a^2b^3}{c^2} \text{ by } 4abc$$

$$(vii) \frac{2a^2}{9b^2} \text{ by } \frac{3b}{2a}$$

$$(viii) \frac{-5 \cdot 5x^2}{y} \text{ by } \frac{11x}{y}$$

$$(ix) \frac{64x^2y^2}{z^2} \text{ by } \frac{8xy}{z}$$

Solution:

$$(i) -\frac{3m}{4} \div 2m = \frac{-3 \times m}{4 \times 2 \times m} = -\frac{3}{8}$$

$$(ii) -15p^6q^8 \div -5p^6q^7 = \frac{-5 \times 3 \times p^6 \times q^8}{-5 \times p^6 \times q^7} \\ = 3q^{8-7} = 3q$$

$$(iii) -21m^5n^7 \div 14m^2n^2$$

$$= \frac{-3 \times 7 \times m^{5-2}n^{7-2}}{14} = -\frac{3}{2}m^3n^5$$

$$(iv) 36a^4x^5y^6 \div 4x^2a^3y^2$$

$$= \frac{4 \times 9a^{4-3} \times x^{5-2} \times y^{6-2}}{4} = 9ax^3y^4$$

$$(v) 20x^3a^6 \div 5xy = \frac{4 \times 5x^3a^6}{5xy}$$

$$= \frac{4 \times 5 \times x^{3-1} \times a^6}{5xy} = \frac{4x^2a^6}{y}$$

$$(vi) \frac{28a^2b^3}{c^2} \div 4abc$$

$$= \frac{4 \times 7 \times a^{2-1} \times b^{3-1}}{4 \times c^{2+1}} = \frac{7ab^2}{c^3}$$

$$(vii) \frac{2a^2}{9b^2} \div \frac{3b}{2a} = \frac{2a^2}{9b^2} \times \frac{2a}{3b}$$

$$= \frac{2 \times 2 \times a^{2+1}}{9 \times 3b^{2+1}} = \frac{4a^3}{27b^3}$$

$$(viii) \frac{-5 \cdot 5x^2}{y} \div \frac{11x}{y} = \frac{-55x^2}{10y} \times \frac{y}{11x}$$

$$= -\frac{5x}{10} = -0.5x$$

$$(ix) \frac{64x^2y^2}{z^2} \div \frac{8xy}{z}$$

$$= \frac{8 \times 8 \times x^2 \times y^2}{z^2} \times \frac{z}{8 \times x \times y}$$

$$= \frac{8x^{2-1}y^{2-1}}{z^{2-1}} = \frac{8xy}{z}$$

Question 4.

Simplify :

$$(i) \frac{-15m^5n^2}{-3m^5} \quad (ii) \frac{35x^4y^2}{-15x^2y^2}$$

$$(iii) \frac{-24x^6y^2}{6x^6y}$$

Solution:

$$(i) \frac{-15m^5n^2}{-3m^5} = \frac{-3 \times 5 \times m^5 \times n^2}{-3 \times m^5} = 5n^2$$

$$(ii) \frac{35x^4y^2}{-15x^2y^2} = \frac{-5 \times -7 \times x^4 \times y^2}{3 \times -5 \times x^2 \times y^2}$$

$$= \frac{-7x^{4-2}}{3} = -\frac{7x^2}{3}$$

$$(iii) \frac{-24x^6y^2}{6x^6y} = \frac{-4 \times 6 \times x^6 \times y^2}{6 \times x^6 \times y}$$

$$= -4y^{2-1} = -4y$$

Question 5.

Divide :

- (i) $9x^3 - 6x^2$ by $3x$
(ii) $6m^2 - 16m^3 + 10m^4$ by $-2m$
(iii) $15x^3y^2 + 25x^2y^3 - 36x^4y^4$ by $5x^2y^2$
(iv) $36a^3x^5 - 24a^4x^4 + 18a^5x^3$ by $-6a^3x^3$.

Solution:

$$(i) \ 9x^3 - 6x^2 \text{ by } 3x$$

$$= \frac{9x^3 - 6x^2}{3x} = \frac{9x^3}{3x} - \frac{6x^2}{3x}$$

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

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

$$(ii) \ 6m^2 - 16m^3 + 10m^4 \text{ by } -2m$$

$$= \frac{6m^2 - 16m^3 + 10m^4}{-2m}$$

$$= \frac{6m^2}{-2m} - \frac{16m^3}{-2m} + \frac{10m^4}{-2m}$$

$$= -3m^{2-1} + 8m^{3-1} - 5m^{4-1}$$

$$= -3m + 8m^2 - 5m^3$$

$$(iii) \ 15x^3y^2 + 25x^2y^3 - 36x^4y^4 \text{ by } 5x^2y^2$$

$$= \frac{15x^3y^2 + 25x^2y^3 - 36x^4y^4}{5x^2y^2}$$

$$= \frac{15x^3y^2}{5x^2y^2} + \frac{25x^2y^3}{5x^2y^2} - \frac{36x^4y^4}{5x^2y^2}$$

$$= 3x^{3-2}y^{2-2} + 5x^{2-2}y^{3-2} \\ - \frac{36}{5}x^{4-2}y^{4-2}$$

$$= 3x^1y^0 + 5x^0y^1 - \frac{36}{5}x^2y^2$$

$$= 3x + 5y - \frac{36}{5}x^2y^2 \quad (\because x^0 \text{ or } y^0 = 1)$$

(iv) $36a^3x^5 - 24a^4x^4 + 18a^5x^3$ by $-6a^3x^3$

$$= \frac{36a^3x^5 - 24a^4x^4 + 18a^5x^3}{-6a^3x^3}$$

$$= \frac{36a^3x^5}{-6a^3x^3} - \frac{24a^4x^4}{-6a^3x^3} + \frac{18a^5x^3}{-6a^3x^3}$$

$$= -6a^{3-3}x^{5-3} + 4a^{4-3}x^{4-3} - 3a^{5-3}x^{3-3}$$

$$= -6a^0x^2 + 4a^1x^2 - 3a^2x^0$$

$$= -6x^2 + 4ax - 3a^2 \quad (\because x^0 \text{ or } y^0 = 1)$$