



Exercise 9.1

Question 1:

Identify the terms, their coefficients for each of the following expressions.

(i) $5xyz^2 - 3zy$

(ii) $1 + x + x^2$

(iii) $4x^2y^2 - 4x^2y^2z^2 + z^2$

(iv) $3 - pq + qr - rp$

(v) $\frac{x}{2} + \frac{y}{2} - xy$

(vi) $0.3a - 0.6ab + 0.5b$

Answer:

The terms and the respective coefficients of the given expressions are as follows.

-	Terms	Coefficients
(i)	$5xyz^2$ $- 3zy$	5 -3
(ii)	1 x x^2	1 1 1
(iii)	$4x^2y^2$ $- 4x^2y^2z^2$ z^2	4 -4 1
(iv)	3 $- pq$ qr $- rp$	3 -1 1 -1



(v)	$-xy$	-1
(vi)	$0.3a$ $-0.6ab$ $0.5b$	0.3 -0.6 0.5

Question 2:

Classify the following polynomials as monomials, binomials, trinomials. Which polynomials do not fit in any of these three categories?

$x + y$, 1000 , $x + x_2 + x_3 + x_4$, $7 + y + 5x$, $2y - 3y_2$, $2y - 3y_2 + 4y_3$, $5x - 4y + 3xy$, $4z - 15z_2$, $ab + bc + cd + da$, pqr , $p_2q + pq_2$, $2p + 2q$

Answer:

The given expressions are classified as

Monomials: 1000 , pqr

Binomials: $x + y$, $2y - 3y_2$, $4z - 15z_2$, $p_2q + pq_2$, $2p + 2q$

Trinomials: $7 + y + 5x$, $2y - 3y_2 + 4y_3$, $5x - 4y + 3xy$

Polynomials that do not fit in any of these categories are

$x + x_2 + x_3 + x_4$, $ab + bc + cd + da$

Question 3:

Add the following.

(i) $ab - bc$, $bc - ca$, $ca - ab$

(ii) $a - b + ab$, $b - c + bc$, $c - a + ac$

(iii) $2p_2q_2 - 3pq + 4$, $5 + 7pq - 3p_2q_2$

(iv) $l_2 + m_2$, $m_2 + n_2$, $n_2 + l_2$, $2lm + 2mn + 2nl$

**Answer:**

The given expressions written in separate rows, with like terms one below the other and then the addition of these expressions are as follows.

(i)

$$\begin{array}{r} ab - bc \\ + \quad bc - ca \\ + \quad -ab \quad + ca \\ \hline 0 \end{array}$$

Thus, the sum of the given expressions is 0.

(ii)

$$\begin{array}{r} a - b + ab \\ + \quad b \quad - c + bc \\ + \quad -a \quad c \quad + ac \\ \hline ab + bc + ac \end{array}$$

Thus, the sum of the given expressions is $ab + bc + ac$.

(iii)

$$\begin{array}{r} 2p^2q^2 - 3pq + 4 \\ + \quad -3p^2q^2 + 7pq + 5 \\ \hline -p^2q^2 + 4pq + 9 \end{array}$$

Thus, the sum of the given expressions is $-p^2q^2 + 4pq + 9$.

(iv)

$$\begin{array}{r} l^2 + m^2 \\ + \quad m^2 + n^2 \\ + \quad l^2 \quad + n^2 \\ + \quad 2lm + 2mn + 2nl \\ \hline 2l^2 + 2m^2 + 2n^2 + 2lm + 2mn + 2nl \end{array}$$

Thus, the sum of the given expressions is $2(l^2 + m^2 + n^2 + lm + mn + nl)$.

Question 4:



(a) Subtract $4a - 7ab + 3b + 12$ from $12a - 9ab + 5b - 3$

(b) Subtract $3xy + 5yz - 7zx$ from $5xy - 2yz - 2zx + 10xyz$

(c) Subtract $4p^2q - 3pq + 5pq^2 - 8p + 7q - 10$ from $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$

Answer:

The given expressions in separate rows, with like terms one below the other and then the subtraction of these expressions is as follows.

(a)

$$\begin{array}{r} 12a - 9ab + 5b - 3 \\ 4a - 7ab + 3b + 12 \\ (-) \quad (+) \quad (-) \quad (-) \\ \hline 8a - 2ab + 2b - 15 \end{array}$$

(b)

$$\begin{array}{r} 5xy - 2yz - 2zx + 10xyz \\ 3xy + 5yz - 7zx \\ (-) \quad (-) \quad (+) \\ \hline 2xy - 7yz + 5zx + 10xyz \end{array}$$

(c)

$$\begin{array}{r} 18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q \\ -10 - 8p + 7q - 3pq + 5pq^2 + 4p^2q \\ (+) \quad (+) \quad (-) \quad (+) \quad (-) \quad (-) \\ \hline 28 + 5p - 18q + 8pq - 7pq^2 + p^2q \end{array}$$



Exercise 9.2

Question 1:

Find the product of the following pairs of monomials.

(i) $4, 7p$ (ii) $-4p, 7p$ (iii) $-4p, 7pq$

(iv) $4p^3, -3p$ (v) $4p, 0$

Answer:

The product will be as follows.

(i) $4 \times 7p = 4 \times 7 \times p = 28p$

(ii) $-4p \times 7p = -4 \times p \times 7 \times p = (-4 \times 7) \times (p \times p) = -28p^2$

(iii) $-4p \times 7pq = -4 \times p \times 7 \times p \times q = (-4 \times 7) \times (p \times p \times q) = -28p^2q$

(iv) $4p^3 \times -3p = 4 \times (-3) \times p \times p \times p \times p = -12p^4$

(v) $4p \times 0 = 4 \times p \times 0 = 0$

Question 2:

Find the areas of rectangles with the following pairs of monomials as their lengths and breadths respectively.

$(p, q); (10m, 5n); (20x^2, 5y^2); (4x, 3x^2); (3mn, 4np)$

Answer:

We know that,

Area of rectangle = Length $\times$ Breadth

Area of 1st rectangle = $p \times q = pq$

Area of 2nd rectangle = $10m \times 5n = 10 \times 5 \times m \times n = 50mn$

Area of 3rd rectangle = $20x^2 \times 5y^2 = 20 \times 5 \times x^2 \times y^2 = 100x^2y^2$

Area of 4th rectangle = $4x \times 3x^2 = 4 \times 3 \times x \times x^2 = 12x^3$

Area of 5th rectangle = $3mn \times 4np = 3 \times 4 \times m \times n \times n \times p = 12mn^2p$

Question 3:

Complete the table of products.

First monomial $\rightarrow$	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
Second monomial $\downarrow$						



$2x$	$4x^2$	...	...	...	...	...
$-5y$	...	...	$-15x^2y$	...	...	...
$3x^2$	...	...	...	...	...	...
$-4xy$	...	...	...	...	...	...
$7x^2y$	...	...	...	...	...	...
$-9x^2y^2$	...	...	...	...	...	...

Answer:

The table can be completed as follows.

	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
$2x$	$4x^2$	$-10xy$	$6x^3$	$-8x^2y$	$14x^3y$	$-18x^3y^2$
$-5y$	$-10xy$	$25y^2$	$-15x^2y$	$20xy^2$	$-35x^2y^2$	$45x^2y^3$
$3x^2$	$6x^3$	$-15x^2y$	$9x^4$	$-12x^3y$	$21x^4y$	$-27x^4y^2$
$-4xy$	$-8x^2y$	$20xy^2$	$-12x^3y$	$16x^2y^2$	$-28x^3y^2$	$36x^3y^3$
$7x^2y$	$14x^3y$	$-35x^2y^2$	$21x^4y$	$-28x^3y^2$	$49x^4y^2$	$-63x^4y^3$
$-9x^2y^2$	$-18x^3y^2$	$45x^2y^3$	$-27x^4y^2$	$36x^3y^3$	$-63x^4y^3$	$81x^4y^4$

Question 4:

Obtain the volume of rectangular boxes with the following length, breadth and height respectively.

(i) $5a$, $3a^2$, $7a^4$ (ii) $2p$, $4q$, $8r$ (iii) xy , $2x^2y$, $2xy^2$



(iv) $a, 2b, 3c$

Answer:

We know that,

Volume = Length $\times$ Breadth $\times$ Height

(i) Volume = $5a \times 3a^2 \times 7a^4 = 5 \times 3 \times 7 \times a \times a^2 \times a^4 = 105 a^7$

(ii) Volume = $2p \times 4q \times 8r = 2 \times 4 \times 8 \times p \times q \times r = 64pqr$

(iii) Volume = $xy \times 2x^2y \times 2xy^2 = 2 \times 2 \times xy \times x^2y \times xy^2 = 4x^4y^4$

(iv) Volume = $a \times 2b \times 3c = 2 \times 3 \times a \times b \times c = 6abc$

Question 5:

Obtain the product of

(i) xy, yz, zx (ii) $a, -a^2, a^3$ (iii) $2, 4y, 8y^2, 16y^3$

(iv) $a, 2b, 3c, 6abc$ (v) $m, -mn, mnp$

Answer:

(i) $xy \times yz \times zx = x^2y^2z^2$

(ii) $a \times (-a^2) \times a^3 = -a^6$

(iii) $2 \times 4y \times 8y^2 \times 16y^3 = 2 \times 4 \times 8 \times 16 \times y \times y^2 \times y^3 = 1024 y^6$

(iv) $a \times 2b \times 3c \times 6abc = 2 \times 3 \times 6 \times a \times b \times c \times abc = 36a^2b^2c^2$

(v) $m \times (-mn) \times mnp = -m^3n^2p$



Exercise 9.3

Question 1:

Carry out the multiplication of the expressions in each of the following pairs.

(i) $4p, q + r$ (ii) $ab, a - b$ (iii) $a + b, 7a_2b_2$

(iv) $a_2 - 9, 4a$ (v) $pq + qr + rp, 0$

Answer:

(i) $(4p) \times (q + r) = (4p \times q) + (4p \times r) = 4pq + 4pr$

(ii) $(ab) \times (a - b) = (ab \times a) + [ab \times (-b)] = a_2b - ab_2$

(iii) $(a + b) \times (7a_2b_2) = (a \times 7a_2b_2) + (b \times 7a_2b_2) = 7a_3b_2 + 7a_2b_3$

(iv) $(a_2 - 9) \times (4a) = (a_2 \times 4a) + (-9) \times (4a) = 4a_3 - 36a$

(v) $(pq + qr + rp) \times 0 = (pq \times 0) + (qr \times 0) + (rp \times 0) = 0$

Question 2:

Complete the table

---	First expression	Second Expression	Product
(i)	a	$b + c + d$	-
(ii)	$x + y - 5$	$5xy$	-
(iii)	p	$6p^2 - 7p + 5$	-
(iv)	$4p^2q^2$	$p^2 - q^2$	-
(v)	$a + b + c$	abc	-

Answer:

The table can be completed as follows.

-	First expression	Second Expression	Product
(i)	a	$b + c + d$	$ab + ac + ad$
(ii)	$x + y - 5$	$5xy$	$5x^2y + 5^2xy - 25xy$



(iii)	p	$6p^2 - 7p + 5$	$6p^3 - 7p^2 + 5p$
(iv)	$4p^2q^2$	$p^2 - q^2$	$4p^4q^2 - 4p^2q^4$
(v)	$a + b + c$	abc	$a^2bc + ab^2c^2 + abc^3$

Question 3:

Find the product.

(i) $(a_2) \times (2a_{22}) \times (4a_{26})$

(ii) $\left(\frac{2}{3}xy\right) \times \left(\frac{-9}{10}x^2y^2\right)$

(iii) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right)$

(iv) $x \times x_2 \times x_3 \times x_4$

Answer:

(i) $(a_2) \times (2a_{22}) \times (4a_{26}) = 2 \times 4 \times a_2 \times a_{22} \times a_{26} = 8a_{50}$

(ii) $\left(\frac{2}{3}xy\right) \times \left(\frac{-9}{10}x^2y^2\right) = \left(\frac{2}{3}\right) \times \left(\frac{-9}{10}\right) \times x \times y \times x^2 \times y^2 = \frac{-3}{5}x^3y^3$

(iii) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right) = \left(-\frac{10}{3}\right) \times \left(\frac{6}{5}\right) \times pq^3 \times p^3q = -4p^4q^4$

(iv) $x \times x_2 \times x_3 \times x_4 = x_{10}$

Question 4:

(a) Simplify $3x(4x - 5) + 3$ and find its values for (i) $x = 3$, (ii)

$$x = \frac{1}{2}$$

(b) $a(a^2 + a + 1) + 5$ and find its values for (i) $a = 0$, (ii) $a = 1$, (iii) $a = -1$.

Answer:

(a) $3x(4x - 5) + 3 = 12x^2 - 15x + 3$

(i) For $x = 3$, $12x^2 - 15x + 3 = 12(3)^2 - 15(3) + 3$

$= 108 - 45 + 3$

$= 66$



$$(ii) \text{ For } x = \frac{1}{2}, 12x^2 - 15x + 3 = 12\left(\frac{1}{2}\right)^2 - 15\left(\frac{1}{2}\right) + 3$$

$$\begin{aligned} &= 12 \times \frac{1}{4} - \frac{15}{2} + 3 \\ &= 3 - \frac{15}{2} + 3 = 6 - \frac{15}{2} \\ &= \frac{12-15}{2} = \frac{-3}{2} \end{aligned}$$

$$(b) a(a_2 + a + 1) + 5 = a_3 + a_2 + a + 5$$

$$(i) \text{ For } a = 0, a_3 + a_2 + a + 5 = 0 + 0 + 0 + 5 = 5$$

$$\begin{aligned} (ii) \text{ For } a = 1, a_3 + a_2 + a + 5 &= (1)_3 + (1)_2 + 1 + 5 \\ &= 1+1+1+5=8 \end{aligned}$$

$$\begin{aligned} (iii) \text{ For } a = -1, a_3 + a_2 + a + 5 &= (-1)_3 + (-1)_2 + (-1) + 5 \\ &= -1+1-1+5=4 \end{aligned}$$

Question 5:

$$(a) \text{ Add: } p(p - q), q(q - r) \text{ and } r(r - p)$$

$$(b) \text{ Add: } 2x(z - x - y) \text{ and } 2y(z - y - x)$$

$$(c) \text{ Subtract: } 3l(l - 4m + 5n) \text{ from } 4l(10n - 3m + 2l)$$

$$(d) \text{ Subtract: } 3a(a + b + c) - 2b(a - b + c) \text{ from } 4c(-a + b + c)$$

Answer:

$$(a) \text{ First expression} = p(p - q) = p^2 - pq$$

$$\text{Second expression} = q(q - r) = q^2 - qr$$

$$\text{Third expression} = r(r - p) = r^2 - pr$$

Adding the three expressions, we obtain

$$\begin{array}{r} p^2 - pq \\ + \quad \quad \quad q^2 - qr \\ + \quad \quad \quad \quad \quad r^2 - pr \\ \hline p^2 - pq + q^2 - qr + r^2 - pr \end{array}$$

Therefore, the sum of the given expressions is $p^2 + q^2 + r^2 - pq - qr - pr$.



(b) First expression = $2x(z - x - y) = 2xz - 2x^2 - 2xy$

Second expression = $2y(z - y - x) = 2yz - 2y^2 - 2yx$

Adding the two expressions, we obtain

$$\begin{array}{r} 2xz - 2x^2 - 2xy \\ + \quad \quad - 2yx + 2yz - 2y^2 \\ \hline 2xz - 2x^2 - 4xy + 2yz - 2y^2 \end{array}$$

Therefore, the sum of the given expressions is $-2x^2 - 2y^2 - 4xy + 2yz + 2zx$.

(c) $3l(l - 4m + 5n) = 3l^2 - 12lm + 15ln$

$4l(10n - 3m + 2l) = 40ln - 12lm + 8l^2$

Subtracting these expressions, we obtain

$$\begin{array}{r} 40ln - 12lm + 8l^2 \\ 15ln - 12lm + 3l^2 \\ (-) \quad (+) \quad (-) \\ \hline +25ln \quad \quad +5l^2 \end{array}$$

Therefore, the result is $5l^2 + 25ln$.

(d) $3a(a + b + c) - 2b(a - b + c) = 3a^2 + 3ab + 3ac - 2ba + 2b^2 - 2bc$

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

$4c(-a + b + c) = -4ac + 4bc + 4c^2$

Subtracting these expressions, we obtain

$$\begin{array}{r} -4ac + 4bc + 4c^2 \\ 3ac - 2bc \quad \quad + 3a^2 + 2b^2 + ab \\ (-) \quad (+) \quad \quad (-) \quad (-) \quad (-) \\ \hline -7ac + 6bc + 4c^2 - 3a^2 - 2b^2 - ab \end{array}$$

Therefore, the result is $-3a^2 - 2b^2 + 4c^2 - ab + 6bc - 7ac$.



Exercise 9.4

Question 1:

Multiply the binomials.

(i) $(2x + 5)$ and $(4x - 3)$ (ii) $(y - 8)$ and $(3y - 4)$

(iii) $(2.5l - 0.5m)$ and $(2.5l + 0.5m)$ (iv) $(a + 3b)$ and $(x + 5)$

(v) $(2pq + 3q^2)$ and $(3pq - 2q^2)$

(vi) $\left(\frac{3}{4}a^2 + 3b^2\right)$ and $4\left(a^2 - \frac{2}{3}b^2\right)$

Answer:

(i) $(2x + 5) \times (4x - 3) = 2x \times (4x - 3) + 5 \times (4x - 3)$

$$= 8x^2 - 6x + 20x - 15$$

$$= 8x^2 + 14x - 15 \text{ (By adding like terms)}$$

(ii) $(y - 8) \times (3y - 4) = y \times (3y - 4) - 8 \times (3y - 4)$

$$= 3y^2 - 4y - 24y + 32$$

$$= 3y^2 - 28y + 32 \text{ (By adding like terms)}$$

(iii) $(2.5l - 0.5m) \times (2.5l + 0.5m) = 2.5l \times (2.5l + 0.5m) - 0.5m (2.5l + 0.5m)$

$$= 6.25l^2 + 1.25lm - 1.25lm - 0.25m^2$$

$$= 6.25l^2 - 0.25m^2$$

(iv) $(a + 3b) \times (x + 5) = a \times (x + 5) + 3b \times (x + 5)$

$$= ax + 5a + 3bx + 15b$$

(v) $(2pq + 3q^2) \times (3pq - 2q^2) = 2pq \times (3pq - 2q^2) + 3q^2 \times (3pq - 2q^2)$

$$= 6p^2q^2 - 4pq^3 + 9pq^3 - 6q^4$$

$$= 6p^2q^2 + 5pq^3 - 6q^4$$

(vi) $\left(\frac{3}{4}a^2 + 3b^2\right) \times \left[4\left(a^2 - \frac{2}{3}b^2\right)\right] = \left(\frac{3}{4}a^2 + 3b^2\right) \times \left(4a^2 - \frac{8}{3}b^2\right)$

$$= \frac{3}{4}a^2 \times \left(4a^2 - \frac{8}{3}b^2\right) + 3b^2 \times \left(4a^2 - \frac{8}{3}b^2\right)$$

$$= 3a^4 - 2a^2b^2 + 12b^2a^2 - 8b^4$$

$$= 3a^4 + 10a^2b^2 - 8b^4$$

**Question 2:**

Find the product.

(i) $(5 - 2x)(3 + x)$ (ii) $(x + 7y)(7x - y)$

(iii) $(a_2 + b)(a + b_2)$ (iv) $(p_2 - q_2)(2p + q)$

Answer:

(i) $(5 - 2x)(3 + x) = 5(3 + x) - 2x(3 + x)$

$$= 15 + 5x - 6x - 2x^2$$

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

(ii) $(x + 7y)(7x - y) = x(7x - y) + 7y(7x - y)$

$$= 7x^2 - xy + 49xy - 7y^2$$

$$= 7x^2 + 48xy - 7y^2$$

(iii) $(a_2 + b)(a + b_2) = a_2(a + b_2) + b(a + b_2)$

$$= a_3 + a_2b_2 + ab + b_3$$

(iv) $(p_2 - q_2)(2p + q) = p_2(2p + q) - q_2(2p + q)$

$$= 2p_3 + p_2q - 2pq_2 - q_3$$

Question 3:

Simplify.

(i) $(x_2 - 5)(x + 5) + 25$

(ii) $(a_2 + 5)(b_3 + 3) + 5$

(iii) $(t + s_2)(t_2 - s)$

(iv) $(a + b)(c - d) + (a - b)(c + d) + 2(ac + bd)$

(v) $(x + y)(2x + y) + (x + 2y)(x - y)$

(vi) $(x + y)(x_2 - xy + y_2)$

(vii) $(1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y$

(viii) $(a + b + c)(a + b - c)$

Answer:

(i) $(x_2 - 5)(x + 5) + 25$

$$= x_2(x + 5) - 5(x + 5) + 25$$

$$= x_3 + 5x_2 - 5x - 25 + 25$$

$$= x_3 + 5x_2 - 5x$$



$$\begin{aligned} & \text{(ii)} (a_2 + 5) (b_3 + 3) + 5 \\ &= a_2 (b_3 + 3) + 5 (b_3 + 3) + 5 \\ &= a_2 b_3 + 3a_2 + 5b_3 + 15 + 5 \\ &= a_2 b_3 + 3a_2 + 5b_3 + 20 \end{aligned}$$

$$\begin{aligned} & \text{(iii)} (t + s_2) (t_2 - s) \\ &= t (t_2 - s) + s_2 (t_2 - s) \\ &= t_3 - st + s_2 t_2 - s_3 \end{aligned}$$

$$\begin{aligned} & \text{(iv)} (a + b) (c - d) + (a - b) (c + d) + 2 (ac + bd) \\ &= a (c - d) + b (c - d) + a (c + d) - b (c + d) + 2 (ac + bd) \\ &= ac - ad + bc - bd + ac + ad - bc - bd + 2ac + 2bd \\ &= (ac + ac + 2ac) + (ad - ad) + (bc - bc) + (2bd - bd - bd) \\ &= 4ac \end{aligned}$$

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

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

$$\begin{aligned} & \text{(vii)} (1.5x - 4y) (1.5x + 4y + 3) - 4.5x + 12y \\ &= 1.5x (1.5x + 4y + 3) - 4y (1.5x + 4y + 3) - 4.5x + 12y \\ &= 2.25x^2 + 6xy + 4.5x - 6xy - 16y^2 - 12y - 4.5x + 12y \\ &= 2.25x^2 + (6xy - 6xy) + (4.5x - 4.5x) - 16y^2 + (12y - 12y) \\ &= 2.25x^2 - 16y^2 \end{aligned}$$

$$\begin{aligned} & \text{(viii)} (a + b + c) (a + b - c) \\ &= a (a + b - c) + b (a + b - c) + c (a + b - c) \\ &= a^2 + ab - ac + ab + b^2 - bc + ca + bc - c^2 \end{aligned}$$



$$\begin{aligned} &= a^2 + b^2 - c^2 + (ab + ab) + (bc - bc) + (ca - ca) \\ &= a^2 + b^2 - c^2 + 2ab \end{aligned}$$



Exercise 9.5

Question 1:

Use a suitable identity to get each of the following products.

(i) $(x + 3)(x + 3)$ (ii) $(2y + 5)(2y + 5)$

(iii) $(2a - 7)(2a - 7)$ (iv) $\left(3a - \frac{1}{2}\right)\left(3a - \frac{1}{2}\right)$

(v) $(1.1m - 0.4)(1.1m + 0.4)$ (vi) $(a_2 + b_2)(-a_2 + b_2)$

(vii) $(6x - 7)(6x + 7)$ (viii) $(-a + c)(-a + c)$

(ix) $\left(\frac{x}{2} + \frac{3y}{4}\right)\left(\frac{x}{2} + \frac{3y}{4}\right)$ (x) $(7a - 9b)(7a - 9b)$

Answer:

The products will be as follows.

$$\begin{aligned} \text{(i)} \quad (x + 3)(x + 3) &= (x + 3)^2 \\ &= (x)^2 + 2(x)(3) + (3)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2] \\ &= x^2 + 6x + 9 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (2y + 5)(2y + 5) &= (2y + 5)^2 \\ &= (2y)^2 + 2(2y)(5) + (5)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2] \\ &= 4y^2 + 20y + 25 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (2a - 7)(2a - 7) &= (2a - 7)^2 \\ &= (2a)^2 - 2(2a)(7) + (7)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2] \\ &= 4a^2 - 28a + 49 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad \left(3a - \frac{1}{2}\right)\left(3a - \frac{1}{2}\right) &= \left(3a - \frac{1}{2}\right)^2 \\ &= (3a)^2 - 2(3a)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2] \\ &= 9a^2 - 3a + \frac{1}{4} \end{aligned}$$

(v) $(1.1m - 0.4)(1.1m + 0.4)$



$$= (1.1m)^2 - (0.4)^2 [(a + b)(a - b) = a^2 - b^2]$$

$$= 1.21m^2 - 0.16$$

$$(vi) (a_2 + b_2)(-a_2 + b_2) = (b_2 + a_2)(b_2 - a_2)$$

$$= (b_2)^2 - (a_2)^2 [(a + b)(a - b) = a^2 - b^2]$$

$$= b_4 - a_4$$

$$(vii) (6x - 7)(6x + 7) = (6x)^2 - (7)^2 [(a + b)(a - b) = a^2 - b^2]$$

$$= 36x^2 - 49$$

$$(viii) (-a + c)(-a + c) = (-a + c)^2$$

$$= (-a)^2 + 2(-a)(c) + (c)^2 [(a + b)^2 = a^2 + 2ab + b^2]$$

$$= a^2 - 2ac + c^2$$

$$(ix) \left(\frac{x}{2} + \frac{3y}{4}\right)\left(\frac{x}{2} + \frac{3y}{4}\right) = \left(\frac{x}{2} + \frac{3y}{4}\right)^2$$

$$= \left(\frac{x}{2}\right)^2 + 2\left(\frac{x}{2}\right)\left(\frac{3y}{4}\right) + \left(\frac{3y}{4}\right)^2 [(a + b)^2 = a^2 + 2ab + b^2]$$

$$= \frac{x^2}{4} + \frac{3xy}{4} + \frac{9y^2}{16}$$

$$(x) (7a - 9b)(7a - 9b) = (7a - 9b)^2$$

$$= (7a)^2 - 2(7a)(9b) + (9b)^2 [(a - b)^2 = a^2 - 2ab + b^2]$$

$$= 49a^2 - 126ab + 81b^2$$

Question 2:

Use the identity $(x + a)(x + b) = x^2 + (a + b)x + ab$ to find the following products.

$$(i) (x + 3)(x + 7) \quad (ii) (4x + 5)(4x + 1)$$

$$(iii) (4x - 5)(4x - 1) \quad (iv) (4x + 5)(4x - 1)$$

$$(v) (2x + 5y)(2x + 3y) \quad (vi) (2a^2 + 9)(2a^2 + 5)$$

$$(vii) (xyz - 4)(xyz - 2)$$

Answer:

The products will be as follows.

$$(i) (x + 3)(x + 7) = x^2 + (3 + 7)x + (3)(7)$$

$$= x^2 + 10x + 21$$



$$\begin{aligned} \text{(ii)} \quad (4x + 5)(4x + 1) &= (4x)^2 + (5 + 1)(4x) + (5)(1) \\ &= 16x^2 + 24x + 5 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (4x - 5)(4x - 1) &= (4x)^2 + [(-5) + (-1)](4x) + (-5)(-1) \\ &= 16x^2 - 24x + 5 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad (4x + 5)(4x - 1) &= (4x)^2 + [(5) + (-1)](4x) + (5)(-1) \\ &= 16x^2 + 16x - 5 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad (2x + 5y)(2x + 3y) &= (2x)^2 + (5y + 3y)(2x) + (5y)(3y) \\ &= 4x^2 + 16xy + 15y^2 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad (2a^2 + 9)(2a^2 + 5) &= (2a^2)^2 + (9 + 5)(2a^2) + (9)(5) \\ &= 4a^4 + 28a^2 + 45 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad (xyz - 4)(xyz - 2) \\ &= (xyz)^2 + [(-4) + (-2)](xyz) + (-4)(-2) \\ &= x^2y^2z^2 - 6xyz + 8 \end{aligned}$$

Question 3:

Find the following squares by using the identities.

$$\text{(i)} (b - 7)^2 \quad \text{(ii)} (xy + 3z)^2 \quad \text{(iii)} (6x^2 - 5y)^2$$

$$\text{(iv)} \left(\frac{2}{3}m + \frac{3}{2}n\right)^2 \quad \text{(v)} (0.4p - 0.5q)^2 \quad \text{(vi)} (2xy + 5y)^2$$

Answer:

$$\begin{aligned} \text{(i)} \quad (b - 7)^2 &= (b)^2 - 2(b)(7) + (7)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2] \\ &= b^2 - 14b + 49 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (xy + 3z)^2 &= (xy)^2 + 2(xy)(3z) + (3z)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2] \\ &= x^2y^2 + 6xyz + 9z^2 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (6x^2 - 5y)^2 &= (6x^2)^2 - 2(6x^2)(5y) + (5y)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2] \\ &= 36x^4 - 60x^2y + 25y^2 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad \left(\frac{2}{3}m + \frac{3}{2}n\right)^2 &= \left(\frac{2}{3}m\right)^2 + 2\left(\frac{2}{3}m\right)\left(\frac{3}{2}n\right) + \left(\frac{3}{2}n\right)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2] \end{aligned}$$



$$= \frac{4}{9}m^2 + 2mn + \frac{9}{4}n^2$$

$$(v) (0.4p - 0.5q)^2 = (0.4p)^2 - 2(0.4p)(0.5q) + (0.5q)^2$$

$$[(a - b)^2 = a^2 - 2ab + b^2]$$

$$= 0.16p^2 - 0.4pq + 0.25q^2$$

$$(vi) (2xy + 5y)^2 = (2xy)^2 + 2(2xy)(5y) + (5y)^2$$

$$[(a + b)^2 = a^2 + 2ab + b^2]$$

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

Question 4:

Simplify.

$$(i) (a^2 - b^2)^2 \quad (ii) (2x + 5)^2 - (2x - 5)^2$$

$$(iii) (7m - 8n)^2 + (7m + 8n)^2 \quad (iv) (4m + 5n)^2 + (5m + 4n)^2$$

$$(v) (2.5p - 1.5q)^2 - (1.5p - 2.5q)^2$$

$$(vi) (ab + bc)^2 - 2ab^2c \quad (vii) (m^2 - n^2m)^2 + 2m^3n^2$$

Answer:

$$(i) (a^2 - b^2)^2 = (a^2)^2 - 2(a^2)(b^2) + (b^2)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2]$$

$$= a^4 - 2a^2b^2 + b^4$$

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

$$[(a - b)^2 = a^2 - 2ab + b^2]$$

$$[(a + b)^2 = a^2 + 2ab + b^2]$$

$$= 4x^2 + 20x + 25 - [4x^2 - 20x + 25]$$

$$= 4x^2 + 20x + 25 - 4x^2 + 20x - 25 = 40x$$

$$(iii) (7m - 8n)^2 + (7m + 8n)^2$$

$$= (7m)^2 - 2(7m)(8n) + (8n)^2 + (7m)^2 + 2(7m)(8n) + (8n)^2$$

$$[(a - b)^2 = a^2 - 2ab + b^2 \text{ and } (a + b)^2 = a^2 + 2ab + b^2]$$

$$= 49m^2 - 112mn + 64n^2 + 49m^2 + 112mn + 64n^2$$

$$= 98m^2 + 128n^2$$

$$(iv) (4m + 5n)^2 + (5m + 4n)^2$$

$$= (4m)^2 + 2(4m)(5n) + (5n)^2 + (5m)^2 + 2(5m)(4n) + (4n)^2$$

$$[(a + b)^2 = a^2 + 2ab + b^2]$$



$$= 16m_2 + 40mn + 25n_2 + 25m_2 + 40mn + 16n_2$$

$$= 41m_2 + 80mn + 41n_2$$

$$(v) (2.5p - 1.5q)_2 - (1.5p - 2.5q)_2$$

$$= (2.5p)_2 - 2(2.5p)(1.5q) + (1.5q)_2 - [(1.5p)_2 - 2(1.5p)(2.5q) + (2.5q)_2]$$

$$[(a - b)_2 = a_2 - 2ab + b_2]$$

$$= 6.25p_2 - 7.5pq + 2.25q_2 - [2.25p_2 - 7.5pq + 6.25q_2]$$

$$= 6.25p_2 - 7.5pq + 2.25q_2 - 2.25p_2 + 7.5pq - 6.25q_2]$$

$$= 4p_2 - 4q_2$$

$$(vi) (ab + bc)_2 - 2ab_2c$$

$$= (ab)_2 + 2(ab)(bc) + (bc)_2 - 2ab_2c [(a + b)_2 = a_2 + 2ab + b_2]$$

$$= a_2b_2 + 2ab_2c + b_2c_2 - 2ab_2c$$

$$= a_2b_2 + b_2c_2$$

$$(vii) (m_2 - n_2m)_2 + 2m_3n_2$$

$$= (m_2)_2 - 2(m_2)(n_2m) + (n_2m)_2 + 2m_3n_2 [(a - b)_2 = a_2 - 2ab + b_2]$$

$$= m_4 - 2m_3n_2 + n_4m_2 + 2m_3n_2$$

$$= m_4 + n_4m_2$$

Question 5:

Show that

$$(i) (3x + 7)_2 - 84x = (3x - 7)_2 \quad (ii) (9p - 5q)_2 + 180pq = (9p + 5q)_2$$

$$(iii) \left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2mn = \frac{16}{9}m^2 + \frac{9}{16}n^2$$

$$(iv) (4pq + 3q)_2 - (4pq - 3q)_2 = 48pq_2$$

$$(v) (a - b)(a + b) + (b - c)(b + c) + (c - a)(c + a) = 0$$

Answer:

$$(i) \text{L.H.S} = (3x + 7)_2 - 84x$$

$$= (3x)_2 + 2(3x)(7) + (7)_2 - 84x$$

$$= 9x_2 + 42x + 49 - 84x$$

$$= 9x_2 - 42x + 49$$

$$\text{R.H.S} = (3x - 7)_2 = (3x)_2 - 2(3x)(7) + (7)_2$$

$$= 9x_2 - 42x + 49$$



$$\text{L.H.S} = \text{R.H.S}$$

$$\begin{aligned} \text{(ii) L.H.S} &= (9p - 5q)^2 + 180pq \\ &= (9p)^2 - 2(9p)(5q) + (5q)^2 + 180pq \\ &= 81p^2 - 90pq + 25q^2 + 180pq \\ &= 81p^2 + 90pq + 25q^2 \end{aligned}$$

$$\begin{aligned} \text{R.H.S} &= (9p + 5q)^2 \\ &= (9p)^2 + 2(9p)(5q) + (5q)^2 \\ &= 81p^2 + 90pq + 25q^2 \end{aligned}$$

$$\text{L.H.S} = \text{R.H.S}$$

$$\begin{aligned} \text{(iii) L.H.S} &= \left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2mn \\ &= \left(\frac{4}{3}m\right)^2 - 2\left(\frac{4}{3}m\right)\left(\frac{3}{4}n\right) + \left(\frac{3}{4}n\right)^2 + 2mn \\ &= \frac{16}{9}m^2 - 2mn + \frac{9}{16}n^2 + 2mn \\ &= \frac{16}{9}m^2 + \frac{9}{16}n^2 = \text{R.H.S.} \end{aligned}$$

$$\begin{aligned} \text{(iv) L.H.S} &= (4pq + 3q)^2 - (4pq - 3q)^2 \\ &= (4pq)^2 + 2(4pq)(3q) + (3q)^2 - [(4pq)^2 - 2(4pq)(3q) + (3q)^2] \\ &= 16p^2q^2 + 24pq^2 + 9q^2 - [16p^2q^2 - 24pq^2 + 9q^2] \\ &= 16p^2q^2 + 24pq^2 + 9q^2 - 16p^2q^2 + 24pq^2 - 9q^2 \\ &= 48pq^2 = \text{R.H.S} \end{aligned}$$

$$\begin{aligned} \text{(v) L.H.S} &= (a - b)(a + b) + (b - c)(b + c) + (c - a)(c + a) \\ &= (a^2 - b^2) + (b^2 - c^2) + (c^2 - a^2) = 0 = \text{R.H.S.} \end{aligned}$$

Question 6:

Using identities, evaluate.

$$\text{(i) } 71^2 \quad \text{(ii) } 99^2 \quad \text{(iii) } 102^2 \quad \text{(iv) } 998^2$$

$$\text{(v) } (5.2)^2 \quad \text{(vi) } 297 \times 303 \quad \text{(vii) } 78 \times 82$$

$$\text{(viii) } 8.9^2 \quad \text{(ix) } 1.05 \times 9.5$$

**Answer:**

$$(i) 71_2 = (70 + 1)_2$$

$$= (70)_2 + 2(70)(1) + (1)_2 [(a + b)_2 = a_2 + 2ab + b_2]$$

$$= 4900 + 140 + 1 = 5041$$

$$(ii) 99_2 = (100 - 1)_2$$

$$= (100)_2 - 2(100)(1) + (1)_2 [(a - b)_2 = a_2 - 2ab + b_2]$$

$$= 10000 - 200 + 1 = 9801$$

$$(iii) 102_2 = (100 + 2)_2$$

$$= (100)_2 + 2(100)(2) + (2)_2 [(a + b)_2 = a_2 + 2ab + b_2]$$

$$= 10000 + 400 + 4 = 10404$$

$$(iv) 998_2 = (1000 - 2)_2$$

$$= (1000)_2 - 2(1000)(2) + (2)_2 [(a - b)_2 = a_2 - 2ab + b_2]$$

$$= 1000000 - 4000 + 4 = 996004$$

$$(v) (5.2)_2 = (5.0 + 0.2)_2$$

$$= (5.0)_2 + 2(5.0)(0.2) + (0.2)_2 [(a + b)_2 = a_2 + 2ab + b_2]$$

$$= 25 + 2 + 0.04 = 27.04$$

$$(vi) 297 \times 303 = (300 - 3) \times (300 + 3)$$

$$= (300)_2 - (3)_2 [(a + b)(a - b) = a_2 - b_2]$$

$$= 90000 - 9 = 89991$$

$$(vii) 78 \times 82 = (80 - 2)(80 + 2)$$

$$= (80)_2 - (2)_2 [(a + b)(a - b) = a_2 - b_2]$$

$$= 6400 - 4 = 6396$$

$$(viii) 8.9_2 = (9.0 - 0.1)_2$$

$$= (9.0)_2 - 2(9.0)(0.1) + (0.1)_2 [(a - b)_2 = a_2 - 2ab + b_2]$$

$$= 81 - 1.8 + 0.01 = 79.21$$

$$(ix) 1.05 \times 9.5 = 1.05 \times 0.95 \times 10$$

$$= (1 + 0.05)(1 - 0.05) \times 10$$

$$= [(1)_2 - (0.05)_2] \times 10$$

$$= [1 - 0.0025] \times 10 [(a + b)(a - b) = a_2 - b_2]$$

$$= 0.9975 \times 10 = 9.975$$

**Question 7:**

Using $a^2 - b^2 = (a + b)(a - b)$, find

(i) $51^2 - 49^2$ (ii) $(1.02)^2 - (0.98)^2$ (iii) $153^2 - 147^2$

(iv) $12.1^2 - 7.9^2$

Answer:

(i) $51^2 - 49^2 = (51 + 49)(51 - 49)$

$= (100)(2) = 200$

(ii) $(1.02)^2 - (0.98)^2 = (1.02 + 0.98)(1.02 - 0.98)$

$= (2)(0.04) = 0.08$

(iii) $153^2 - 147^2 = (153 + 147)(153 - 147)$

$= (300)(6) = 1800$

(iv) $12.1^2 - 7.9^2 = (12.1 + 7.9)(12.1 - 7.9)$

$= (20.0)(4.2) = 84$

Question 8:

Using $(x + a)(x + b) = x^2 + (a + b)x + ab$, find

(i) 103×104 (ii) 5.1×5.2 (iii) 103×98 (iv) 9.7×9.8

Answer:

(i) $103 \times 104 = (100 + 3)(100 + 4)$

$= (100)^2 + (3 + 4)(100) + (3)(4)$

$= 10000 + 700 + 12 = 10712$

(ii) $5.1 \times 5.2 = (5 + 0.1)(5 + 0.2)$

$= (5)^2 + (0.1 + 0.2)(5) + (0.1)(0.2)$

$= 25 + 1.5 + 0.02 = 26.52$

(iii) $103 \times 98 = (100 + 3)(100 - 2)$

$= (100)^2 + [3 + (-2)](100) + (3)(-2)$

$= 10000 + 100 - 6$

$= 10094$

(iv) $9.7 \times 9.8 = (10 - 0.3)(10 - 0.2)$

$= (10)^2 + [(-0.3) + (-0.2)](10) + (-0.3)(-0.2)$

$= 100 + (-0.5)10 + 0.06 = 100.06 - 5 = 95.06$

