

ML Aggarwal Solutions for Class 8 Maths

Chapter 10: Algebraic Expressions and Identities

Exercise 10.1

1. Identify the terms, their numerical as well as literal coefficients in each of the following expressions:

- (i) $12x^2yz - 4xy^2$
 (ii) $8 + mn + nl - lm$
 (iii) $x^2/3 + y/6 - xy^2$
 (iv) $-4p + 2.3q + 1.7r$

Solution:

	Terms	Numerical coefficient	Literal coefficient
(i)	$12x^2yz$	12	x^2yz
	$-4xy^2$	-4	xy^2
(ii)	8	8	-
	mn	1	mn
	nl	1	nl
	$-lm$	-1	lm
(iii)	$\frac{x^2}{3}$	$\frac{1}{3}$	x^2
	$\frac{y}{6}$	$\frac{1}{6}$	y
(iv)	$-xy^2$	-1	xy^2
	$-4p$	-4	p
	$2.3q$	2.3	q
	$1.7r$	1.7	r

2. Identify monomials, binomials, and trinomials from the following algebraic expressions :

- (i) $5p \times q \times r^2$
 (ii) $3x^2 + y \div 2z$
 (iii) $-3 + 7x^2$
 (iv) $(5a^2 - 3b^2 + c)/2$
 (v) $7x^5 - 3x/y$
 (vi) $5p \div 3q - 3p^2 \times q^2$

Solution:

(i) $5p \times q \times r^2 = 5pqr^2$

As this algebraic expression has only one term, its therefore a monomial.

(ii) $3x^2 + y \div 2z = 3x^2/2z + y/2z$

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As this algebraic expression has two terms, its therefore a binomial.

(iii) $-3 + 7x^2$

As this algebraic expression has two terms, its therefore a binomial.

(iv) $\frac{5a^2-3b^2+c}{2} = \frac{5a^2}{2} - \frac{3b^2}{2} + \frac{c}{2}$

As this algebraic expression has three terms, its therefore a trinomial.

(v) $7x^5 - 3x/y$

As this algebraic expression has two terms, its therefore a binomial.

(vi) $5p \div 3q - 3p^2 \times q^2 = 5p/3q - 3p^2q^2$

As this algebraic expression has two terms, its therefore a binomial.

3. Identify which of the following expressions are polynomials. If so, write their degrees.

(i) $2/5x^4 - \sqrt{3}x^2 + 5x - 1$

(ii) $7x^3 - 3/x^2 + \sqrt{5}$

(iii) $4a^3b^2 - 3ab^4 + 5ab + 2/3$

(iv) $2x^2y - 3/xy + 5y^3 + \sqrt{3}$

Solution:

(i) It is a polynomial and the degree of this expression is 4.

(ii) It is not a polynomial.

(iii) It is a polynomial and the degree of this expression is 5.

(iv) It is not a polynomial.

4. Add the following expressions:

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

(ii) $5p^2q^2 + 4pq + 7, 3 + 9pq - 2p^2q$

(iii) $l^2 + m^2 + n^2, lm + mn, mn + nl, nl + lm$

(iv) $4x^3 - 7x^2 + 9, 3x^2 - 5x + 4, 7x^3 - 11x + 1, 6x^2 - 13x$

Solution:

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

On adding the expressions, we have

$$\Rightarrow ab - bc + bc - ca + ca - ab = 0$$

(ii) $5p^2q^2 + 4pq + 7, 3 + 9pq - 2p^2q$

On adding the expressions, we have

$$= 5p^2q^2 + 4pq + 7 + 3 + 9pq - 2p^2q$$

$$= 5p^2q^2 - 2p^2q^2 + 4pq + 9pq + 7 + 3$$

$$= 3p^2q^2 + 13pq + 10$$

(iii) $l^2 + m^2 + n^2, lm + mn, mn + nl, nl + lm$

On adding the expressions, we have

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$$= l^2 + m^2 + n^2 + lm + mn + mn + nl + nl + lm$$
$$= l^2 + m^2 + n^2 + 2lm + 2mn + 2nl$$

(iv) $4x^3 - 7x^2 + 9, 3x^2 - 5x + 4, 7x^3 - 11x + 1, 6x^2 - 13x$

On adding the expressions, we have

$$= 4x^3 - 7x^2 + 9 + 3x^2 - 5x + 4 + 7x^3 - 11x + 1 + 6x^2 - 13x$$
$$= 4x^3 + 7x^3 - 7x^2 + 3x^2 + 6x^2 - 5x - 11x - 13x + 9 + 4 + 1$$
$$= 11x^3 - 2x^2 - 29x + 14$$

5. Subtract:

(i) $8a + 3ab - 2b + 7$ from $14a - 5ab + 7b - 5$

(ii) $8xy + 4yz + 5zx$ from $12xy - 3yz - 4zx + 5xyz$

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

Solution:

(i) Subtracting $8a + 3ab - 2b + 7$ from $14a - 5ab + 7b - 5$, we have

$$= (14a - 5ab + 7b - 5) - (8a + 3ab - 2b + 7)$$
$$= 14a - 5ab + 7b - 5 - 8a - 3ab + 2b - 7$$
$$= 6a - 8ab + 9b - 12$$

(ii) Subtracting $8xy + 4yz + 5zx$ from $12xy - 3yz - 4zx + 5xyz$, we have

$$= (12xy - 3yz - 4zx + 5xyz) - (8xy + 4yz + 5zx)$$
$$= 12xy - 3yz - 4zx + 5xyz - 8xy - 4yz - 5zx$$
$$= 4xy - 7yz - 9zx + 5xyz$$

(iii) Subtracting $4p^2q - 3pq + 5pq^2 - 8p + 7q - 10$ from $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$, we have

$$= (18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q) - (4p^2q - 3pq + 5pq^2 - 8p + 7q - 10)$$
$$= 18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q - 7p^2q + 3pq - 5pq^2 + 8p - 7q + 10$$
$$= 28 + 5p - 78q + 8pq - 7pq^2 + p^2q$$

6. Subtract the sum of $3x^2 + 5xy + 7y^2 + 3$ and $2x^2 - 4xy - 3y^2 + 7$ from $9x^2 - 8xy + 11y^2$

Solution:

First, adding $3x^2 + 5xy + 7y^2 + 3$ and $2x^2 - 4xy - 3y^2 + 7$, we have

$$= 3x^2 + 5xy + 7y^2 + 3 + 2x^2 - 4xy - 3y^2 + 7$$
$$= 5x^2 + xy + 4y^2 + 10$$

Now,

Subtracting $5x^2 + xy + 4y^2 + 10$ from $9x^2 - 8xy + 11y^2$

$$= (9x^2 - 8xy + 11y^2) - (5x^2 + xy + 4y^2 + 10)$$
$$= 9x^2 - 8xy + 11y^2 - 5x^2 - xy - 4y^2 - 10$$
$$= 4x^2 - 9xy + 7y^2 - 10$$

7. What must be subtracted from $3a^2 - 5ab - 2b^2 - 3$ to get $5a^2 - 7ab - 3b^2 + 3a$?

Solution:

From the question, its understood that we have to subtract $5a^2 - 7ab - 3b^2 + 3a$ from $3a^2 - 5ab - 2b^2 - 3$

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$$\begin{aligned} &= 3a^2 - 5ab - 2b^2 - 3 - (5a^2 - 7ab - 3b^2 + 3a) \\ &= 3a^2 - 5ab - 2b^2 - 3 - 5a^2 + 7ab + 3b^2 - 3a \\ &= -2a^2 + 2ab + b^2 - 3a - 3 \end{aligned}$$

8. The perimeter of a triangle is $7p^2 - 5p + 11$ and two of its sides are $p^2 + 2p - 1$ and $3p^2 - 6p + 3$. Find the third side of the triangle.

Solution:

Given,

$$\text{Perimeter of a triangle} = 7p^2 - 5p + 11$$

$$\text{And, two of its sides are } p^2 + 2p - 1 \text{ and } 3p^2 - 6p + 3$$

We know that,

$$\text{Perimeter of a triangle} = \text{Sum of three sides of triangle}$$

$$\Rightarrow 7p^2 - 5p + 11 = (p^2 + 2p - 1) + (3p^2 - 6p + 3) + (\text{Third side of triangle})$$

$$7p^2 - 5p + 11 = (4p^2 - 4p + 2) + (\text{Third side of triangle})$$

$$\begin{aligned} \Rightarrow \text{Third side of triangle} &= (7p^2 - 5p + 11) - (4p^2 - 4p + 2) \\ &= (7p^2 - 4p^2) + (-5p + 4p) + (11 - 2) \\ &= 3p^2 - p + 9 \end{aligned}$$

Thus, the third side of the triangle is $3p^2 - p + 9$.



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Exercise 10.2

1. Find the product of:

(i) $4x^3$ and $-3xy$

(ii) $2xyz$ and 0

(iii) $-(2/3)p^2q$, $(3/4)pq^2$ and $5pqr$

(iv) $-7ab$, $-3a^3$ and $-(2/7)ab^2$

(v) $-1/2x^2 - (3/5)xy$, $(2/3)yz$ and $(5/7)xyz$

Solution:

Product of:

(i) $4x^3$ and $-3xy = 4x^3 \times (-3xy) = -12x^{3+1}y = -12x^4y$

(ii) $2xyz$ and $0 = 2xyz \times 0 = 0$

(iii) $\left(-\frac{2}{3}p^2q\right) \times \left(\frac{3}{4}pq^2\right) \times (5pqr)$
 $= -\frac{2}{3} \times \frac{3}{4} \times 5 \times p^2q \times pq^2 \times pqr$
 $= -\frac{5}{2}p^4q^4r$

(iv) $(-7ab) \times (-3a^3) \times \left(-\frac{2}{7}ab^2\right)$
 $= (-7) \times (-3) \times \left(-\frac{2}{7}\right) \times ab \times a^3 \times ab^2$
 $= -6a^5b^3$

(v) $\left(-\frac{1}{2}x^2\right) \times \left(-\frac{3}{5}xy\right) \times \left(\frac{2}{3}yz\right) \times \left(\frac{5}{7}xyz\right)$
 $= \left(-\frac{1}{2}\right) \times \left(-\frac{3}{5}\right) \times \left(\frac{2}{3}\right) \times \left(\frac{5}{7}\right) \times x^2 \times xy \times yz \times xyz$
 $= \frac{1}{7}x^4y^3z^2$

2. Multiply:

(i) $(3x - 5y + 7z)$ by $-3xyz$

(ii) $(2p^2 - 3pq + 5q^2 + 5)$ by $-2pq$

(iii) $(2/3a^2b - 4/5ab^2 + 2/7ab + 3)$ by $35ab$

(iv) $(4x^2 - 10xy + 7y^2 - 8x + 4y + 3)$ by $3xy$

Solution:

(i) $-3xyz \times (3x - 5y + 7z)$
 $= (-3xyz) \times 3x + (-3xyz) \times (-5y) + (-3xyz) \times (7z)$
 $= -9x^2yz + 15xyz^2 - 21xyz^2$

(ii) $-2pq \times (2p^2 - 3pq + 5q^2 + 5)$

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$$= (-2pq) \times 2p^2 + (-2pq) \times (-3pq) + (-2pq) \times (5q^2) + (-2pq) \times 5$$
$$= -4p^3q + 6p^2q^2 - 10pq^3 - 10pq$$

(iii) $\left(\frac{2}{3}a^2b - \frac{4}{5}ab^2 + \frac{2}{7}ab + 3\right)$ by $35ab$

$$= \left(\frac{2}{3}a^2b\right) \times 35ab - \left(\frac{4}{5}ab^2\right) \times 35ab + \left(\frac{2}{7}ab\right) \times 35ab + 3 \times 35ab$$
$$= \left(\frac{70}{3}\right)a^3b^2 - 28a^2b^3 + 10a^2b^2 + 105ab$$

(iv) $(4x^2 - 10xy + 7y^2 - 8x + 4y + 3)$ by $3xy$

$$= 4x^2 \times 3xy - 10xy \times 3xy + 7y^2 \times 3xy - 8x \times 3xy + 4y \times 3xy + 3 \times 3xy$$
$$= 12x^3y - 30x^2y^2 + 21xy^3 - 24x^2y + 12xy^2 + 9xy$$

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

(i) (p^2q, pq^2)

(ii) $(5xy, 7xy^2)$

Solution:

(i) Given, sides of a rectangle are p^2q and pq^2

Hence,

$$\text{Area} = p^2q \times pq^2 = p^{2+1} \times q^{2+1} = p^3q^3$$

(ii) Given, sides are $5xy$ and $7xy^2$

Hence,

$$\text{Area} = 5xy \times 7xy^2 = 35x^{1+1} \times y^{1+2} = 35x^2y^3$$

4. Find the volume of rectangular boxes with the following length, breadth and height respectively:

(i) $5ab, 3a^2b, 7a^4b^2$

(ii) $2pq, 4q^2, 8rp$

Solution:

Given are the length, breadth and height of a rectangular box:

(i) $5ab, 3a^2b, 7a^4b^2$

$$\begin{aligned}\therefore \text{Volume} &= \text{Length} \times \text{breadth} \times \text{height} \\ &= 5ab \times 3a^2b \times 7a^4b^2 \\ &= 5 \times 3 \times 7 \times a^{1+2+4} \times b^{1+1+2} \\ &= 105a^7b^4\end{aligned}$$

(ii) $2pq, 4q^2, 8rp$

$$\begin{aligned}\therefore \text{Volume} &= \text{Length} \times \text{breadth} \times \text{height} \\ &= 2pq \times 4q^2 \times 8rp \\ &= 2 \times 4 \times 8 \times p^{1+1} \times q^{1+2} \times r \\ &= 64p^2q^3r\end{aligned}$$

5. Simplify the following expressions and evaluate them as directed:

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- (i) $x^2(3 - 2x + x^2)$ for $x = 1$; $x = -1$; $x = 2/3$ and $x = -1/2$
(ii) $5xy(3x + 4y - 7) - 3y(xy - x^2 + 9) - 8$ for $x = 2$, $y = -1$

Solution:

(i) $x^2(3 - 2x + x^2)$

For $x = 1$; $x = -1$; $x = 2/3$ and $x = -1/2$

$$x^2(3 - 2x + x^2) = 3x^2 - 2x^3 + x^4$$

(a) For $x = 1$

$$\begin{aligned} 3x^2 - 2x^3 + x^4 &= 3(1)^2 - 2(1)^3 + (1)^4 \\ &= 3 \times 1 - 2 \times 1 + 1 \\ &= 3 - 2 + 1 = 2 \end{aligned}$$

(b) For $x = -1$

$$\begin{aligned} 3x^2 - 2x^3 + x^4 &= 3(-1)^2 - 2(-1)^3 + (-1)^4 \\ &= 3 \times 1 - 2 \times (-1) + 1 \\ &= 3 + 2 + 1 = 6 \end{aligned}$$

(c) For $x = 2/3$

$$\begin{aligned} 3x^2 - 2x^3 + x^4 &= 3(2/3)^2 - 2(2/3)^3 + (2/3)^4 \\ &= 3 \times (4/9) - 2 \times (8/27) + (16/81) \\ &= (4/3) - (16/27) + (16/81) \\ &= (108 - 48 + 16)/81 \\ &= (124 - 48)/81 \\ &= 76/81 \end{aligned}$$

(d) For $x = -1/2$

$$\begin{aligned} 3x^2 - 2x^3 + x^4 &= 3(-1/2)^2 - 2(-1/2)^3 + (-1/2)^4 \\ &= 3 \times (1/4) - 2 \times (-1/8) + (1/16) \\ &= (3/4) + 1/4 + (1/16) \\ &= (12 + 4 + 1)/16 \\ &= 17/16 \end{aligned}$$

(ii) $5xy(3x + 4y - 7) - 3y(xy - x^2 + 9) - 8$
 $= 15x^2y + 20xy^2 - 35xy - 3xy^2 + 3x^2y - 21y - 8$
 $= 18x^2y + 17xy^2 - 35xy - 27y - 8$

When $x = 2$, $y = -1$, we have

$$\begin{aligned} &= 18(2)^2 \times (-1) + 17(2)(-1)^2 - 35(2)(-1) - 27(-1) - 8 \\ &= 18 \times 4 \times (-1) + 17 \times 2 \times 1 - 35 \times 2 \times (-1) - 27 \times (-1) - 8 \\ &= -74 + 34 + 70 + 27 - 8 \\ &= 131 - 80 = 51 \end{aligned}$$

6. Add the following:

(i) $4p(2 - p^2)$ and $8p^3 - 3p$

(ii) $7xy(8x + 2y - 3)$ and $4xy^2(3y - 7x + 8)$

Solution:

Adding,

(i) $4p(2 - p^2)$ and $8p^3 - 3p$

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$$\begin{aligned} &= 8p - 4p^3 + 8p^3 - 3p \\ &= 5p + 4p^3 \\ &= 4p^3 + 5p \end{aligned}$$

$$\begin{aligned} &\text{(ii) } 7xy(8x + 2y - 3) \text{ and } 4xy^2(3y - 7x + 8) \\ &= 56x^2y + 14xy^2 - 21xy + 12xy^3 - 28x^2y^2 + 32xy^2 \\ &= 12xy^3 - 28x^2y^2 + 56x^2y + 46xy^2 - 21xy \end{aligned}$$

7. Subtract:

$$\text{(i) } 6x(x - y + z) - 3y(x + y - z) \text{ from } 2z(-x + y + z)$$

$$\text{(ii) } 7xy(x^2 - 2xy + 3y^2) - 8x(x^2y - 4xy + 7xy^2) \text{ from } 3y(4x^2y - 5xy + 8xy^2)$$

Solution:

Subtracting,

$$\begin{aligned} &\text{(i) } 6x(x - y + z) - 3y(x + y - z) \text{ from } 2z(-x + y + z) \\ &\Rightarrow 6x^2 - 6xy + 6xz - 3xy - 3y^2 + 3yz \text{ from } -2xz + 2yz + 2z^2 \\ &= (-2xz + 2yz + 2z^2) - (6x^2 - 6xy + 6xz - 3xy - 3y^2 + 3yz) \\ &= -2xz + 2yz + 2z^2 - 6x^2 + 6xy - 6xz + 3xy + 3y^2 - 3yz \\ &= 9xy - yz - 8zx - 6x^2 + 3y^2 + 2z^2 \end{aligned}$$

$$\begin{aligned} &\text{(ii) } 7xy(x^2 - 2xy + 3y^2) - 8x(x^2y - 4xy + 7xy^2) \text{ from } 3y(4x^2y - 5xy + 8xy^2) \\ &\Rightarrow 7x^3y - 14x^2y^2 + 21xy^3 - 8x^3y + 32x^2y - 56x^2y^2 \text{ from } 12x^2y^2 - 15xy^2 + 24xy^3 \\ &= (12x^2y^2 - 15xy^2 + 24xy^3) - (7x^3y - 14x^2y^2 + 21xy^3 - 8x^3y + 32x^2y - 56x^2y^2) \\ &= 12x^2y^2 - 15xy^2 + 24xy^3 - 7x^3y + 14x^2y^2 - 12xy^3 + 8x^3y - 32x^2y + 56x^2y^2 \\ &= 82x^2y^2 + 3xy^3 + x^3y - 15xy^2 - 32x^2y \end{aligned}$$

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Exercise 10.3

1. Multiply:

(i) $(5x - 2)$ by $(3x + 4)$

(ii) $(ax + b)$ by $(cx + d)$

(iii) $(4p - 7)$ by $(2 - 3p)$

(iv) $(2x^2 + 3)$ by $(3x - 5)$

(v) $(1.5a - 2.5b)$ by $(1.5a + 2.5b)$

(vi) $(\frac{3}{7}p^2 + 4q^2)$ by $7(p^2 - \frac{3}{4}q^2)$

Solution:

$$\begin{aligned} \text{(i)} \quad & (5x - 2) \text{ by } (3x + 4) \\ &= (5x - 2) \times (3x + 4) \\ &= 5x(3x + 4) - 2(3x + 4) \\ &= 15x^2 + 20x - 6x - 8 \\ &= 15x^2 + 14x - 8 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & (ax + b) \text{ by } (cx + d) \\ &= (ax + b) \times (cx + d) \\ &= ax(cx + d) + b(cx + d) \\ &= acx^2 + adx + bcx + bd \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & (4p - 7) \text{ by } (2 - 3p) \\ &= (4p - 7) \times (2 - 3p) \\ &= 4p(2 - 3p) - 7(2 - 3p) \\ &= 8p - 12p^2 - 14 + 21p \\ &= 29p - 12p^2 - 14 \end{aligned}$$

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

$$\begin{aligned} \text{(v)} \quad & (1.5a - 2.5b) \text{ by } (1.5a + 2.5b) \\ &= (1.5a - 2.5b)(1.5a + 2.5b) \\ &= 1.5a(1.5 + 2.5b) - 2.5b(1.5a + 2.5b) \\ &= 2.25a^2 + 3.75ab - 3.75ab - 6.25b^2 \\ &= 2.25a^2 - 6.25b^2 \end{aligned}$$



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$$\begin{aligned} \text{(vi)} \quad & \left(\frac{3}{7}p^2 + 4q^2\right) \text{ by } 7\left(p^2 - \frac{3}{4}q^2\right) \\ & = \left(\frac{3}{7}p^2 + 4q^2\right) \times 7\left(p^2 - \frac{3}{4}q^2\right) \\ & = 7\left(\frac{3}{7}p^2 + 4q^2\right)\left(p^2 - \frac{3}{4}q^2\right) \\ & = 7\left[\frac{3}{7}p^2\left(p^2 - \frac{3}{4}q^2\right) + 4q^2\left(p^2 - \frac{3}{4}q^2\right)\right] \\ & = 7\left[\frac{3}{7}p^4 - \frac{9}{28}p^2q^2 + 4p^2q^2 - 3q^4\right] \\ & = 3p^4 - \frac{9}{4}p^2q^2 + 28p^2q^2 - 21q^4 \\ & = 3p^4 - \frac{9p^2q^2 + 112p^2q^2}{4} - 21q^4 \\ & = 3p^4 + \frac{103}{4}p^2q^2 - 21q^4 \end{aligned}$$

2. Multiply:

(i) $(x - 2y + 3)$ by $(x + 2y)$

(ii) $(3 - 5x + 2x^2)$ by $(4x - 5)$

Solution:

$$\begin{aligned} \text{(i)} \quad & (x - 2y + 3) \text{ by } (x + 2y) \\ & = (x - 2y + 3) \times (x + 2y) \\ & = x(x + 2y) - 2y(x + 2y) + 3(x + 2y) \\ & = x^2 + 2xy - 2xy - 4y^2 + 3x + 6y \\ & = x^2 - 4y^2 + 3x + 6y \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & (3 - 5x + 2x^2) \text{ by } (4x - 5) \\ & = (4x - 5)(3 - 5x + 2x^2) \\ & = 4x(3 - 5x + 2x^2) - 5(3 - 5x + 2x^2) \\ & = 12x - 20x^2 + 8x^3 - 15 + 25x - 10x^2 \\ & = 8x^3 - 30x^2 + 37x - 15 \end{aligned}$$

3. Multiply:

(i) $(3x^2 - 2x - 1)$ by $(2x^2 + x - 5)$

(ii) $(2 - 3y - 5y^2)$ by $(2y - 1 + 3y^2)$

Solution:

$$\begin{aligned} \text{(i)} \quad & (3x^2 - 2x - 1) \text{ by } (2x^2 + x - 5) \\ & = (3x^2 - 2x - 1)(2x^2 + x - 5) \end{aligned}$$

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$$\begin{aligned} &= 3x^2(2x^2 + x - 5) - 2x(2x^2 + x - 5) - 1(2x^2 + x - 5) \\ &= 6x^4 + 3x^3 - 15x^2 - 4x^3 - 2x^2 + 10x - 2x^2 - x + 5 \\ &= 6x^4 - x^3 - 19x^2 + 9x + 5 \end{aligned}$$

$$\begin{aligned} \text{(ii)} & (2 - 3y - 5y^2) \text{ by } (2y - 1 + 3y^2) \\ &= (2 - 3y - 5y^2) \times (2y - 1 + 3y^2) \\ &= 2(2y - 1 + 3y^2) - 3y(2y - 1 + 3y^2) - 5y^2(2y - 1 + 3y^2) \\ &= 4y - 2 + 6y^2 - 6y^2 + 3y - 9y^3 - 10y^3 + 5y^2 - 15y^4 \\ &= -15y^4 - 19y^3 + 5y^2 + 7y - 2 \end{aligned}$$

4. Simplify:

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

$$\text{(ii)} (x + 3)(x - 3)(x + 4)(x - 4)$$

$$\text{(iii)} (x + 5)(x + 6)(x + 7)$$

$$\text{(iv)} (p + q - 2r)(2p - q + r) - 4qr$$

$$\text{(v)} (p + q)(r + s) + (p - q)(r - s) - 2(pr + qs)$$

$$\text{(vi)} (x + y + z)(x - y + z) + (x + y - z)(-x + y + z) - 4zx$$

Solution:

$$\begin{aligned} \text{(i)} & (x^2 + 3)(x - 3) + 9 \\ &= x^2(x - 3) + 3(x - 3) + 9 \\ &= x^2 - 3x^2 + 3x - 9 + 9 \\ &= x^3 - 3x^2 + 3x \end{aligned}$$

$$\begin{aligned} \text{(ii)} & (x + 3)(x - 3)(x + 4)(x - 4) \\ &= \{(x + 3)(x - 3)\} \times \{(x + 4)(x - 4)\} \\ &= \{x(x - 3) + 3(x - 3)\} \{x(x - 4) + 4(x - 4)\} \\ &= (x^2 - 3x + 3x - 9) \{x^2 - 4x + 4x - 16\} \\ &= (x^2 - 9)(x^2 - 16) \\ &= x^2(x^2 - 16) - 9(x^2 - 16) \\ &= x^4 - 16x^2 - 9x^2 + 144 \\ &= x^4 - 25x^2 + 144 \end{aligned}$$

$$\begin{aligned} \text{(iii)} & (x + 5)(x + 6)(x + 7) \\ &= \{(x + 5) \times (x + 6)\} (x + 7) \\ &= (x^2 + 6x + 5x + 30)(x + 7) \\ &= (x^2 + 11x + 30)(x + 7) \\ &= x(x^2 + 11x + 30) + 7(x^2 + 11x + 30) \\ &= x^3 + 11x^2 + 30x + 7x^2 + 77x + 210 \\ &= x^3 + 18x^2 + 107x + 210 \end{aligned}$$

$$\begin{aligned} \text{(iv)} & (p + q - 2r)(2p - q + r) - 4qr \\ &= p(2p - q + r) + q(2p - q + r) - 2r(2p - q + r) - 4qr \\ &= 2p^2 - pq + pr + 2pq - q^2 + qr - 4pr + 2qr - 2r^2 - 4qr \\ &= 2p^2 - q^2 - 2r^2 + pq - 3pr - 2qr \end{aligned}$$

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$$\begin{aligned} & \text{(v) } (p + q)(r + s) + (p - q)(r - s) - 2(pr + qs) \\ &= (pr + ps + qr + qs) + (pr - ps - qr + qs) - 2pr - 2qs \\ &= 0 \end{aligned}$$

$$\begin{aligned} & \text{(vi) } (x + y + z)(x - y + z) + (x + y - z)(-x + y + z) - 4zx \\ &= x^2 - xy + xz + xy - y^2 + yz + xz - yz + z^2 - x^2 + xy + xz \\ &\quad - xy + x^2 + yx + xz - yz - z^2 - 4zx \\ &= 0 \end{aligned}$$

5. If two adjacent sides of a rectangle are $5x^2 + 25xy + 4y^2$ and $2x^2 - 2xy + 3y^2$, find its area.

Solution:

Given,

The adjacent sides of a rectangle are $5x^2 + 25xy + 4y^2$ and $2x^2 - 2xy + 3y^2$

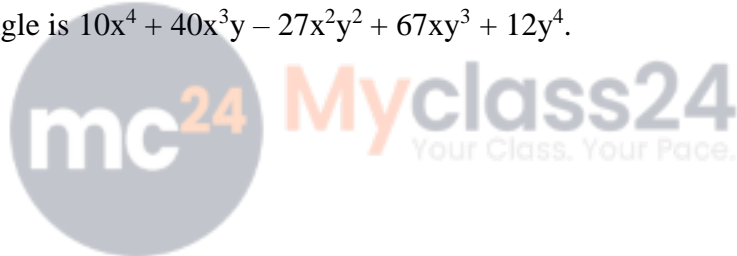
So,

Area of rectangle = Product of two adjacent sides

$$\begin{aligned} &= (5x^2 + 25xy + 4y^2)(2x^2 - 2xy + 3y^2) \\ &= 10x^4 - 10x^3y + 15x^2y^2 + 50x^3y - 50x^2y^2 + 75xy^3 + 8x^2y^2 - 8xy^3 + 12y^4 \\ &= 10x^4 + 40x^3y - 27x^2y^2 + 67xy^3 + 12y^4 \end{aligned}$$

Thus,

The area of the rectangle is $10x^4 + 40x^3y - 27x^2y^2 + 67xy^3 + 12y^4$.



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Exercise 10.4

1. Divide:

(i) $-39pq^2r^5$ by $-24p^3q^3r$

(ii) $-a^2b^3$ by a^3b^2

Solution:

$$\begin{aligned} \text{(i)} \quad & -39pq^2r^5 \div (-24p^3q^3r) \\ & = -39pq^2r^5 / -24p^3q^3r \\ & = \left(\frac{-39}{-24} \right) \times \left(\frac{pq^2r^5}{p^3q^3r} \right) \\ & = \frac{13}{8} \times \frac{r^4}{p^2q} = \frac{13r^4}{8p^2q} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & \frac{-3}{4}a^2b^3 \div \frac{6}{7}a^3b^2 \\ & = \frac{\frac{-3}{4}a^2b^3}{\frac{6}{7}a^3b^2} \\ & = \left(\frac{\frac{-3}{4}}{\frac{6}{7}} \right) \times \left(\frac{a^2b^3}{a^3b^2} \right) \\ & = \left(\frac{-3}{4} \times \frac{7}{6} \right) \times \left(\frac{b}{a} \right) \\ & = \frac{-7}{8} \times \frac{b}{a} = \frac{-7b}{8a} \end{aligned}$$

2. Divide:

(i) $9x^4 - 8x^3 - 12x + 3$ by $3x$

(ii) $14p^2q^3 - 32p^3q^2 + 15pq^2 - 22p + 18q$ by $-2p^2q$.

Solution:

$$\begin{aligned} \text{(i)} \quad & \frac{9x^4 - 8x^3 - 12x + 3}{3x} \\ & = \frac{9x^4}{3x} - \frac{8x^3}{3x} - \frac{12x}{3x} + \frac{3}{3x} \\ & = 3x^3 - \frac{8}{3}x^2 - 4 + \frac{1}{x} \end{aligned}$$

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$$\begin{aligned}
 \text{(ii)} \quad & \frac{14p^2q^3 - 32p^3q^2 + 15pq^2 - 22p + 18q}{-2p^2q} \\
 &= \frac{14p^2q^3}{-2p^2q} - \frac{32p^3q^2}{-2p^2q} + \frac{15pq^2}{-2p^2q} - \frac{22p}{-2p^2q} + \frac{18q}{-2p^2q} \\
 &= -7q^2 + 16pq - \frac{15q}{2p} + \frac{11}{pq} - \frac{9}{p^2}
 \end{aligned}$$

3. Divide:

(i) $6x^2 + 13x + 5$ by $2x + 1$

(ii) $1 + y^3$ by $1 + y$

(iii) $5 + x - 2x^2$ by $x + 1$

(iv) $x^3 - 6x^2 + 12x - 8$ by $x - 2$

Solution:

(i) $6x^2 + 13x + 5 \div 2x + 1$

$$\begin{array}{r}
 \overline{2x + 1 \) 6x^2 + 13x + 5} \quad (3x + 5) \\
 \underline{6x^2 + 3x} \\
 10x + 5 \\
 \underline{10x + 5} \\
 0
 \end{array}$$

\therefore Quotient = $3x + 5$ and remainder = 0

(ii) $1 + y^3 \div 1 + y$

$$\begin{array}{r}
 \overline{y + 1 \) y^3 + 1} \quad (y^2 - y + 1) \\
 \underline{y^3 + y^2} \\
 -y^2 + 1 \\
 \underline{-y^2 - y} \\
 + + \\
 \underline{ y + 1} \\
 y + 1 \\
 \underline{ y + 1} \\
 0
 \end{array}$$

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\therefore Quotient = $y^2 - y + 1$ and remainder = 0

(iii) On arranging the terms of dividend in descending order of powers of x and then dividing, we get
 $-2x^2 + x + 5 \div x + 1$

$$\begin{array}{r}
 x + 1 \overline{) -2x^2 + x + 5} \quad (-2x + 3) \\
 \underline{-2x^2 - 2x} \\
 + + \\
 \hline
 3x + 5 \\
 \underline{3x + 3} \\
 + 2 \\
 \underline{- 2} \\
 0
 \end{array}$$

\therefore Quotient = $-2x + 3$ and remainder = 2

(iv) $x^3 - 6x^2 + 12x - 8 \div x - 2$

$$\begin{array}{r}
 x - 2 \overline{) x^3 - 6x^2 + 12x - 8} \quad (x^2 - 4x + 4) \\
 \underline{x^3 - 2x^2} \\
 -4x^2 + 12x \\
 \underline{-4x^2 + 8x} \\
 + - 4x - 8 \\
 \underline{- 4x - 8} \\
 + 0
 \end{array}$$

\therefore Quotient = $x^2 - 4x + 4$ and remainder = 0

4. Divide:

(i) $6x^3 + x^2 - 26x - 25$ by $3x - 7$

(ii) $m^3 - 6m^2 + 7$ by $m - 1$

Solution:

(i) $6x^3 + x^2 - 26x - 25 \div 3x - 7$

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$$\begin{array}{r}
 3x - 7 \overline{) 6x^3 + x^2 - 26x - 25} \quad (2x^2 + 5x + 3) \\
 \underline{6x^3 - 14x^2} \\
 - + \\
 \hline
 15x^2 - 26x - 25 \\
 \underline{15x^2 - 35x} \\
 - + \\
 \hline
 9x - 25 \\
 \underline{9x - 21} \\
 - + \\
 \hline
 -4
 \end{array}$$

∴ Quotient = $2x^2 + 5x + 3$ and remainder = -4

(ii) $m^3 - 6m^2 + 7 \div m - 1$

$$\begin{array}{r}
 m - 1 \overline{) m^3 - 6m^2 + 7} \quad (m^2 - 5m - 5) \\
 \underline{m^3 - m^2} \\
 - + \\
 \hline
 -5m^2 \\
 \underline{-5m^2 + 5m} \\
 + - \\
 \hline
 -5m + 7 \\
 \underline{-5m + 5} \\
 + - \\
 \hline
 2
 \end{array}$$

∴ Quotient = $m^2 - 5m - 5$ and remainder = 2 .

5. Divide:

(i) $a^3 + 2a^2 + 2a + 1$ by $a^2 + a + 1$

(ii) $12x^3 - 17x^2 + 26x - 18$ by $3x^2 - 2x + 5$

Solution:

(i) $a^3 + 2a^2 + 2a + 1 \div a^2 + a + 1$

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$$\begin{array}{r}
 a^2 + a + 1 \overline{) a^3 + 2a^2 + 2a + 1} \quad (a + 1 \\
 \underline{a^3 + a^2 + a} \\
 - - - - \\
 \underline{a^2 + a + 1} \\
 a^2 + a + 1 \\
 \underline{ + + } \\
 0
 \end{array}$$

∴ Quotient = $a + 1$ and remainder = 0.

$$\begin{array}{r}
 (ii) \quad 12x^3 - 17x^2 + 26x - 18 \div 3x^2 - 2x + 5 \\
 3x^2 - 2x + 5 \overline{) 12x^3 - 17x^2 + 26x - 18} \quad (4x - 3 \\
 \underline{12x^3 - 8x^2 + 20x} \\
 - + - - \\
 \underline{-9x^2 + 6x - 18} \\
 -9x^2 + 6x - 15 \\
 \underline{ + + } \\
 -3
 \end{array}$$

∴ Quotient = $4x - 3$ and remainder = -3

6. If the area of a rectangle is $8x^2 - 45y^2 + 18xy$ and one of its sides is $4x + 15y$, find the length of adjacent side.

Solution:

Given,

$$\text{Area of rectangle} = 8x^2 - 45y^2 + 18xy$$

$$\text{And, one side} = 4x + 15y$$

$$\begin{aligned}
 \therefore \text{Second (adjacent) side} &= \text{Area of rectangle} / \text{One side} \\
 &= 8x^2 - 45y^2 + 18xy \div 4x + 15y
 \end{aligned}$$

$$\begin{array}{r}
 4x + 15y \overline{) 8x^2 + 18xy - 45y^2} \\
 \underline{8x^2 + 30xy} \\
 - - - \\
 \underline{-12xy - 45y^2} \\
 -12xy - 45y^2 \\
 \underline{ + } \\
 0
 \end{array}$$

Thus, length of the adjacent side is $2x - 3y$.

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Exercise 10.5

1. Using suitable identities, find the following products:

(i) $(3x + 5)(3x + 5)$

(ii) $(9y - 5)(9y - 5)$

(iii) $(4x + 11y)(4x - 11y)$

(iv) $(3m/2 + 2n/3)(3m/2 - 2n/3)$

(v) $(2/a + 5/b)(2a + 5/b)$

(vi) $(p^2/2 + 2/q^2)(p^2/2 - 2/q^2)$

Solution:

(i) $(3x + 5)(3x + 5)$

$$= (3x + 5)^2$$

$$= (3x)^2 + 2 \times 3x \times 5 + (5)^2$$

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

$$= 9x^2 + 30x + 25$$

(ii) $(9y - 5)(9y - 5)$

$$= (9y - 5)^2$$

$$= (9y)^2 - 2 \times 9y \times 5 + (5)^2$$

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

$$= 81y^2 - 90y + 25$$

(iii) $(4x + 11y)(4x - 11y)$

$$= (4x)^2 - (11y)^2$$

$$= 16x^2 - 121y^2$$

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

(iv) $(3m/2 + 2n/3)(3m/2 - 2n/3)$

$$= (3m/2)^2 - (2n/3)^2$$

$$= 9m^2/4 - 4n^2/9$$

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

(v) $(2/a + 5/b)(2a + 5/b)$

$$= (2/a + 5/b)^2$$

$$= (2/a)^2 + 2(2/a)(5/b) + (5/b)^2$$

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

$$= 4/a^2 + 20a/b + 25/b^2$$

(vi) $(p^2/2 + 2/q^2)(p^2/2 - 2/q^2)$

$$= (p^2/2)^2 - (2/q^2)^2$$

$$= p^4/4 - 4/q^4$$

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

2. Using the identities, evaluate the following:

(i) 81^2

(ii) 97^2

(iii) 105^2

(iv) 997^2

(v) 6.1^2

(vi) 496×504

(vii) 20.5×19.5

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(viii) 9.62

Solution:

$$\begin{aligned} \text{(i)} \quad (81)^2 &= (80 + 1)^2 \\ &= (80)^2 + 2 \times 80 \times 1 + (1)^2 && [\text{Using, } (a + b)^2 = a^2 + 2ab + b^2] \\ &= 6400 + 160 + 1 \\ &= 6561 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (97)^2 &= (100 - 3)^2 \\ &= (100)^2 - 2 \times 100 \times 3 + (3)^2 && [\text{Using, } (a - b)^2 = a^2 - 2ab + b^2] \\ &= 10000 - 600 + 9 \\ &= 10009 - 600 \\ &= 9409 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (105)^2 &= (100 + 5)^2 \\ &= (100)^2 + 2 \times 100 \times 5 + (5)^2 && [\text{Using, } (a + b)^2 = a^2 + 2ab + b^2] \\ &= 10000 + 1000 + 25 \\ &= 11025 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad (997)^2 &= (1000 - 3)^2 \\ &= (1000)^2 - 2 \times 1000 \times 3 + (3)^2 && [\text{Using, } (a - b)^2 = a^2 - 2ab + b^2] \\ &= 1000000 - 6000 + 9 \\ &= 1000009 - 6000 \\ &= 994009 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad (6.1)^2 &= (6 + 0.1)^2 \\ &= (6)^2 + 2 \times 6 \times 0.1 + (0.1)^2 && [\text{Using, } (a + b)^2 = a^2 + 2ab + b^2] \\ &= 36 + 1.2 + 0.01 \\ &= 37.21 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad 496 \times 504 \\ &= (500 - 4)(500 + 4) && [\text{Using, } (a + b)(a - b) = a^2 - b^2] \\ &= (500)^2 - (4)^2 \\ &= 250000 - 16 \\ &= 249984 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad 20.5 \times 19.5 \\ &= (20 + 0.5)(20 - 0.5) && [\text{Using, } (a + b)(a - b) = a^2 - b^2] \\ &= (20)^2 - (0.5)^2 \\ &= 400 - 0.25 \\ &= 399.75 \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad (9.6)^2 &= (10 - 0.4)^2 \\ &= (10)^2 - 2 \times 10 \times 0.4 + (0.4)^2 && [\text{Using, } (a - b)^2 = a^2 - 2ab + b^2] \\ &= 100 - 8.0 + 0.16 \\ &= 92.16 \end{aligned}$$

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3. Find the following squares, using the identities:

(i) $(pq + 5r)^2$ (ii) $(5a/2 - 3b/5)^2$
(iii) $(\sqrt{2a} + \sqrt{3b})^2$ (iv) $(2x/3y - 3y/2x)^2$

Solution:

(i) $(pq + 5r)^2$
 $= (pq)^2 + 2 \times pq \times 5r + (5r)^2$ [Using, $(a + b)^2 = a^2 + 2ab + b^2$]
 $= p^2q^2 + 10pqr + 25r^2$

(ii) $(5a/2 - 3b/5)^2$
 $= (5a/2)^2 - 2 \times (5a/2) \times (-3b/5) + (3b/5)^2$ [Using, $(a - b)^2 = a^2 - 2ab + b^2$]
 $= 25a^2/4 - 3ab + 9b^2/25$

(iii) $(\sqrt{2a} + \sqrt{3b})^2$
 $= (\sqrt{2a})^2 + 2 \times \sqrt{2a} \times \sqrt{3b} + (\sqrt{3b})^2$ [Using, $(a + b)^2 = a^2 + 2ab + b^2$]
 $= 2a^2 + 2\sqrt{6ab} + 3b^2$

(iv) $(2x/3y - 3y/2x)^2$
 $= \left(\frac{2x}{3y}\right)^2 - 2 \times \frac{2x}{2y} \times \frac{3y}{2x} + \left(\frac{3y}{2x}\right)^2$ $\{(a - b)^2 = a^2 - 2ab + b^2\}$
 $= \frac{4x^2}{9y^2} - 2 + \frac{9y^2}{4x^2}$

4. Using the identity, $(x + a)(x + b) = x^2 + (a + b)x + ab$, find the following products:

(i) $(x + 7)(x + 3)$
(ii) $(3x + 4)(3x - 5)$
(iii) $(p^2 + 2q)(p^2 - 3q)$
(iv) $(abc + 3)(abc - 5)$

Solution:

(i) $(x + 7)(x + 3)$
 $= (x)^2 + (7 + 3)x + 7 \times 3$
 $= x^2 + 10x + 21$

(ii) $(3x + 4)(3x - 5)$
 $= (3x)^2 + (4 - 5)(3x) + 4 \times (-5)$
 $= 9x^2 - 3x - 20$

(iii) $(P^2 + 2q)(p^2 - 3q)$
 $= (p^2)^2 + (2q - 3q)p^2 + 2q \times (-3q)$
 $= p^4 - p^2q - 6pq$

(iv) $(abc + 3)(abc - 5)$

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$$\begin{aligned} &= (abc)^2 + (3 - 5)abc + 3 \times (-5) \\ &= a^2b^2c^2 - 2abc - 15 \end{aligned}$$

5. Using the identity, $(x + a)(x + b) = x^2 + (a + b)x + ab$, evaluate the following:

(i) 203×204

(ii) 8.2×8.7

(iii) 107×93

Solution:

$$\begin{aligned} \text{(i) } 203 \times 204 &= (200 + 3)(200 + 4) \\ &= (200)^2 + (3 + 4) \times 200 + 3 \times 4 \\ &= 40000 + 1400 + 12 \\ &= 41412 \end{aligned}$$

$$\begin{aligned} \text{(ii) } 8.2 \times 8.7 &= (8 + 0.2)(8 + 0.7) \\ &= (8)^2 + (0.2 + 0.7) \times 8 + 0.2 \times 0.7 \\ &= 64 + 8 \times (0.9) + 0.14 \\ &= 64 + 7.2 + 0.14 \\ &= 71.34 \end{aligned}$$

$$\begin{aligned} \text{(iii) } 107 \times 93 &= (100 + 7)(100 - 7) \\ &= (100)^2 + (7 - 7) \times 100 + 7 \times (-7) \\ &= 10000 + 0 - 49 \\ &= 9951 \end{aligned}$$



6. Using the identity $a^2 - b^2 = (a + b)(a - b)$, find

(i) $53^2 - 47^2$

(ii) $(2.05)^2 - (0.95)^2$

(iii) $(14.3)^2 - (5.7)^2$

Solution:

$$\begin{aligned} \text{(i) } 53^2 - 47^2 &= (50 + 3)(50 - 3) \\ &= (50)^2 - (3)^2 \\ &= 2500 - 9 \\ &= 2491 \end{aligned}$$

$$\begin{aligned} \text{(ii) } (2.05)^2 - (0.95)^2 &= (2.05 + 0.95)(2.05 - 0.95) \\ &= 3 \times 1.10 \\ &= 3.3 \end{aligned}$$

(iii) $(14.3)^2 - (5.7)^2$

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$$\begin{aligned}
 &= (14.3 + 5.7)(14.3 - 5.7) \\
 &= 20 \times 8.6 \\
 &= 172
 \end{aligned}$$

7. Simplify the following:

(i) $(2x + 5y)^2 + (2x - 5y)^2$

(ii) $(7a/2 - 5b/2)^2 - (5a/2 - 7b/2)^2$

(iii) $(p^2 - q^2r)^2 + 2p^2q^2r$

Solution:

(i) $(2x + 5y)^2 + (2x - 5y)^2$ [Using, $(a \pm b)^2 = a^2 \pm 2ab + b^2$]
 $= (2x)^2 + 2 \times 2x \times 5y + (5y)^2 + (2x)^2 - 2 \times 2x \times 5y + (5y)^2$
 $= 4x^2 + 20xy + 25y^2 + 4x^2 - 20xy + 25y^2$
 $= 8x^2 + 50y^2$

(ii) $(7a/2 - 5b/2)^2 - (5a/2 - 7b/2)^2$
 $= \left[\left(\frac{7}{2}a\right)^2 - 2 \times \frac{7}{2}a \times \frac{5}{2}b + \left(\frac{5}{2}b\right)^2 \right] - \left[\left(\frac{5}{2}a\right)^2 - 2 \times \frac{5}{2}a \times \frac{7}{2}b + \left(\frac{7}{2}b\right)^2 \right]$
 $= \left[\frac{49}{4}a^2 - \frac{35}{2}ab + \frac{25}{4}b^2 \right] - \left[\frac{25}{4}a^2 - \frac{35}{2}ab + \frac{49}{4}b^2 \right]$
 $= \frac{49}{4}a^2 - \frac{35}{2}ab + \frac{25}{4}b^2 - \frac{25}{4}a^2 + \frac{35}{2}ab - \frac{49}{4}b^2$
 $= \frac{49}{4}a^2 - \frac{25}{4}a^2 + \frac{25}{4}b^2 - \frac{49}{4}b^2$
 $= \frac{24}{4}a^2 + \frac{-24}{4}b^2$
 $= 6a^2 - 6b^2$

(iii) $(p^2 - q^2r)^2 + 2p^2q^2r$ [Using, $(a - b)^2 = a^2 - 2ab + b^2$]
 $= (p^2)^2 - 2 \times p^2 \times q^2r + (q^2r)^2 + 2p^2q^2r$
 $= p^4 - 2p^2q + q^4r^2 + 2p^2q^2r$
 $= p^4 + q^4r^2$

8. Show that:

(i) $(4x + 7y)^2 - (4x - 7y)^2 = 112xy$

(ii) $(3p/7 - 7q/6)^2 + pq = 9p^2/49 + 49q^2/36$

(iii) $(p - q)(p + q) + (q - r)(q + r) + (r - p)(r + p) = 0$

Solution:

(i) Taking LHS, we have

$$\begin{aligned}
 \text{LHS} &= (4x + 7y)^2 - (4x - 7y)^2 && \text{[Using, } (a \pm b)^2 = a^2 \pm 2ab + b^2\text{]} \\
 &= [(4x)^2 + 2 \times 4x \times 7y + (7y)^2] - [(4x)^2 - 2 \times 4x \times 7y + (7y)^2] \\
 &= (16x^2 + 56xy + 49y^2) - (16x^2 - 56xy + 49y^2) \\
 &= 16x^2 + 56xy + 49y^2 - 16x^2 + 56xy - 49y^2
 \end{aligned}$$

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$$= 112xy = \text{RHS}$$

(ii) Taking LHS, we have

$$\begin{aligned} \text{LHS} &= \left(\frac{3}{7}p - \frac{7}{6}q\right)^2 + pq \\ &= \left(\frac{3}{7}p\right)^2 - 2 \times \frac{3}{7}p \times \frac{7}{6}q + \left(\frac{7}{6}q\right)^2 + pq \quad \{(a-b)^2 = a^2 - 2ab + b^2\} \\ &= \frac{9}{49}p^2 - pq + \frac{49}{36}q^2 + pq \\ &= \frac{9}{49}p^2 + \frac{49}{36}q^2 = \text{RHS} \end{aligned}$$

(iii) Taking LHS, we have

$$\begin{aligned} \text{LHS} &= (p-q)(p+q) + (q-r)(q+r) + (r-p)(r+p) \\ &= p^2 - q^2 + q^2 - r^2 + r^2 - p^2 \quad [\text{Using, } (a+b)(a-b) = a^2 - b^2] \\ &= 0 = \text{RHS} \end{aligned}$$

9. If $x + 1/x = 2$, evaluate:

(i) $x^2 + 1/x^2$ (ii) $x^4 + 1/x^4$

Solution:

(i) We have, $x + 1/x = 2$

On squaring on both sides, we get

$$(x + 1/x)^2 = 2^2$$

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

$$x^2 + 2 + 1/x^2 = 4$$

$$x^2 + 1/x^2 = 4 - 2$$

Thus,

$$x^2 + 1/x^2 = 2$$

(ii) Again squaring, we get

$$(x^2 + 1/x^2)^2 = 2^2$$

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

$$x^4 + 2 + 1/x^4 = 4$$

$$x^4 + 1/x^4 = 4 - 2$$

Thus,

$$x^4 + 1/x^4 = 2$$

10. If $x - 1/x = 7$, evaluate:

(i) $x^2 + 1/x^2$ (ii) $x^4 + 1/x^4$

Solution:

We have, $x - 1/x = 7$

On squaring on both sides, we get

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$$\begin{aligned}(x - 1/x)^2 &= 7^2 \\ x^2 - 2 \times x^2 \times 1/x^2 + 1/x^2 &= 49 \\ x^2 - 2 + 1/x^2 &= 49 \\ x^2 + 1/x^2 &= 49 + 2 \\ \text{Thus,} \\ x^2 + 1/x^2 &= 51\end{aligned}$$

(ii) Again squaring, we get

$$\begin{aligned}(x^2 + 1/x^2)^2 &= 51^2 \\ x^4 + 1/x^4 + 2 \times x^2 \times 1/x^2 &= 2601 \\ x^4 + 1/x^4 + 2 &= 2601 \\ x^4 + 1/x^4 &= 2601 - 2 \\ \text{Thus,} \\ x^4 + 1/x^4 &= 2599\end{aligned}$$

11. If $x^2 + 1/x^2 = 23$, evaluate:

(i) $x + 1/x$ (ii) $x - 1/x$

Solution:

We have, $x^2 + 1/x^2 = 23$

$$\begin{aligned}\text{(i) } (x + 1/x)^2 &= x^2 + 1/x^2 + 2 \\ &= 23 + 2 \\ &= 25\end{aligned}$$

Taking square root on both sides, we get

$$(x + 1/x) = \pm 5$$

Thus, $x + 1/x = 5$ or -5

$$\begin{aligned}\text{(ii) } (x - 1/x)^2 &= x^2 + 1/x^2 - 2 \\ &= 23 - 2 \\ &= 21\end{aligned}$$

Taking square root on both sides, we get

$$(x - 1/x) = \pm\sqrt{21}$$

Thus, $x - 1/x = \sqrt{21}$ or $-\sqrt{21}$

12. If $a + b = 9$ and $ab = 10$, find the value of $a^2 + b^2$.

Solution:

Given,

$$a + b = 9 \text{ and } ab = 10$$

Now, squaring $a + b = 9$ on both sides, we have

$$(a + b)^2 = (9)^2$$

$$a^2 + b^2 + 2ab = 81$$

$$a^2 + b^2 + 2 \times 10 = 81$$

$$a^2 + b^2 + 20 = 81$$

$$a^2 + b^2 = 81 - 20 = 61$$

$$\therefore a^2 + b^2 = 61$$

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13. If $a - b = 6$ and $a^2 + b^2 = 42$, find the value of

Solution:

Given

$$a - b = 6 \text{ and } a^2 + b^2 = 42$$

$$a - b = 6$$

Now, squaring $a - b = 6$ on both sides, we have

$$(a - b)^2 = (6)^2$$

$$a^2 + b^2 - 2ab = 36$$

$$42 - 2ab = 36$$

$$2ab = 42 - 36 = 6$$

$$ab = 6/2 = 3$$

$$\therefore ab = 3$$

14. If $a^2 + b^2 = 41$ and $ab = 4$, find the values of

(i) $a + b$

(ii) $a - b$

Solution:

Given, $a^2 + b^2 = 41$ and $ab = 4$

(i) $(a + b)^2 = a^2 + b^2 + 2ab$

$$= 41 + 2 \times 4$$

$$= 41 + 8$$

$$= 49$$

$$\therefore a + b = \pm 7$$

(ii) $(a - b)^2 = a^2 + b^2 - 2ab$

$$= 41 - 2 \times 4$$

$$= 41 - 8$$

$$= 33$$

$$\therefore a - b = \pm\sqrt{33}$$



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Check Your Progress

1. Add the following expressions:

(i) $-5x^2y + 3xy^2 - 7xy + 8$, $12x^2y - 5xy^2 + 3xy - 2$

(ii) $9xy + 3yz - 5zx$, $4yz + 9zx - 5y$, $-5xz + 2x - 5xy$

Solution:

(i) $(-5x^2y + 3xy^2 - 7xy + 8) + (12x^2y - 5xy^2 + 3xy - 2)$
 $= 7x^2y - 2xy^2 - 4xy + 6$

(ii) $(9xy + 3yz - 5zx) + (4yz + 9zx - 5y, -5xz + 2x - 5xy)$
 $= 4xy + 7yz - zx + 2x - 5y$

2. Subtract:

(i) $5a + 3b + 11c - 2$ from $3a + 5b - 9c + 3$

(ii) $10x^2 - 8y^2 + 5y - 3$ from $8x^2 - 5xy + 2y^2 + 5x - 3y$

Solution:

(i) $5a - 3b + 11c - 2$ from $3a + 5b - 9c + 3$
 $= (3a + 5b - 9c + 3) - (5a - 3b + 11c - 2)$
 $= 3a + 5b - 9c + 3 - 5a + 3b - 11c + 2$
 $= -2a + 8b - 20c + 5$

(ii) $10x^2 - 8y^2 + 5y - 3$ from $8x^2 - 5xy + 2y^2 + 5x - 3y$
 $= (8x^2 - 5xy + 2y^2 + 5x - 3y) - (10x^2 - 8y^2 + 5y - 3)$
 $= 8x^2 - 5xy + 2y^2 + 5x - 3y - 10x^2 + 8y^2 - 5y + 3$

3. What must be added to $5x^2 - 3x + 1$ to get $3x^3 - 7x^2 + 8$?

Solution:

From the question, the required expression is

$$\begin{aligned} &= (3x^3 - 7x^2 + 8) - (5x^2 - 3x + 1) \\ &= 3x^3 - 7x^2 + 8 - 5x^2 + 3x - 1 \\ &= 3x^3 - 12x^2 + 3x + 7 \end{aligned}$$

4. Find the product of

(i) $3x^2y$ and $-4xy^2$

(ii) $-(4/5)xy$, $(5/7)yz$ and $-(14/9)zx$

Solution:

Product of:

(i) $3x^2y$ and $-4xy^2$
 $= 3x^2 \times (-4xy^2)$
 $= -12x^{2+1} y^{1+2}$
 $= -12x^3y^3$

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$$\begin{aligned} & \text{(ii) } -(4/5)xy, (5/7)yz \text{ and } -(14/9)zx \\ & = -(4/5)xy \times (5/7)yz \times -(14/9)zx \\ & = -(4/5) \times (5/7) \times -(14/9) x^2y^2z^2 \\ & = (8/9)x^2y^2z^2 \end{aligned}$$

5. Multiply:

(i) $(3pq - 4p^2 + 5q^2 + 7)$ by $-7pq$

(ii) $(3/4x^2y - 4/5xy + 5/6xy^2)$ by $-15xyz$

Solution:

$$\begin{aligned} & \text{(i) } (3pq - 4p^2 + 5q^2 + 7) \times (-7pq) \\ & = -7pq \times 3pq - 7pq \times (-4p^2) + (-7pq) (5q^2) - 7pq \times 7 \\ & = -21p^2q^2 + 28p^3q - 35pq^3 - 49pq \end{aligned}$$

$$\begin{aligned} & \text{(ii) } (3/4x^2y - 4/5xy + 5/6xy^2) \times (-15xyz) \\ & = -15xyz \left(\frac{3}{4}x^2y - \frac{4}{5}xy + \frac{5}{6}xy^2 \right) \\ & = -15xyz \times \frac{3}{4}x^2y - 15xyz \times \left(\frac{-4}{5}xy \right) - 15xyz \left(\frac{5}{6}xy^2 \right) \\ & = \frac{-45}{4}x^3y^2z + 12x^2y^2z - \frac{25}{2}x^2y^3z \end{aligned}$$

6. Multiply:

(i) $(5x^2 + 4x - 2)$ by $(3 - x - 4x^2)$

(ii) $(7x^2 + 12xy - 9y^2)$ by $(3x^2 - 5xy + 3y^2)$

Solution:

$$\begin{aligned} & \text{(i) } (5x^2 + 4x - 2) \times (3 - x - 4x^2) \\ & = 5x^2(3 - x - 4x^2) + 4x(3 - x - 4x^2) - 2(3x - x - 4x^2) \\ & = 15x^2 - 5x^3 - 20x^4 + 12x - 4x^2 - 16x^3 - 6x + 2x + 8x^2 \\ & = -20x^4 - 21x^3 + 19x^2 + 14x - 6 \end{aligned}$$

$$\begin{aligned} & \text{(ii) } (7x^2 + 12xy - 9y^2) \times (3x^2 - 5xy + 3y^2) \\ & = 7x^2(3x^2 - 5xy + 3y^2) + 12xy(3x^2 - 5xy + 3y^2) - 9y^2(3x^2 - 5xy + 3y^2) \\ & = 21x^4 - 35x^3y + 21x^2y^2 + 36x^3y - 60x^2y^2 + 36xy^3 - 27x^2y^2 + 45xy^3 - 27y^4 \\ & = 21x^4 + x^3y + 81xy^3 - 66x^2y^2 - 27y^4 \end{aligned}$$

7. Simplify the following expressions and evaluate them as directed:

(i) $(3ab - 2a^2 + 5b^2) \times (2b^2 - 5ab + 3a^2) + 8a^3b - 7b^4$ for $a = 1, b = -1$

(ii) $(1.7x - 2.5y)(2y + 3x + 4) - 7.8x^2 - 10y$ for $x = 0, y = 1$.

Solution:

$$\begin{aligned} & \text{(i) } (3ab - 2a^2 + 5b^2) \times (2b^2 - 5ab + 3a^2) + 8a^3b - 7b^4 \\ & = 3ab(2b^2 - 5ab + 3a^2) - 2a^2(2b^2 - 5ab + 3a^2) + 5b^2(2b^2 - 5ab + 3a^2) + 8a^3b - 7b^4 \end{aligned}$$

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$$= 6ab^{32} - 15a^2b^2 + 9a^3b - 4a^2b^2 + 10a^3b - 6a^4 + 10b^4 - 25ab^3 + 15a^2b^2 + 8a^3b - 7b^4$$

$$= 27a^3b - 4a^2b^2 - 19ab^3 - 6a^4 + 3b^4$$

Putting, $a = 1$ and $b = (-1)$

$$= 27(1)^3(-1) - 4(1)^2(-1)^2 - 19(1)(-1)^3 - 6(1)^4 + 3(-1)^4$$

$$= -27 - 4 + 19 - 6 + 3$$

$$= -37 + 22$$

$$= -15$$

$$(ii) (1.7x - 2.5y)(2y + 3x + 4) - 7.8x^2 - 10y$$

$$1.7x(2y + 3x + 4) - 2.5y(2y + 3x + 4) - 7.8x^2 - 10y$$

$$= 3.4xy + 5.1x^2 + 6.8x - 5y^2 - 7.5xy - 10y - 7.8x^2 - 10y$$

$$= -2.7x^2 - 4.1xy - 5y^2 + 6.8x - 20y$$

Putting, $x = 0$ and $y = 1$

$$= -2.7 \times 0 - 4.1 \times 0 \times 1 - 5(1)^2 + 6.8 \times 0 - 20 \times 1$$

$$= 0 + 0 - 5 + 0 - 20$$

$$= -25$$

8. Carry out the following divisions:

(i) $66pq^2r^3 \div 11qr^2$

(ii) $(x^3 + 2x^2 + 3x) \div 2x$

Solution:

(i) $66pq^2r^3 / 11qr^2$

$$= 6pq^{2-1}r^{3-2}$$

$$= 6pqr$$

(ii) $(x^3 + 2x^2 + 3x) / 2x$

$$= x^3/2x + 2x^2/2x + 3x/2x$$

$$= \frac{1}{2}x^2 + x + \frac{3}{2}$$



9. Divide $10x^4 - 19x^3 + 17x^2 + 15x - 42$ by $2x^2 - 3x + 5$.

Solution:

$$(10x^4 - 19x^3 + 17x^2 + 15x - 42) \div (2x^2 - 3x + 5)$$

Performing long division, we have

$$\begin{array}{r}
 5x^2 - 2x - 7 \\
 \hline
 2x^2 - 3x + 5 \overline{) 10x^4 - 19x^3 + 17x^2 + 15x - 42} \\
 \underline{10x^4 - 15x^3 + 25x^2} \\
 -4x^3 - 8x^2 + 15x \\
 \underline{-4x^3 + 6x^2 - 10x} \\
 +14x^2 + 25x - 42 \\
 \underline{-14x^2 + 21x - 35} \\
 +4x - 7 \\
 \hline
 4x - 7
 \end{array}$$

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Thus, Quotient = $5x^2 - 2x - 7$ and Remainder = $4x - 7$

10. Using identities, find the following products:

(i) $(3x + 4y)(3x + 4y)$

(ii) $(5a/2 - b)(5a/2 - b)$

(iii) $(3.5m - 1.5n)(3.5m + 1.5n)$

(iv) $(7xy - 2)(7xy + 7)$

Solution:

(i) $(3x + 4y)(3x + 4y)$

$= (3x + 4y)^2$

$= (3x)^2 + 2 \times 3x \times 4y + (4y)^2$ [Using, $(a + b)^2 = a^2 + 2ab + b^2$]

$= 9x^2 + 24xy + 16y^2$

(ii) $(5a/2 - b)(5a/2 - b)$

$= (5a/2 - b)^2$

$= (5a/2)^2 + 2 \times 5a/2 \times (-b) + (b)^2$ [Using, $(a - b)^2 = a^2 - 2ab + b^2$]

$= 25a^2/4 - 5ab + b^2$

(iii) $(3.5m - 1.5n)(3.5m + 1.5n)$

$= (3.5m)^2 - (1.5n)^2$

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

$= 12.25m^2 - 2.25n^2$

(iv) $(7xy - 2)(7xy + 7)$

$= (7xy)^2 + (-2 + 7) \times (7xy) + (-2) \times 7$ [Using, $(x + a)(x + b) = x^2 + (a + b)x + ab$]

$= 49x^2y^2 + 35xy - 14$

11. Using suitable identities, evaluate the following:

(i) 105^2

(ii) 97^2

(iii) 201×199

(iv) $87^2 - 13^2$

(v) 105×107

Solution:

(i) $(105)^2 = (100 + 5)^2$

$= (100)^2 + 2 \times 100 \times 5 + (5)^2$

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

$= 10000 + 1000 + 25$

$= 11025$

(ii) $(97)^2 = (100 - 3)^2$

$= (100)^2 - 2 \times 100 \times 3 + (3)^2$

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

$= 10000 - 600 + 9$

$= 10009 - 600$

$= 9409$

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$$\begin{aligned} \text{(iii) } 201 \times 199 &= (200 + 1)(200 - 1) \\ &= (200)^2 - (1)^2 \\ &= 40000 - 1 \\ &= 39999 \end{aligned}$$

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

$$\begin{aligned} \text{(iv) } 87^2 - 13^2 \\ &= (87 + 13)(87 - 13) \\ &= 100 \times 74 \\ &= 7400 \end{aligned}$$

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

$$\begin{aligned} \text{(v) } 105 \times 107 \\ &= (100 + 5)(100 + 7) \\ &= (100)^2 + (5 + 7) \times 100 + 5 \times 7 \\ &= 10000 + 1200 + 35 \\ &= 11235 \end{aligned}$$

$$[\text{Using, } (x + a)(x + b) = x^2 + (a + b)x + ab]$$

12. Prove that following:

(i) $(a + b)^2 - (a - b)^2 + 4ab$

(ii) $(2a + 3b)^2 + (2a - 3b)^2 = 8a^2 + 18b^2$

Solution:

(i) Taking the RHS, we have

$$\begin{aligned} \text{RHS} &= (a - b)^2 + 4ab \\ &= a^2 - 2ab + b^2 + 4ab \\ &= a^2 + 2ab + b^2 \\ &= (a + b)^2 = \text{L.H.S.} \end{aligned}$$



(ii) Taking the LHS, we have

$$\begin{aligned} \text{LHS} &= (2a + 3b)^2 + (2a - 3b)^2 \\ &= (2a)^2 + 2 \times 2a \times 3b + (3b)^2 + (2a)^2 - 2 \times 2a \times 3b + (3b)^2 \\ &= 4a^2 + 12ab + 9b^2 + 4a^2 - 12ab + 9b^2 \\ &= 8a^2 + 18b^2 = \text{RHS} \end{aligned}$$

13. If $x + 1/x = 5$, evaluate

(i) $x^2 + 1/x^2$ (ii) $x^4 + 1/x^4$

Solution:

(i) We have, $x + 1/x = 5$

On squaring on both sides, we get

$$\begin{aligned} (x + 1/x)^2 &= 5^2 \\ x^2 + 1/x^2 + 2 \times x \times 1/x &= 25 \\ x^2 + 2 + 1/x^2 &= 25 \\ x^2 + 1/x^2 &= 25 - 2 \\ \text{Hence, } x^2 + 1/x^2 &= 23 \end{aligned}$$

(ii) Again, squaring $x^2 + 1/x^2 = 23$ on both sides, we get

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$$(x^2 + 1/x^2)^2 = 23^2$$

$$x^4 + 1/x^4 + 2 \times x^2 \times 1/x^2 = 529$$

$$x^4 + 1/x^4 + 2 = 529$$

$$x^4 + 1/x^4 = 529 - 2$$

Hence,

$$x^4 + 1/x^4 = 527$$

14. If $a + b = 5$ and $a^2 + b^2 = 13$, find ab .

Solution:

Given,

$$a + b = 5 \text{ and } a^2 + b^2 = 13$$

On squaring $a + b = 5$ both sides, we get

$$(a + b)^2 = (5)^2$$

$$a^2 + b^2 + 2ab = 25$$

$$13 + 2ab = 25 \Rightarrow 2ab = 25 - 13 = 12$$

$$\Rightarrow ab = 12/2 = 6$$

$$\therefore ab = 6$$

