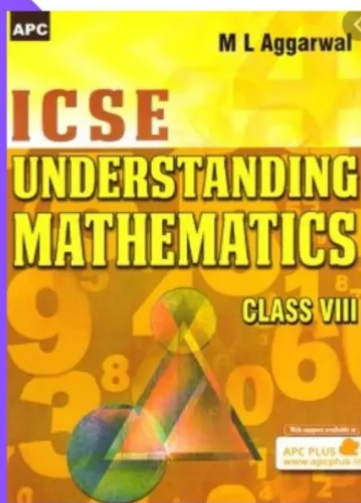


ML Aggarwal Solutions for Class 8 Maths

Chapter 10- Algebraic Expressions and Identities



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CLASS 8 MATHS

Chapter 10: Algebraic
Expressions and Identities

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ML Aggarwal Solutions for Class 8 Maths

Chapter 10- Algebraic Expressions and Identities

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ML Aggarwal Solutions for Class 8 Maths Chapter 10- Algebraic Expressions and Identities

ML Aggarwal 8th Maths Chapter 10, Class 8 Maths Chapter 10 solutions

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:

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	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:

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

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

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

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:

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

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

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

On adding the expressions, we have

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

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

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

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

On adding the expressions, we have

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

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

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(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

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

$$= 14a - 5ab + 7b - 5 - 8a - 3ab + 2b - 7$$

$$= 6a - 8ab + 9ab - 12$$

(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

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

$$= 18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q - 7p^2q + 3pq - 5pq^2 + 8p - 7q + 10$$

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$$= 28 + 5p - 78q + 8pq - 7pq^2 + p^2q$$

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 $3a^2 - 5ab - 2b^2 - 3$

$$= 3a^2 - 5ab - 2b^2 - 3 - (5a^2 - 7ab - 3b^2 + 3a)$$

$$= 3a^2 - 5ab - 2b^2 - 3 - 5a^2 + 7ab + 3b^2 - 3a$$

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

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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,

Perimeter of a triangle = $7p^2 - 5p + 11$

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

We know that,

Perimeter of a triangle = Sum of three sides of triangle

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

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

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

$$= (7p^2 - 4p^2) + (-5p + 4p) + (11 - 2)$$

$$= 3p^2 - p + 9$$

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

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:

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Product of:

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

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

$$\begin{aligned} \text{(iii)} \quad & \left(-\frac{2}{3}p^2q\right) \times \left(\frac{3}{4}pq^2\right) \times (5pqr) \\ &= -\frac{2}{3} \times \frac{3}{4} \times 5 \times p^2q \times pq^2 \times pqr \\ &= -\frac{5}{2}p^4q^4r \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & (-7ab) \times (-3a^3) \times \left(-\frac{2}{7}ab^2\right) \\ &= (-7) \times (-3) \times \left(-\frac{2}{7}\right) \times ab \times a^3 \times ab^2 \\ &= -6a^5b^3. \end{aligned}$$

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

2. Multiply:

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

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

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(iii) $(\frac{2}{3}a^2b - \frac{4}{5}ab^2 + \frac{2}{7}ab + 3)$ 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) $-2pq \times (2p^2 - 3pq + 5q^2 + 5)$

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

$$= -4p^3q + 6p^2q^2 - 10pq^3 - 10pq$$

(iii)

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

$$= (\frac{2}{3})a^2b \times 35ab - (\frac{4}{5})ab^2 \times 35ab + (\frac{2}{7})ab \times 35ab + 3 \times 35ab$$

$$= (\frac{70}{3})a^3b^2 - 28a^2b^3 + 10a^2b^2 + 105ab$$

(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:

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

$$\therefore \text{Volume} = \text{Length} \times \text{breadth} \times \text{height}$$

$$= 5ab \times 3a^2b \times 7a^4b^2$$

$$= 5 \times 3 \times 7 \times a^{1+2+4} \times b^{1+1+2}$$

$$= 105a^7b^4$$

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

$$\therefore \text{Volume} = \text{Length} \times \text{breadth} \times \text{height}$$

$$= 2pq \times 4q^2 \times 8rp$$

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$$= 2 \times 4 \times 8 \times p^{1+1} \times q^{1+2} \times r$$

$$= 64p^2q^3r$$

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

(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 $x = 1$

$$3x^2 - 2x^3 + x^4 = 3(1)^2 - 2(1)^3 + (1)^4$$

$$= 3 \times 1 - 2 \times 1 + 1$$

$$= 3 - 2 + 1 = 2$$

(b) For $x = -1$

$$3x^2 - 2x^3 + x^4 = 3(-1)^2 - 2(-1)^3 + (-1)^4$$

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

$$= 3 + 2 + 1 = 6$$

(c) For $x = 2/3$

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

$$= 3 \times (4/9) - 2 \times (8/27) + (16/81)$$

$$= (4/3) - (16/27) + (16/81)$$

$$= (108 - 48 + 16)/81$$

$$= (124 - 48)/81$$

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$$= 76/81$$

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

$$3x^2 - 2x^3 + x^4 = 3(-1/2)^2 - 2(-1/2)^3 + (-1/2)^4$$

$$= 3 \times (1/4) - 2 \times (-1/8) + (1/16)$$

$$= (3/4) + 1/4 + (1/16)$$

$$= (12 + 4 + 1)/16$$

$$= 17/16$$

(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

$$= 18(2)^2 \times (-1) + 17(2)(-1)^2 - 35(2)(-1) - 27(-1) - 8$$

$$= 18 \times 4 \times (-1) + 17 \times 2 \times 1 - 35 \times 2 \times (-1) - 27 \times (-1) - 8$$

$$= -74 + 34 + 70 + 27 - 8$$

$$= 131 - 80 = 51$$

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 $8p^3 - 3p$

$$= 8p - 4p^3 + 8p^3 - 3p$$

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$$= 5p + 4p^3$$

$$= 4p^3 + 5p$$

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

$$= 56x^2y + 14xy^2 - 21xy + 12xy^3 - 28x^2y^2 + 32xy^2$$

$$= 12xy^3 - 28x^2y^2 + 56x^2y + 46xy^2 - 21xy$$

7. Subtract:

(i) $6x(x - y + z) - 3y(x + y - z)$ from $2z(-x + y + z)$

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

Solution:

Subtracting,

(i) $6x(x - y + z) - 3y(x + y - z)$ from $2z(-x + y + z)$

$$\Rightarrow 6x^2 - 6xy + 6xz - 3xy - 3y^2 + 3yz \text{ from } -2xz + 2yz + 2z^2$$

$$= (-2xz + 2yz + 2z^2) - (6x^2 - 6xy + 6xz - 3xy - 3y^2 + 3yz)$$

$$= -2xz + 2yz + 2z^2 - 6x^2 + 6xy - 6xz + 3xy + 3y^2 - 3yz$$

$$= 9xy - yz - 8zx - 6x^2 + 3y^2 + 2z^2$$

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

$$\Rightarrow 7x^3y - 14x^2y^2 + 21xy^3 - 8x^3y + 32x^2y - 56x^2y^2 \text{ from } 12x^2y^2 - 15xy^2 + 24xy^3$$

$$= (12x^2y^2 - 15xy^2 + 24xy^3) - (7x^3y - 14x^2y^2 + 21xy^3 - 8x^3y + 32x^2y - 56x^2y^2)$$

$$= 12x^2y^2 - 15xy^2 + 24xy^3 - 7x^3y + 14x^2y^2 - 12xy^3 + 8x^3y - 32x^2y + 56x^2y^2$$

$$= 82x^2y^2 + 3xy^3 + x^3y - 15xy^2 - 32x^2y$$

Exercise 10.3

1. Multiply:

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

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(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)

Solution:

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

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

$$= 5x(3x + 4) - 2(3x + 4)$$

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

$$= 15x^2 + 14x - 8$$

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

$$= (ax + b) \times (cx + d)$$

$$= ax(cx + d) + b(cx + d)$$

$$= acx^2 + adx + bcx + bd$$

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

$$= (4p - 7) \times (2 - 3p)$$

$$= 4p(2 - 3p) - 7(2 - 3p)$$

$$= 8p - 12p^2 - 14 + 21p$$

$$= 29p - 12p^2 - 14$$

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

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

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

$$= 6x^3 - 10x^2 + 9x - 15$$

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

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$$= (1.5a - 2.5b)(1.5a + 2.5b)$$

$$= 1.5a(1.5 + 2.5b) - 2.5b(1.5a + 2.5b)$$

$$= 2.25a^2 + 3.75ab - 3.75ab - 6.25b^2$$

$$= 2.25a^2 - 6.25b^2$$

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

$$= \left(\frac{3}{7}p^2 + 4q^2 \right) \times 7\left(p^2 - \frac{3}{4}q^2 \right)$$

$$= 7\left(\frac{3}{7}p^2 + 4q^2 \right) \left(p^2 - \frac{3}{4}q^2 \right)$$

$$= 7\left[\frac{3}{7}p^2\left(p^2 - \frac{3}{4}q^2 \right) + 4q^2\left(p^2 - \frac{3}{4}q^2 \right) \right]$$

$$= 7\left[\frac{3}{7}p^4 - \frac{9}{28}p^2q^2 + 4p^2q^2 - 3q^4 \right]$$

$$= 3p^4 - \frac{9}{4}p^2q^2 + 28p^2q^2 - 21q^4$$

$$= 3p^4 - \frac{9p^2q^2 + 112p^2q^2}{4} - 21q^4$$

$$= 3p^4 + \frac{103}{4}p^2q^2 - 21q^4$$

2. Multiply:

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

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

Solution:

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

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

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

$$= x^2 + 2xy - 2xy - 4y^2 + 3x + 6y$$

$$= x^2 - 4y^2 + 3x + 6y$$

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

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

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

$$= 12x - 20x^2 + 8x^3 - 15 + 25x - 10x^2$$

$$= 8x^3 - 30x^2 + 37x - 15$$

3. Multiply:

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

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

Solution:

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

$$= (3x^2 - 2x - 1)(2x^2 + x - 5)$$

$$= 3x^2(2x^2 + x - 5) - 2x(2x^2 + x - 5) - 1(2x^2 + x - 5)$$

$$= 6x^4 + 3x^3 - 15x^2 - 4x^3 - 2x^2 + 10x - 2x^2 - x + 5$$

$$= 6x^4 - x^3 - 19x^2 + 9x + 5$$

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

$$= (2 - 3y - 5y^2) \times (2y - 1 + 3y^2)$$

$$= 2(2y - 1 + 3y^2) - 3y(2y - 1 + 3y^2) - 5y^2(2y - 1 + 3y^2)$$

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$$\begin{aligned} &= 4y - 2 + 6y^2 - 6y^2 + 3y - 9y^3 - 10y^3 + 5y^2 - 15y^4 \\ &= -15y^4 - 19y^3 + 5y^2 + 7y - 2 \end{aligned}$$

4. Simplify:

(i) $(x^2 + 3)(x - 3) + 9$

(ii) $(x + 3)(x - 3)(x + 4)(x - 4)$

(iii) $(x + 5)(x + 6)(x + 7)$

(iv) $(p + q - 2r)(2p - q + r) - 4qr$

(v) $(p + q)(r + s) + (p - q)(r - s) - 2(pr + qs)$

(vi) $(x + y + z)(x - y + z) + (x + y - z)(-x + y + z) - 4zx$

Solution:

(i) $(x^2 + 3)(x - 3) + 9$

$$= x^2(x - 3) + 3(x - 3) + 9$$

$$= x^2 - 3x^2 + 3x - 9 + 9$$

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

(ii) $(x + 3)(x - 3)(x + 4)(x - 4)$

$$= \{(x + 3)(x - 3)\} \times \{(x + 4)(x - 4)\}$$

$$= \{x(x - 3) + 3(x - 3)\} \{x(x - 4) + 4(x - 4)\}$$

$$= (x^2 - 3x + 3x - 9) \{x^2 - 4x + 4x - 16\}$$

$$= (x^2 - 9)(x^2 - 16)$$

$$= x^2(x^2 - 16) - 9(x^2 - 16)$$

$$= x^4 - 16x^2 - 9x^2 + 144$$

$$= x^4 - 25x^2 + 144$$

(iii) $(x + 5)(x + 6)(x + 7)$

$$= \{(x + 5) \times (x + 6)\} (x + 7)$$

$$= (x^2 + 6x + 5x + 30)(x + 7)$$

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$$= (x^2 + 11x + 30)(x + 7)$$

$$= x(x^2 + 11x + 30) + 7(x^2 + 11x + 30)$$

$$= x^3 + 11x^2 + 30x + 7x^2 + 77x + 210$$

$$= x^3 + 18x^2 + 107x + 210$$

$$(iv) (p + q - 2r)(2p - q + r) - 4qr$$

$$= p(2p - q + r) + q(2p - q + r) - 2r(2p - q + r) - 4qr$$

$$= 2p^2 - pq + pr + 2pq - q^2 + qr - 4pr + 2qr - 2r^2 - 4qr$$

$$= 2p^2 - q^2 - 2r^2 + pq - 3pr - 2qr$$

$$(v) (p + q)(r + s) + (p - q)(r - s) - 2(pr + qs)$$

$$= (pr + ps + qr + qs) + (pr - ps - qr + qs) - 2pr - 2qs$$

$$= 0$$

$$(vi) (x + y + z)(x - y + z) + (x + y - z)(-x + y + z) - 4zx$$

$$= x^2 - xy + xz + xy - y^2 + yz + xz - yz + z^2 - x^2 + xy + xz$$

$$- xy + x^2 + yx + xz - yz - z^2 - 4zx$$

$$= 0$$

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

$$= (5x^2 + 25xy + 4y^2)(2x^2 - 2xy + 3y^2)$$

$$= 10x^4 - 10x^3y + 15x^2y^2 + 50x^3y - 50x^2y^2 + 75xy^3 + 8x^2y^2 - 8xy^3 + 12y^4$$

$$= 10x^4 + 40x^3y - 27x^2y^2 + 67xy^3 + 12y^4$$

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Thus,

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

Exercise 10.4

1. Divide:

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

(ii) $-\frac{3}{4}a^2b^3$ by $\frac{6}{7}a^3b^2$

Solution:

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

$$= -39pq^2r^5 / -24p^3q^3r$$

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

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

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:

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

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

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

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

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

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

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

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

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

∴ 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

$$-2x^2 + x + 5 \div x + 1$$

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

∴ Quotient = $-2x + 3$ and remainder = 2

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

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

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

4. Divide:

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

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

Solution:

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

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

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

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

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

∴ 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) $a^3 + 2a^2 + 2a + 1 \div a^2 + a + 1$

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

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

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$\therefore$ 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,

Area of rectangle = $8x^2 - 45y^2 + 18xy$

And, one side = $4x + 15y$

$\therefore$ Second (adjacent) side = Area of rectangle / One side

$$= 8x^2 - 45y^2 + 18xy \div 4x + 15y$$

$$\begin{array}{r} 2x - 3y \\ 4x + 15y \overline{) 8x^2 + 18xy - 45y^2} \\ \underline{8x^2 + 30xy} \\ -12xy - 45y^2 \\ \underline{-12xy - 45y^2} \\ + + \\ \hline 0 \end{array}$$

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

Exercise 10.5

1. Using suitable identities, find the following products:

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

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

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

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

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

(viii) 9.62

Solution:

(i) $(81)^2 = (80 + 1)^2$

$$= (80)^2 + 2 \times 80 \times 1 + (1)^2 \text{ [Using, } (a + b)^2 = a^2 + 2ab + b^2]$$

$$= 6400 + 160 + 1$$

$$= 6561$$

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

$$= (100)^2 - 2 \times 100 \times 3 + (3)^2 \text{ [Using, } (a - b)^2 = a^2 - 2ab + b^2]$$

$$= 10000 - 600 + 9$$

$$= 10009 - 600$$

$$= 9409$$

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

$$= (100)^2 + 2 \times 100 \times 5 + (5)^2 \text{ [Using, } (a + b)^2 = a^2 + 2ab + b^2]$$

$$= 10000 + 1000 + 25$$

$$= 11025$$

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$$(iv) (997)^2 = (1000 - 3)^2$$

$$= (1000)^2 - 2 \times 1000 \times 3 + (3)^2 \text{ [Using, } (a - b)^2 = a^2 - 2ab + b^2]$$

$$= 1000000 - 6000 + 9$$

$$= 1000009 - 6000$$

$$= 994009$$

$$(v) (6.1)^2 = (6 + 0.1)^2$$

$$= (6)^2 + 2 \times 6 \times 0.1 + (0.1)^2 \text{ [Using, } (a + b)^2 = a^2 + 2ab + b^2]$$

$$= 36 + 1.2 + 0.01$$

$$= 37.21$$

$$(vi) 496 \times 504$$

$$= (500 - 4) (500 + 4) \text{ [Using, } (a + b) (a - b) = a^2 - b^2]$$

$$= (500)^2 - (4)^2$$

$$= 250000 - 16$$

$$= 249984$$

$$(vii) 20.5 \times 19.5$$

$$= (20 + 0.5) (20 - 0.5) \text{ [Using, } (a + b) (a - b) = a^2 - b^2]$$

$$= (20)^2 - (0.5)^2$$

$$= 400 - 0.25$$

$$= 399.75$$

$$(viii) (9.6)^2 = (10 - 0.4)^2$$

$$= (10)^2 - 2 \times 10 \times 0.4 + (0.4)^2 \text{ [Using, } (a - b)^2 = a^2 - 2ab + b^2]$$

$$= 100 - 8.0 + 0.16$$

$$= 92.16$$

3. Find the following squares, using the identities:

(i) $(pq + 5r)^2$ (ii) $(5a/2 - 3b/5)^2$

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(iii) $(\sqrt{2a} + \sqrt{3b})^2$ (iv) $(2x/3y - 3y/2x)^2$

Solution:

(i) $(pq + 5r)^2$

$$= (pq)^2 + 2 \times pq \times 5r + (5r)^2 \text{ [Using, } (a + b)^2 = a^2 + 2ab + b^2]$$

$$= p^2q^2 + 10pqr + 25r^2$$

(ii) $(5a/2 - 3b/5)^2$

$$= (5a/2)^2 - 2 \times (5a/2) \times (-3b/5) + (3b/5)^2 \text{ [Using, } (a - b)^2 = a^2 - 2ab + b^2]$$

$$= 25a^2/4 - 3ab + 9b^2/25$$

(iii) $(\sqrt{2a} + \sqrt{3b})^2$

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

$$= 2a^2 + 2\sqrt{6ab} + 3b^2$$

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

$$\begin{aligned} &= \left(\frac{2x}{3y}\right)^2 - 2 \times \frac{2x}{2y} \times \frac{3y}{2x} + \left(\frac{3y}{2x}\right)^2 \quad \{(a - b)^2 = a^2 - 2ab + b^2\} \\ &= \frac{4x^2}{9y^2} - 2 + \frac{9y^2}{4x^2} \end{aligned}$$

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) $(x + 7)(x + 3)$

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

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

$$(ii) (3x + 4)(3x - 5)$$

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

$$= 9x^2 - 3x - 20$$

$$(iii) (P^2 + 2q)(p^2 - 3q)$$

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

$$= p^4 - p^2q - 6pq$$

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

$$= (abc)^2 + (3 - 5)abc + 3 \times (-5)$$

$$= a^2b^2c^2 - 2abc - 15$$

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

$$(i) 203 \times 204$$

$$(ii) 8.2 \times 8.7$$

$$(iii) 107 \times 93$$

Solution:

$$(i) 203 \times 204$$

$$= (200 + 3)(200 + 4)$$

$$= (200)^2 + (3 + 4) \times 200 + 3 \times 4$$

$$= 40000 + 1400 + 12$$

$$= 41412$$

$$(ii) 8.2 \times 8.7$$

$$= (8 + 0.2)(8 + 0.7)$$

$$= (8)^2 + (0.2 + 0.7) \times 8 + 0.2 \times 0.7$$

$$= 64 + 8 \times (0.9) + 0.14$$

$$= 64 + 7.2 + 0.14$$

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$$= 71.34$$

$$(iii) 107 \times 93$$

$$= (100 + 7) (100 - 7)$$

$$= (100)^2 + (7 - 7) \times 100 + 7 \times (-7)$$

$$= 10000 + 0 - 49$$

$$= 9951$$

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:

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

$$= (50 + 3) (50 - 3)$$

$$= (50)^2 - (3)^2$$

$$= 2500 - 9$$

$$= 2491$$

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

$$= (2.05 + 0.95) (2.05 - 0.95)$$

$$= 3 \times 1.10$$

$$= 3.3$$

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

$$= (14.3 + 5.7) (14.3 - 5.7)$$

$$= 20 \times 8.6$$

$$= 172$$

7. Simplify the following:

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

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(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

$$\begin{aligned}\text{LHS} &= (4x + 7y)^2 - (4x - 7y)^2 \text{ [Using, } (a \pm b)^2 = a^2 \pm 2ab + b^2\text{]} \\ &= [(4x)^2 + 2 \times 4x \times 7y + (7y)^2] - [(4x)^2 - 2 \times 4x \times 7y + (7y)^2] \\ &= (16x^2 + 56xy + 49y^2) - (16x^2 - 56xy + 49y^2) \\ &= 16x^2 + 56xy + 49y^2 - 16x^2 + 56xy - 49y^2 \\ &= 112xy = \text{RHS}\end{aligned}$$

(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

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

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

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

Solution:

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(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

$$(x - 1/x)^2 = 7^2$$

$$x^2 - 2 \times x \times 1/x + 1/x^2 = 49$$

$$x^2 - 2 + 1/x^2 = 49$$

$$x^2 + 1/x^2 = 49 + 2$$

Thus,

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$$x^2 + 1/x^2 = 51$$

(ii) Again squaring, we get

$$(x^2 + 1/x^2)^2 = 51^2$$

$$x^4 + 1/x^4 + 2 \times x^2 \times 1/x^2 = 2601$$

$$x^4 + 1/x^4 + 2 = 2601$$

$$x^4 + 1/x^4 = 2601 - 2$$

Thus,

$$x^4 + 1/x^4 = 2599$$

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

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

Solution:

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

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

$$= 23 + 2$$

$$= 25$$

Taking square root on both sides, we get

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

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

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

$$= 23 - 2$$

$$= 21$$

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 $a^2 + b^2$.

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Solution:

Given,

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

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

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

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

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

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

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

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

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) $a - b$

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Solution:

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

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

$$= 41 + 2 \times 4$$

$$= 41 + 8$$

$$= 49$$

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

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

$$= 41 - 2 \times 4$$

$$= 41 - 8$$

$$= 33$$

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

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:

$$(i) 5a + 3b + 11c - 2 \text{ from } 3a + 5b - 9c + 3$$

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

Solution:

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(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 $8x^2 - 5xy + 2y^2 + 5x - 3y$

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

$$= 8x^2 - 5xy + 2y^2 + 5x - 3y - 10x^2 + 8y^2 - 5y + 3$$

$$= -2x^2 - 5xy + 10y^2 + 5x - 8y + 3$$

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

$$= (3x^3 - 7x^2 + 8) - (5x^2 - 3x + 1)$$

$$= 3x^3 - 7x^2 + 8 - 5x^2 + 3x - 1$$

$$= 3x^3 - 12x^2 + 3x + 7$$

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 $-4xy^2$

$$= 3x^2 \times (-4xy^2)$$

$$= -12x^{2+1}y^{1+2}$$

$$= -12x^3y^3$$

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

$$= -(4/5)xy \times (5/7)yz \times -(14/9)zx$$

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$$= -(4/5) \times (5/7) \times -(14/9) x^2 y^2 z^2$$

$$= (8/9) x^2 y^2 z^2$$

5. Multiply:

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

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

Solution:

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

$$= -7pq \times 3pq - 7pq \times (-4p^2) + (-7pq) (5q^2) - 7pq \times 7$$

$$= -21p^2q^2 + 28p^3q - 35pq^3 - 49pq$$

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

$$= -15xyz \left(\frac{3}{4} x^2 y - \frac{4}{5} xy + \frac{5}{6} xy^2 \right)$$

$$= -15xyz \times \frac{3}{4} x^2 y - 15xyz \times \left(-\frac{4}{5} xy \right) - 15xyz \left(\frac{5}{6} xy^2 \right)$$

$$= \frac{-45}{4} x^3 y^2 z + 12x^2 y^2 z - \frac{25}{2} x^2 y^3 z$$

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:

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

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

$$= 15x^2 - 5x^3 - 20x^4 + 12x - 4x^2 - 16x^3 - 6x + 2x + 8x^2$$

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$$= -20x^4 - 21x^3 + 19x^2 + 14x - 6$$

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

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

$$= 21x^4 - 35x^3y + 21x^2y^2 + 36x^3y - 60x^2y^2 + 36xy^3 - 27x^2y^2 + 45xy^3 - 27y^4$$

$$= 21x^4 + x^3y + 81xy^3 - 66x^2y^2 - 27y^4$$

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

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

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

Solution:

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

$$= 3ab(2b^2 - 5ab + 3a^2) - 2a^2(2b^2 - 5ab + 3a^2) + 5b^2(2b^2 - 5ab + 3a^2) + 8a^3b - 7b^4$$

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

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

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 $y = 1$

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

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

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$$= -25$$

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

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

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

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

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

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

$$= (3.5m)^2 - (1.5n)^2 \text{ [Using, } (a - b)(a + b) = a^2 - b^2]$$

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

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

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

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

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:

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

$$= (100)^2 + 2 \times 100 \times 5 + (5)^2 \text{ [Using, } (a + b)^2 = a^2 + 2ab + b^2]$$

$$= 10000 + 1000 + 25$$

$$= 11025$$

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

$$= (100)^2 - 2 \times 100 \times 3 + (3)^2 \text{ [Using, } (a - b)^2 = a^2 - 2ab + b^2]$$

$$= 10000 - 600 + 9$$

$$= 10009 - 600$$

$$= 9409$$

$$(iii) 201 \times 199 = (200 + 1)(200 - 1)$$

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$$= (200)^2 - (1)^2 \text{ [Using, } (a + b)(a - b) = a^2 - b^2 \text{]}$$

$$= 40000 - 1$$

$$= 39999$$

$$\text{(iv) } 87^2 - 13^2$$

$$= (87 + 13)(87 - 13) \text{ [Using, } a^2 - b^2 = (a + b)(a - b) \text{]}$$

$$= 100 \times 74$$

$$= 7400$$

$$\text{(v) } 105 \times 107$$

$$= (100 + 5)(100 + 7)$$

$$= (100)^2 + (5 + 7) \times 100 + 5 \times 7 \text{ [Using, } (x + a)(x + b) = x^2 + (a + b)x + ab \text{]}$$

$$= 10000 + 1200 + 35$$

$$= 11235$$

12. Prove that following:

$$\text{(i) } (a + b)^2 - (a - b)^2 + 4ab$$

$$\text{(ii) } (2a + 3b)^2 + (2a - 3b)^2 = 8a^2 + 18b^2$$

Solution:

(i) Taking the RHS, we have

$$\text{RHS} = (a - b)^2 + 4ab$$

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

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

$$= (a + b)^2 = \text{L.H.S.}$$

(ii) Taking the LHS, we have

$$\text{LHS} = (2a + 3b)^2 + (2a - 3b)^2$$

$$= (2a)^2 + 2 \times 2a \times 3b + (3b)^2 + (2a)^2 - 2 \times 2a \times 3b + (3b)^2$$

$$= 4a^2 + 12ab + 9b^2 + 4a^2 - 12ab + 9b^2$$

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$$= 8a^2 + 18b^2 = \text{RHS}$$

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

$$(x + 1/x)^2 = 5^2$$

$$x^2 + 1/x^2 + 2 \times x \times 1/x = 25$$

$$x^2 + 2 + 1/x^2 = 25$$

$$x^2 + 1/x^2 = 25 - 2$$

Hence, $x^2 + 1/x^2 = 23$

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

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

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

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

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

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

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

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

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

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

$$\therefore ab = 6$$



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- Chapter 2- Exponents and Powers
- Chapter 3- Squares and Square Roots
- Chapter 4- Cubes and Cube Roots
- Chapter 5- Playing with Numbers
- Chapter 6- Operation On Sets Venn Diagram
- Chapter 7- Percentage
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- Chapter 11- Factorisation
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M. L. Aggarwal, is an Indian mechanical engineer, educator. His achievements include research in solutions of industrial problems related to fatigue design. Recipient Best Paper award, Manipal Institute of Technology, 2004. Member of TSTE.

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