CHAPTER 9

Algebraic Expressions and Identities

Understanding the Lesson

- Algebraic expression and its elements.
- Terms, Factors and Coefficients.
- Monomials, Binomials and Polynomials.
- Like and unlike terms.
- Addition and Subtraction of Algebraic function.
- Multiplication of Algebraic Expressions.
- Multiplication of monomial by a monomial.
- Multiplication of a monomial by a polynomial.
- Multiplication of a polynomial by a polynomial.
- Multiplication of a binomial by a trinomial.
- Standard Identities.

Conceptual Facts

- **Algebraic Expression:** A combination of numbers which includes literal number connected by the symbols +, –, × and ÷ is called an algebraic expression.

  For example: $5x$, $8x - 3$, $2x + 3y$, $\frac{3}{4}x^2$, $4xyz$ are some algebraic expressions.

  Here, 5, 8, 3, 2, $\frac{3}{4}$ and 4 are constants and the literal numbers are x, y and z.

  The different parts of the expression are called terms.

  $$5x,\ 8x,\ 2x,\ 3y,\ \frac{3x^2}{4} \text{ etc., are all the terms.}$$

  Coefficient: A coefficient is a multiplicative factor in some term of a polynomial. It is usually a number, but may be only expression along.

  For example in $7x^2 - 3xy + y + 3$. The first three terms respectively have coefficient 7, –3 and 3 is a constant in given polynomial.

- **Monomial:** The expression having only one term is called monomial.
  For example: $3x$, $8xy$, $6x^2$, $11xyz$, etc.
- **Binomial:** The expression containing two terms is called binomial.

  For example: $2x + y$, $x + y$, $3xy - 5z$, $\frac{1}{2}xy + 5$, etc.
- **Trinomial:** The expression containing three terms is called trinomial.

  For example: $x + 2y + 3$, $xy - z + \frac{1}{2}$, $\frac{1}{2}x^2 + 2x + 5$, etc.
- **Polynomial:** Algebraic expression containing one or more terms with non-zero coefficient is called a polynomial.

  For example: $2 + 3x$, $x + y + 3z - 5$, $\frac{1}{2}x^2 + yz - 5$, etc.
- **Like and Unlike Terms:** Algebraic expressions having same combination of literal numbers are called like terms.

For example: $4xy$, $-5xy$, $\frac{17}{3}xy$, are like terms.

Algebraic expressions having different combinations of literal numbers are called unlike terms.

For example: (xy, yz, zx), $(2x^2, -5xy^2, 7xyz)$, $(3, -5x, 7yz)$ etc.

- **Degree of Algebraic Expression:** Highest power of the variable of an algebraic expression is called its degree.

  For example: Degree of $3x^2 - 7x + 5$ is 2.

- **Addition or Subtraction of two or more polynomials:**

  (*i*) Collect the like terms together.

  (*ii*) Find the sum or difference of the numerical coefficients of these terms.

For example:

(*i*) Add: $2x^2y^3, -5x^2y^3 + \frac{11}{2}x^2y^3$

Sol. $$2x^2y^3 + (-5x^2y^3) + \left(\frac{11}{2}x^2y^3\right) = \left(2 - 5 + \frac{11}{2}\right)x^2y^3 = \frac{5}{2}x^2y^3$$

(*ii*) Subtract: $(3x - 5)$ from $(8x - 25)$

Sol.
$$\begin{array}{rr} 8x & -\ 25 \\ 3x & -\ 5 \\ \underline{(-)} & \underline{(+)} \\ 5x & -\ 20 \end{array}$$

[Arrange the terms columnwise and change the sign of and add]

Multiplication Rule of Signs:

$(+x) \times (+y) = (+xy)$

$(+x) \times (-y) = (-xy)$

$(-x) \times (y) = (-xy)$

$(-x) \times (-y) = (+xy)$

Try These (*Page 138*)

Q1. Give five examples of expressions containing one variable and five examples of expressions containing two variables.

Sol. Expressions containing one variable:

$$3x, \frac{1}{2}y, 5z, 3x^2, \frac{1}{2}z$$

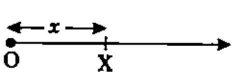
Expressions containing two variables:

$$x + y, xy + 4, 3x - \frac{1}{2}y, xz, 5x^2 + 3y$$

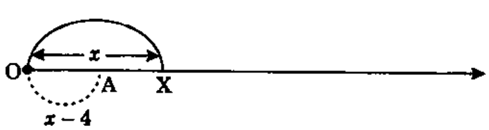
Q2. Show on the number line x, $x - 4$, $2x + 1$, $3x - 2$

Sol. x

Let



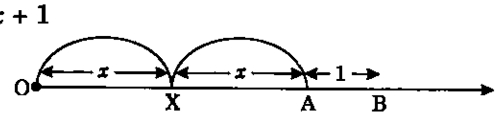
$x - 4$



Here, $OX = x$ and $XA = -4$

$\therefore$ $OA = x - 4$

$\Rightarrow$ $2x + 1$

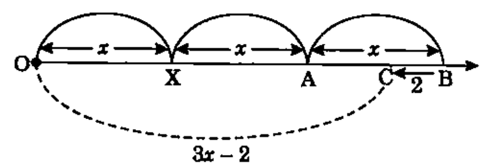


Here, $OX = x$, $XA = x$

$\Rightarrow$ $OA = 2x$

and $AB = 1$ unit

$\Rightarrow$ $3x - 2$



Here, $OX = XA = AB = x$

$\Rightarrow$ $OB = 3x$

$BC = 2$ unit

$\Rightarrow$ $OC = 3x - 2$

TRY THESE (PAGE 138)

Q1. Classify the following polynomials as monomials, binomials, trinomials.

$-z + 5, x + y + z, y + z + 100, ab - ac, 17$

Sol. Monomials: 17

Binomials: $-z + 5, ab - ac$

Trinomials: $x + y + z, y + z + 100$

Q2. Construct:

(a) 3 binomials with only x as a variable.

(b) 3 binomials with x and y as variables.

(c) 3 monomials with x and y as variables.

(d) 2 polynomials with 4 or more terms.

Sol. (a) $x + 2, 3x - 1$ and $\frac{1}{2}x + 3$

(b) $x + y, 2x - 3y$ and $\frac{1}{2}x - \frac{3}{4}y$

(c) $xy, 2xy, -3yx$

(d) $x + y + z - 1$ and $2x + 3y - z + w - 5$

TRY THESE (PAGE 139)

Q1. Write two terms which are like

(i) $7xy$ (ii) $4mn^2$ (iii) $2l$

Sol. (i) $7xy, 5xy, -3xy$ and $\frac{2}{5}xy$ are all like terms.

(ii) $4mn^2, -2mn^2, 6mn^2$ and $\frac{1}{2}mn^2$ are all like terms.

(iii) $2l, 3l, 4l$ and $\frac{1}{2}l$ are all like terms.

EXERCISE 9.1

Q1. 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) $0.3a - 0.6ab + 0.5b$

Sol.

Expression	Terms	Coefficients
(i) $5xyz^2 - 3zy$	$5xyz^2$	5
	$-3zy$	-3
(ii) $1 + x + x^2$	1	1
	x	1
	x^2	1
(iii) $4x^2y^2 - 4x^2y^2z^2 + z^2$	$4x^2y^2$	4
	$-4x^2y^2z^2$	-4
	z^2	1
(iv) $3 - pq + qr - rp$	3	3
	$-pq$	-1
	qr	1
	$-rp$	-1
(v) $\frac{x}{2} + \frac{y}{2} - xy$	$\frac{x}{2}$	$\frac{1}{2}$
	$\frac{y}{2}$	$\frac{1}{2}$
	$-xy$	-1
(vi) $0.3a - 0.6ab + 0.5b$	$0.3a$	0.3
	$-0.6ab$	-0.6
	$0.5b$	0.5

Q2. Classify the following polynomials as monomials, binomials, trinomials. Which polynomials do not fit in any of these three categories?

$x + y, 1000, x + x^2 + x^3 + x^4, 7 + y + 5x, 2y - 3y^2, 2y - 3y^2 + 4y^3, 5x - 4y + 3xy, 4z - 15z^2, ab + bc + cd + da, pqr, p^2q + pq^2, 2p + 2q$

Sol.

Expression	Category
(i) $x + y$	binomial
(ii) 1000	monomial
(iii) $x + x^2 + x^3 + x^4$	polynomial → does not fit in the given categories
(iv) $7 + y + 5x$	trinomial
(v) $2y - 3y^2$	binomial
(vi) $2y - 3y^2 + 4y^3$	trinomial
(vii) $5x - 4y + 3xy$	trinomial
(viii) $4z - 15z^2$	binomial
(ix) $ab + bc + cd + da$	polynomial → does not fit in the given categories
(x) pqr	monomial
(xi) $p^2q + pq^2$	binomial
(xii) $2p + 2q$	binomial

Q3. 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) $l^2 + m^2, m^2 + n^2, n^2 + l^2, 2lm + 2mn + 2nl$

Sol. (i) **Given:** $ab - bc, bc - ca, ca - ab$

We have

$(ab - bc) + (bc - ca) + (ca - ab)$ (Adding all the terms)

$= ab - bc + bc - ca + ca - ab$

$= (ab - ab) + (bc - bc) + (ca - ca)$ (Collecting the like terms together)

$= 0 + 0 + 0 = 0$

(ii) **Given:**

$a - b + ab, b - c + bc, c - a + ac$

We have $(a - b + ab) + (b - c + bc) + (c - a + ac)$ (Adding all the terms)

$= a - b + ab + b - c + bc + c - a + ac$

$= (a - a) + (b - b) + (c - c) + ab + bc + ac$ (Collecting all the like terms together)

$= 0 + 0 + 0 + ab + bc + ac$

$= ab + bc + ac$

(iii) **Given:**

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

By arranging the like terms in the same column, we have

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

(Adding columnwise)

(iv) **Given:** $l^2 + m^2, m^2 + n^2, n^2 + l^2, 2lm + 2mn + nl$

By arranging the like terms in the same column, we have

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

(Adding columnwise)

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

Q4. (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 $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$

Sol. (a) Arranging the like terms columnwise, we have

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

[Change the signs of all the terms of lower expressions and then add]

(b) Arranging the like terms columnwise, we have

$$\begin{array}{l} 5xy - 2yz - 2zx + 10xyz \\ 3xy + 5yz - 7zx + \;\; 0 \\ (-)\;\; (-)\;\; (+)\;\; (-) \\ \hline 2xy - 7yz + 5zx + 10xyz \\ \hline \end{array}$$

[Change the signs of all the terms of lower expressions and then add]

(c) Arranging the like terms columnwise, we have

$$\begin{array}{l} 18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q \\ -10 - 8p + 7q - 3pq + 5p^2q + 4p^2q \\ (+)\;\; (+)\;\; (-)\;\; (+)\;\; (-)\;\; (-) \\ \hline 20 + 5p - 18q + 8pq - 7pq^2 + p^2q \\ \hline \end{array}$$

[Change the signs of all the terms of lower expressions and then add]

The terms are $p^2q - 7pq^2 + 8pq - 18q + 5p + 20$

TRY THESE (*PAGE 142*)

Can you think of two more such situations, where we may need to multiply algebraic expressions?

Hint:
- Think of speed and time;
- Think of interest to be paid, the principal and the rate of simple interest, etc.

Sol. Yes,

Situation I : We think about the area of a rectangle whose length is x and breadth is y.

$\therefore$ Area of the rectangle = length × breadth

$= xy$ sq units

If the length is increased by 5 units and the breadth is decreased by 2 units, then the area of the rectangle

$= (x + 5) \times (y - 2)$ sq units

Situation II: Let a body take t hours to cover a certain distance at the rate of u km/h

$\therefore$ Distance covered = speed × time

$= u \times t$ km

If the speed is increased by 3 km/h and the time is decreased by 5 hours, then the distance covered

$= (u + 3) \times (t - 5)$ km

TRY THESE (PAGE 143)

Q1. Find $4x \times 5y \times 7z$

First find $4x \times 5y$ and multiply it by $7z$; or first find $5y \times 7z$ and multiply it by $4x$.

Is the result the same? What do you observe?

Does the order in which you carry out the multiplication matter?

Sol. **Method I:** $(4x \times 5y) \times 7z$

$20xy \times 7z = 140\ xyz$

Method II: $(5y \times 7z) \times 4x$

$= 35yz \times 4x$

$= 140\ xyz$ same result

Thus we observe that the order of the terms in multiplication does not matter.

EXERCISE 9.2

Q1. 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

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

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

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

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

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

Q2. Find the areas of rectangles with the following pairs of monomials as their lengths and breadths respectively.

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

Sol. (i) Length = p units and breadth = q units

Area of the rectangle

= length × breadth

$= p \times q = pq$ sq units

(ii) Length = 10 m units, breadth = $5n$ units

$\therefore$ Area of the rectangle

= length × breadth

$= 10\ m \times 5\ n$

$= (10 \times 5) \times m \times n$

$= 50mn$ sq units

(iii) Length = $20x^2$ units, breadth = $5y^2$ units

$\therefore$ Area of the rectangle

= length × breadth

$= 20x^2 \times 5y^2$

$= (20 \times 5)x^2 \times y^2$

$= 100x^2y^2$ sq units

(iv) Length = $4x$ units, breadth = $3x^2$ units

$\therefore$ Area of the rectangle

= length × breadth

$= 4x \times 3x^2$

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

$= 12x^3$ sq units

(v) Length = $3mn$ units, breadth = $4np$ units

$\therefore$ Area of the rectangle

= length × breadth

$= 3mn \times 4np$

$= (3 \times 4) \times mn \times np$

$= 12mn^2p$ sq units

Q3. Complete the table of products.

First monomial → Second monomial ↓	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
$2x$	$4x^2$	–	–	–	–	–
$-5y$	–	–	$-15x^2y$	–	–	–
$3x^2$	–	–	–	–	–	–
$-4xy$	–	–	–	–	–	–
$7x^2y$	–	–	–	–	–	–
$-9x^2y^2$	–	–	–	–	–	–

Sol. Completed table

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

Q4. 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*) $a, 2b, 3c$

Sol. (*i*) Here, length $= 5a$, breadth $= 3a^2$, height $= 7a^4$

Volume of the box

$= l \times b \times h$

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

$= 105\, a^7$ cu. units

(*ii*) Here, length $= 2p$, breadth $= 4q$, height $= 8r$

Volume of the box

$= l \times b \times h$

$= 2p \times 4q \times 8r$

$= 64pqr$ cu. units

(*iii*) Here, length $= xy$, breadth $= 2x^2y$, height $= 2xy^2$

Volume of the box

$= l \times b \times h$

$= xy \times 2x^2y \times 2xy^2$

$= (1 \times 2 \times 2) \times xy \times x^2y \times xy^2$

$= 4x^4y^4$ cu. units

(*iv*) Here, length $= a$, breadth $= 2b$, height $= 3c$

Volume of the box

$=$ length × breadth × height

$= a \times 2b \times 3c$

$= (1 \times 2 \times 3)abc$

$= 6\, abc$ cu. units

Q5. 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*) $m, -mn, mnp$

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

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

(*iii*) $2 \times 4y \times 8y^2 \times 16y^3$

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

$= 1024y^6$

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

$= (1 \times 2 \times 3 \times 6) \times a \times b \times c \times abc$

$= 36a^2b^2c^2$

(*v*) $m \times (-mn) \times mnp$

$= [1 \times (-1) \times 1]m \times mn \times mnp$

$= -m^3n^2p$

TRY THESE (*PAGE 144*)

Q1. Find the product:

(*i*) $2x(3x + 5xy)$

(*ii*) $a^2(2ab - 5c)$

Sol. (*i*) $2x(3x + 5xy)$

$= (2x \times 3x) + (2x \times 5xy) = 6x^2 + 10x^2y$

(*ii*) $a^2(2ab - 5c)$

$= (a^2 \times 2ab) - (a^2 \times 5c) = 2a^3b - 5a^2c$

TRY THESE (*PAGE 145*)

Q1. Find the product: $(4p^2 + 5p + 7) \times 3p$

Sol. $(4p^2 + 5p + 7) \times 3p$

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

$= 12p^3 + 15p^2 + 21p$

EXERCISE 9.3

Q1. 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*) $pq + qr + rp, 0$

Sol. (*i*) $4p \times (q + r) = (4p \times q) + (4p \times r)$

$= 4pq + 4pr$

(*ii*) $ab, a - b = ab \times (a - b)$

$= (ab \times a) - (ab \times b)$

$= a^2b - ab^2$

(*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*) $(pq + qr + rp) \times 0 = 0$
[∵ Any number multiplied by 0 is = 0]

Q2. Complete the table.

S. No.	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	–

Sol. (*i*) $a \times (b + c + d)$
$= (a \times b) + (a \times c) + (a \times d)$
$= ab + ac + ad$

(*ii*) $(x + y - 5)(5xy)$
$= (x \times 5xy) + (y \times 5xy) - (5 \times 5xy)$
$= 5x^2y + 5xy^2 - 25xy$

(*iii*) $p \times (6p^2 - 7p + 5)$
$= (p \times 6p^2) - (p \times 7p) + (p \times 5)$
$= 6p^3 - 7p^2 + 5p$

(*iv*) $4p^2q^2 \times (p^2 - q^2)$
$= 4p^2q^2 \times p^2 - 4p^2q^2 \times q^2$
$= 4p^4q^2 - 4p^2q^4$

(*v*) $(a + b + c) \times (abc)$
$= (a \times abc) + (b \times abc) + (c \times abc)$
$= a^2bc + ab^2c + abc^2$

Completed Table:

S. No.	First expression	Second expressiou	Product
(*i*)	a	$b + c + d$	$ab + ac + ad$
(*ii*)	$x + y - 5$	$5xy$	$5x^2y + 5xy^2 - 25xy$
(*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	$a^2bc + ab^2c + abc^2$

Q3. Find the products.

(*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*) $x \times x^2 \times x^3 \times x^4$

Sol. (*i*) $(a^2) \times (2a^{22}) \times (4a^{26})$
$= 1 \times 2 \times 4 \times a^{2+22+26}$
$= 8a^{50}$

(*ii*) $\left(\frac{2}{3}xy\right) \times \left(-\frac{9}{10}x^2y^2\right)$
$= \frac{2}{3} \times \left(-\frac{9}{10}\right) \times x^{1+2} \cdot y^{1+2}$
$= -\frac{3}{5} \cdot x^3y^3$

(*iii*) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right)$
$= \left(-\frac{10}{3}\right) \times \left(\frac{6}{5}\right) \times p^{1+3}q^{3+1}$
$= -4p^4q^4$

(*iv*) $x \times x^2 \times x^3 \times x^4$
$= x^{1+2+3+4} = x^{10}$

Q4. (*a*) Simplify: $3x(4x - 5) + 3$ and find its values for (*i*) $x = 3$ (*ii*) $x = \frac{1}{2}$.

(*b*) Simplify: $a(a^2 + a + 1) + 5$ and find its value for (*i*) $a = 0$ (*ii*) $a = 1$ (*iii*) $a = -1$

Sol. (*a*) We have $3x(4x - 5) + 3$
$= 4x \times 3x - 5 \times 3x + 3$
$= 12x^2 - 15x + 3$

(*i*) For $x = 3$, we have
$12 \times (3)^2 - 15 \times 3 + 3$
$= 12 \times 9 - 45 + 3$
$= 108 - 42 = 66$

(*ii*) For $x = \frac{1}{2}$, we have
$12\left(\frac{1}{2}\right)^2 - 15\left(\frac{1}{2}\right) + 3$
$= 12 \times \frac{1}{4} - \frac{15}{2} + 3$
$= 3 - \frac{15}{2} + 3$
$= \frac{6 - 15 + 6}{2} = \frac{12 - 15}{2} = -\frac{3}{2}$

(*b*) We have $a(a^2 + a + 1) + 5$
$= (a^2 \times a) + (a \times a) + (1 \times a) + 5$
$= a^3 + a^2 + a + 5$

(*i*) For $a = 0$, we have
$= (0)^3 + (0)^2 + (0) + 5 = 5$

(*ii*) For $a = 1$, we have
$= (1)^3 + (1)^2 + (1) + 5$
$= 1 + 1 + 1 + 5 = 8$

(*iii*) For $a = -1$, we have

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

$= -1 + 1 - 1 + 5 = 4$

Q5. (*a*) Add: $p(p-q)$, $q(q-r)$ and $r(r-p)$

(*b*) Add: $2x(z-x-y)$ and $2y(z-y-x)$

(*c*) Subtract: $3l(l-4m+5n)$ from $4l(10n-3m+2l)$

(*d*) Subtract: $3a(a+b+c) - 2b(a-b+c)$ from $4c(-a+b+c)$

Sol. (*a*) $p(p-q) + q(q-r) + r(r-p)$

$= (p \times p) - (p \times q) + (q \times q) - (q \times r) + (r \times r) - (r \times p)$

$= p^2 - pq + q^2 - qr + r^2 - rp$

$= p^2 + q^2 + r^2 - pq - qr - rp$

(*b*) $2x(z-x-y) + 2y(z-y-x)$

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

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

$= -2x^2 - 2y^2 + 2xz + 2yz - 4xy$

$= -2x^2 - 2y^2 - 4xy + 2yz + 2xz$

(*c*) $4l(10n - 3m + 2l) - 3l(l - 4m + 5n)$

$= (4l \times 10n) - (4l \times 3m) + (4l \times 2l) - (3l \times l) - (3l \times -4m) - (3l \times 5n)$

$= 40ln - 12lm + 8l^2 - 3l^2 + 12lm - 15ln$

$= (40ln - 15ln) + (-12lm + 12lm) + (8l^2 - 3l^2)$

$= 25ln + 0 + 5l^2$

$= 25ln + 5l^2 \Rightarrow 5l^2 + 25ln$

(*d*) $[4c(-a+b+c)] - [3a(a+b+c) - 2b(a-b+c)]$

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

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

$= -3a^2 - 2b^2 + 4c^2 - ab + 6bc - 7ac$

EXERCISE 9.4

Q1. 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 $4\left(a^2 - \frac{2}{3}b^2\right)$

Sol. (*i*) $(2x + 5) \times (4x - 3)$

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

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

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

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

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

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

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

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

$= 3y^2 - 28y + 32$

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

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

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

$= 6.25l^2 + 0 - 0.25m^2$

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

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

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

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

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

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

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

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

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

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

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

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

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

$= \left(\frac{3}{\not{4}}a^2 \times \not{4}a^2\right) - \left(\frac{\not{3}}{\not{4}}a^2 \times \frac{\not{8}^2}{\not{3}}b^2\right) + (3b^2 \times 4a^2) - \left(\not{3}b^2 \times \frac{8}{\not{3}}b^2\right)$

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

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

Q2. Find the product:

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

(*iii*) $(a^2 + b)(a + b^2)$ (*iv*) $(p^2 - q^2)(2p + q)$

Sol. (*i*) $(5 - 2x)(3 + x)$

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

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

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

$= 15 - x - 2x^2$

(*ii*) $(x + 7y)(7x - y)$
$= x(7x - y) + 7y(7x - y)$
$= (x \times 7x) - (x \times y) + (7y \times 7x) - (7y \times y)$
$= 7x^2 - xy + 49xy - 7y^2$
$= 7x^2 + 48xy - 7y^2$

(*iii*) $(a^2 + b)(a + b^2)$
$= a^2(a + b^2) + b(a + b^2)$
$= (a^2 \times a) + (a^2 \times b^2) + (b \times a) + (b \times b^2)$
$= a^3 + a^2b^2 + ab + b^3$

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

Q3. 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*) $(a + b + c)(a + b - c)$

Sol. (*i*) $(x^2 - 5)(x + 5) + 25$
$= x^2(x + 5) + 5(x + 5) + 25$
$= x^3 + 5x^2 - 5x - 25 + 25$
$= x^3 + 5x^2 - 5x + 0 = x^3 + 5x^2 - 5x$

(*ii*) $(a^2 + 5)(b^3 + 3) + 5$
$= a^2(b^3 + 3) + 5(b^3 + 3) + 5$
$= a^2b^3 + 3a^2 + 5b^3 + 15 + 5$
$= a^2b^3 + 3a^2 + 5b^3 + 20$

(*iii*) $(t + s^2)(t^2 - s)$
$= t(t^2 - s) + s^2(t^2 - s)$
$= t^3 - st + s^2t^2 - s^3$
$= t^3 + s^2t^2 - st - s^3$

(*iv*) $(a + b)(c - d) + (a - b)(c + d) + 2(ac + bd)$
$= a(c - d) + b(c - d) + a(c + d) - b(c + d) + 2ac + 2bd$
$= ac - ad + bc - bd + ac + ad - bc - bd + 2ac + 2bd$
$= ac + ac + 2ac + bc - bc - ad + ad - bd - bd + 2bd$
$= 4ac + 0 + 0 + 0$
$= 4ac$

(*v*) $(x + y)(2x + y) + (x + 2y)(x - y)$
$= x(2x + y) + y(2x + y) + x(x - y) + 2y(x - y)$
$= 2x^2 + xy + 2xy + y^2 + x^2 - xy + 2xy - 2y^2$
$= 2x^2 + x^2 + xy + 2xy - xy + 2xy + y^2 - 2y^2$
$= 3x^2 + 4xy - y^2$

(*vi*) $(x + y)(x^2 - xy + y^2)$
$= x(x^2 - xy + y^2) + y(x^2 - xy + y^2)$
$= x^3 - x^2y + xy^2 + x^2y - xy^2 + y^3$
$= x^3 - x^2y + x^2y + xy^2 - xy^2 + y^3$
$= x^3 - 0 + 0 + y^3$
$= x^3 + y^3$

(*vii*) $(1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y$
$= 1.5x(1.5x + 4y + 3) - 4y(1.5x + 4y + 3) - 4.5x + 12y$
$= 2.25x^2 + 6xy + 4.5x - 6xy - 16y^2 - 12y - 4.5x + 12y$
$= 2.25x^2 + 6xy - 6xy + 4.5x - 4.5x + 12y - 12y - 16y^2$
$= 2.25x^2 + 0 + 0 + 0 - 16y^2$
$= 2.25x^2 - 16y^2$

(*viii*) $(a + b + c)(a + b - c)$
$= a(a + b - c) + b(a + b - c) + c(a + b - c)$
$= a^2 + ab - ac + ab + b^2 - bc + ac + bc - c^2$
$= a^2 + ab + ab - bc + bc - ac + ac + b^2 - c^2$
$= a^2 + 2ab + b^2 - c^2 + 0 + 0$
$= a^2 + 2ab + b^2 - c^2$

Try These (*Page 149*)

Q1. Put $-b$ in place of b in identity (I). Do you get identity (II)?

Sol. $(a + b)^2 = a^2 + 2ab + b^2$
$\Rightarrow \quad (a - b)^2 = a^2 + 2a(-b) + (-b)^2 = a^2 - 2a + b^2$
Yes, we get identity II.

Try These (*Page 149*)

Q1. Verify Identity (IV), for $a = 2, b = 3, x = 5$.

Sol. We have $(x + a)(x + b)$
$= x^2 + (a + b)x + ab$
LHS $= (x + a)(x + b)$
$= (5 + 2)(5 + 3)$
$= (7)(8) = 56$
RHS $= x^2 + (a + b)x + ab$
$= (5)^2 + (2 + 3)(5) + (2)(3)$
$= 25 + 5 \times 5 + 6$
$= 25 + 25 + 6 = 56$
LHS = RHS
Hence, verified.

Q2. Consider, the special case of Identity (IV) with $a = b$, what do you get? Is it related to Identity (I)?

Sol. We have $(x + a)(x + b) = x^2 + (a + b)x + ab$

Special case, when $a = b$, we get

$$(x + a)(x + a) = x^2 + (a + a)x + a \cdot a$$
$$(x + a)^2 = x^2 + 2ax + a^2$$

which is the formula of $(a + b)^2 = a^2 + 2ab + b^2$

Yes, it is related to identity (I).

Q3. Consider, the special case of Identity (IV) with $a = -c$ and $b = -c$. What do you get? Is it related to Identity (II)?

Sol. We have $(x + a)(x + b) = x^2 + (a + b)x + ab$

Special case, put $a = -c$ and $b = -c$

$$(x - c)(x - c) = x^2 + (-c - c)x + (-c)(-c)$$
$$(x - c)^2 = x^2 - 2cx + c^2$$

which is the formula of

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

Yes, it is related to Identity (II).

Q4. Consider the special case of Identity (IV) with $b = -a$. What do you get? Is it related to Identity (III)?

Sol. We have $(x + a)(x + b)$

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

Special case, put $b = -a$

$$(x + a)(x - a) = x^2 + (a - a)x + a(-a)$$
$$\Rightarrow (x + a)(x - a) = x^2 + 0 - a^2$$
$$\Rightarrow (x + a)(x - a) = x^2 - a^2$$

which is the formula of

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

Yes, it is related to Identity (*iii*).

EXERCISE 9.5

Q1. 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*) $(7a - 9b)(7a - 9b)$

Sol. (*i*) $(x + 3)(x + 3)$

$= (x + 3)^2$

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

$= x^2 + 6x + 9$ $\quad [(a + b)^2 = a^2 + 2ab + b^2]$

(*ii*) $(2y + 5)(2y + 5)$

$= (2y + 5)^2$

$= (2y)^2 + 2(2y)(5) + (5)^2$ $\quad [(a + b)^2 = a^2 + 2ab + b^2]$

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

(*iii*) $(2a - 7)(2a - 7)$

$= (2a - 7)^2$

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

$= 4a^2 - 28a + 49$

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

$= \left(3a - \frac{1}{2}\right)^2$

$= (3a)^2 - 2(3a)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)^2$ $\quad [(a - b)^2 = a^2 - 2ab + b^2]$

$= 9a^2 - 3a + \frac{1}{4}$

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

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

$= 1.21m^2 - 0.16$

(*vi*) $(a^2 + b^2)(-a^2 + b^2)$

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

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

$= b^4 - a^4$

$= -a^4 + b^4$

(*vii*) $(6x - 7)(6x + 7)$

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

$= 36x^2 - 49$

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

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

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

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

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

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

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

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

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

(x) $(7a-9b)(7a-9b)$

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

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

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

Q2. Use the identity $(x+a)(x+b) = x^2 + (a+b)x + ab$ to find the following products.

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

(ii) $(4x+5)(4x+1)$

(iii) $(4x-5)(4x-1)$

(iv) $(4x+5)(4x-1)$

(v) $(2x+5y)(2x+3y)$

(vi) $(2a^2+9)(2a^2+5)$

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

Sol. (i) $(x+3)(x+7)$

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

$= x^2 + 10x + 21$

(ii) $(4x+5)(4x+1)$

$= (4x)^2 + (5+1)(4x) + 5\times 1$

$= 16x^2 + 6(4x) + 5$

$= 16x^2 + 24x + 5$

(iii) $(4x-5)(4x-1)$

$= (4x)^2 - (5+1)(4x) + (-5)\times(+1)$

$= 16x^2 - 6(4x) + 5$

$= 16x^2 - 24x + 5$

(iv) $(4x+5)(4x-1)^2$

$= (4x)^2 + (5-1)(4x) + 5\times(-1)$

$= 16x^2 + 4(4x) - 5$

$= 16x^2 + 16x - 5$

(v) $(2x+5y)(2x+3y)$

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

$= 4x^2 + (8y)(2x) + 15y^2$

$= 4x^2 + 16xy + 15y^2$

(vi) $(2a^2+9)(2a^2+5)$

$= (2a^2)^2 + (9+5)(2a)^2 + 5\times 9$

$= 4a^4 + (14)(2a^2) + 45$

$= 4a^4 + 28a^2 + 45$

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

$= (xyz)^2 - (4+2)(xyz) + (-4)(-2)$

$= x^2y^2z^2 - (6)(xyz) + 8$

$= x^2y^2z^2 - 6xyz + 8$

Q3. Find the following squares by using the identities.

(i) $(b-7)^2$ (ii) $(xy+3z)^2$

(iii) $(6x^2-5y)^2$ (iv) $\left(\frac{2}{3}m+\frac{3}{2}n\right)^2$

(v) $(0.4p-0.5q)^2$ (vi) $(2xy+5y)^2$

Sol. (i) $(b-7)^2 = (b)^2 - 2(b)(7) + (7)^2$

$= b^2 - 14b + 49$

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

(ii) $(xy+3z)^2$

$= (xy)^2 + 2(xy)(3z) + (3z)^2$

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

$= x^2y^2 + 6xyz + 9y^2$

(iii) $(6x^2-5y)^2$

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

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

$= 36x^4 - 60x^2y + 25y^2$

(iv) $\left(\frac{2}{3}m+\frac{3}{2}n\right)^2$

$= \left(\frac{2}{3}m\right)^2 + 2\left(\frac{2}{3}m\right)\left(\frac{3}{2}n\right)+\left(\frac{3}{2}n\right)^2$

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

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

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

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

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

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

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

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

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

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

Q.4 Simplify:

(i) $(a^2-b^2)^2$

(ii) $(2x+5)^2 - (2x-5)^2$

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

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

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

(vi) $(ab+bc)^2 - 2ab^2c$

(vii) $(m^2-n^2m)^2 + 2m^3n^2$

Sol. (i) $(a^2-b^2)^2$

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

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

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

(ii) $(2x + 5)^2 - (2x - 5)^2$

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

$= (4x^2 + 20x + 25) - (4x^2 - 20x + 25)$

$= \cancel{4x^2} + 20x + \cancel{25} - \cancel{4x^2} + 20x - \cancel{25}$

$= 20x + 20x = 40x$

Alternately:

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

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

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

$= (2x + \cancel{5} + 2x - \cancel{5})(\cancel{2x} + 5 - \cancel{2x} + 5)$

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

$= 4x \times 10 = 40x$

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

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

$= 49m^2 - \cancel{112mn} + 64n^2 + 49m^2 + \cancel{112mn} + 64n^2$

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

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

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

$= 16m^2 + 40mn + 25n^2 + 25m^2 + 40mn + 16n^2$

$= 41m^2 + 80mn + 41n^2$

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

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

$= (6.25p^2 - 7.5pq + 2.25q^2) - (2.25p^2 - 7.5pq + 6.25q^2)$

$= 6.25p^2 - \cancel{7.5pq} + 2.25q^2 - 2.25p^2 + \cancel{7.5pq} - 6.25q^2$

$= 6.25p^2 - 2.25p^2 + 2.25q^2 - 6.25q^2$

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

(vi) $(ab + bc)^2 - 2ab^2c$

$= (ab)^2 + 2(ab)(bc) + (bc)^2 - 2ab^2c$

$= a^2b^2 + \cancel{2ab^2c} + b^2c^2 - \cancel{2ab^2c}$

$= a^2b^2 + b^2c^2$

(vii) $(m^2 - n^2m)^2 + 2m^3n^2$

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

$= m^4 - \cancel{2m^3n^2} + n^4m^2 + \cancel{2m^3n^2}$

$= m^4 + n^4m^2$

Q5. Show that:

(i) $(3x + 7)^2 - 84x = (3x - 7)^2$

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

Sol. (i) To Show that:

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

LHS $= (3x + 7)^2 - 84x$

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

$= 9x^2 + 42x + 49 - 84x$

$= 9x^2 - 42x + 49$

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

$= (3x - 7)^2 =$ RHS

LHS = RHS

Hence, proved.

(ii) To show that:

$(9p - 5q)^2 + 180pq = (9p + 5q)^2$

LHS $= (9p - 5q)^2 + 180pq$

$= (9p)^2 - 2(9p)(5q) + (5q^2) + 180pq$

$= 81p^2 - 90pq + 25q^2 + 180pq$

$= 81p^2 + 90pq + 25q^2$

$= (9p)^2 + 2(9p)(5q) + (5q)^2$

$= (9p + 5q)^2 =$ RHS

LHS = RHS

Hence, proved.

(iii) To show that:

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

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

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

$= \frac{16}{9}m^2 - \cancel{2mn} + \frac{9}{16}n^2 + \cancel{2mn}$

$= \frac{16}{9}m^2 + \frac{9}{16}n^2 =$ RHS

LHS = RHS

Hence, proved.

(iv) To show that:

$(4pq + 3q)^2 - (4p - 3q)^2 = 48pq^2$

LHS $= (4pq + 3q)^2 - (4pq - 3q)^2$

$= [(4pq + 3q) + (4pq - 3q)] [(4pq + 3q) - (4pq - 3q)]$

$= (4pq + \cancel{3q} + 4pq - \cancel{3q})$
$(\cancel{4pq} + 3q - \cancel{4pq} + 3q)$
$= (8pq)(6q)$
$= 48pq^2 = \text{RHS}$

LHS = RHS

Hence, proved.

(*v*) To show that:

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

LHS $= (a^2 - b^2) + (b^2 - c^2) + (c^2 - a^2)$ $[\because (x + y)(x - y) = x^2 - y^2]$

$= \cancel{a^2} - \cancel{b^2} + \cancel{b^2} - \cancel{c^2} + \cancel{c^2} - \cancel{a^2}$
$= 0 = \text{RHS}$

LHS = RHS

Hence, proved.

Q6. Using identities, evaluate:

(*i*) 71^2 (*ii*) 99^2
(*iii*) 102^2 (*iv*) 998^2
(*v*) 5.2^2 (*vi*) 297×303
(*vii*) 78×82 (*viii*) 8.9^2
(*ix*) 1.05×9.5

Sol. (*i*) $71^2 = (70 + 1)^2$

$= (70)^2 + 2(70)(1)^2 + (1)^2$ $[(a + b)^2 = a^2 + 2ab + b^2]$
$= 4900 + 140 + 1$
$= 5041$

Hence, $71^2 = 5041$

(*ii*) $99^2 = (100 - 1)^2$

$= (100)^2 - 2(100)(1) + (1)^2$ $[(a - b)^2 = a^2 - 2ab + b^2]$
$= 10000 - 200 + 1$
$= 10001 - 200$
$= 9801$

Hence, $99^2 = 9801$

(*iii*) $102^2 = (100 + 2)^2$

$= (100)^2 + 2(100)(2) + (2)^2$ $[(a + b)^2 = a^2 + 2ab + b^2]$
$= 10000 + 400 + 4$
$= 10404$

Hence, $102^2 = 10404$

(*iv*) $998^2 = (1000 - 2)^2$

$= (1000)^2 - 2(1000)(2) + (2)^2$ $[(a - b)^2 = a^2 - 2ab + b^2]$
$= 1000000 - 4000 + 4$
$= 1000004 - 4000$
$= 996004$

Hence, $998^2 = 996004$

(*v*) $5.2^2 = (5 + 0.2)^2$

$= (5)^2 + 2(5)(0.2) + (0.2)^2$ $[(a + b)^2 = a^2 + 2ab + b^2]$
$= 25 + 2 + 0.04$
$= 27 + 0.04$
$= 27.04$

Hence, $(5.2)^2 = 27.04$

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

$= (300)^2 - (3)^2$ $[(a + b)(a - b) = a^2 - b^2]$
$= 90000 - 9$
$= 89991$

Hence, $297 \times 303 = 89991$

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

$= (80)^2 - (2)^2$ $[(a + b)(a - b) = a^2 - b^2]$
$= 6400 - 4$
$= 6396$

Hence, $78 \times 82 = 6396$

(*viii*) $8.9^2 = (9 - 0.1)^2$

$= (9)^2 - 2(9)(0.1) + (0.1)^2$ $[(a - b)^2 = a^2 - 2ab + b^2]$
$= 81 - 1.8 + 0.01$
$= 81.01 - 1.8$
$= 79.21$

Hence, $8.9^2 = 79.21$

(*ix*) $1.05 \times 9.5 = (1 + 0.5)(10 - 0.5)$

$= 1(10 - 0.5) + 0.05(10 - 0.5)$
$= 10 - 0.5 + 0.05 \times 10 - 0.05 \times 0.5$
$= 10 - 0.5 + 0.5 - 0.025$
$= 10.5 - 0.525$
$= 9.975$

Hence, $1.05 \times 9.5 = 9.975$

Q.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*) $12.1^2 - 7.9^2$

Sol. (*i*) $51^2 - 49^2 = (51 + 49)(51 - 49)$

$= 100 \times 2 = 200$

(*ii*) $(1.02)^2 - (0.98)^2$

$= (1.02 + 0.98)(1.02 - 0.98)$
$= 2.00 \times 0.04$
$= 0.08$

(*iii*) $153^2 - 147^2$

$= (153 + 147)(153 - 147)$
$= 300 \times 6 = 1800$

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

$= (12.1 + 7.9)(12.1 - 7.9)$
$= 20.0 \times 4.2 = 84$

Q8. 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

Sol. (i) 103×104

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

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

$= 10000 + 700 + 12 = 10712$

(ii) 5.1×5.2

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

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

$= 25 + 1.5 + 0.02 = 26.5 + 0.02$

$= 26.52$

(iii) 103×98

$= (100 + 3)(100 - 2)$

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

$= 10000 + 100 - 6$

$= 10100 - 6 = 10094$

(iv) 9.7×9.8

$= (10 - 0.3)(10 - 0.2)$

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

$= 100 - 5 + 0.06$

$= 95 + 0.06$

$= 95.06$

Learning More Q & A

I. Very Short Answer (VSA) Questions

Q1. Write two examples of each of

(i) Monomials

(ii) Binomials

(iii) Trinomials

Sol. (i) Monomials:

(a) $3x$ (b) $5xy^2$

(ii) Binomials: (a) $p + q$ (b) $-5a + 2b$

(iii) Trinomials:

(a) $a + b + c$ (b) $x^2 + x + 2$

Q2. Identify the like expressions.

$5x, -14x, 3x^2 + 1, x^2, -9x^2, xy, -3xy$

Like terms: $5x$ and $-14x$, x^2 and $-9x^2$, xy and $-3xy$

Q3. Identify the terms and their coefficients for each of the following expressions:

(i) $3x^2y - 5x$

(ii) $xyz - 2y$

(iii) $-x - x^2$

Sol.

	Terms	Coefficients
(i)	$3x^2y$	3
	$-5x$	-5
(ii)	xyz	1
	$-2y$	-2
(iii)	$-x$	-1
	$-x^2$	-1

Q4. Add: $-3a^2b^2, -\frac{5}{2}a^2b^2, 4a^2b^2, \frac{2}{3}a^2b^2$

Sol. $(-3a^2b^2) + \left(-\frac{5}{2}a^2b^2\right) + (4a^2b^2) + \left(\frac{2}{3}a^2b^2\right)$

$= \left(-3 - \frac{5}{2} + 4 + \frac{2}{3}\right)a^2b^2$

$= \left(\frac{-18 - 15 + 24 + 4}{6}\right)a^2b^2$

$= \frac{5}{6}a^2b^2$

Q5. Add: $8x^2 + 7xy - 6y^2$, $4x^2 - 3xy + 2y^2$ and $-4x^2 + xy - y^2$

Sol.

$$\begin{array}{rrrr} & 8x^2 & + 7xy & - 6y^2 \\ & 4x^2 & - 3xy & + 2y^2 \\ + & -4x^2 & + xy & - y^2 \\ \hline \text{Sum} & 8x^2 & + 5xy & - 5y^2 \\ \hline \end{array}$$

Q6. Subtract: $(4x + 5)$ from $(-3x + 7)$

Sol. $(-3x + 7) - (4x + 5)$

$= -3x + 7 - 4x - 5$

$= -3x - 4x + 7 - 5$

$= -7x + 2$

Q7. Subtract: $3x^2 - 5x + 7$ from $5x^2 - 7x + 9$

Sol. $(5x^2 - 7x + 9) - (3x^2 - 5x + 7)$

$= 5x^2 - 7x + 9 - 3x^2 + 5x - 7$

$= 5x^2 - 3x^2 + 5x - 7x + 9 - 7$

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

Q8. Multiply the following expressions:

(a) $3xy^2 \times (-5x^2y)$

(b) $\frac{1}{2}x^2yz \times \frac{2}{3}xy^2z \times \frac{1}{5}x^2yz$

Sol. (a) $3xy^2 \times (-5x^2y)$

$= (3) \times (-5) \cdot x^3y^3$

$= -15x^3y^3$

(b) $\frac{1}{2}x^2yz \times \frac{2}{3}xy^2z \times \frac{1}{5}x^2yz$

$= \left(\frac{1}{2} \times \frac{2}{3} \times \frac{1}{5}\right) \cdot x^2yz \times xy^2z \times x^2yz$

$= \frac{1}{15}x^5y^4z^3$

Q9. Find the area of the rectangle whose length and breadths are $3x^2y$ m and $5xy^2$ m respectively.

Sol. Length = $3x^2y$ m, breadth = $5xy^2$ m

Area of rectangle = Length × Breadth

$= (3x^2y \times 5xy^2)$ sq m

$= (3 \times 5) \times x^2y \times xy^2$ sq m

$= 15x^3y^3$ sq m

Q10. Multiply $x^2 + 7x - 8$ by $-2y$.

Sol.
$$\begin{array}{r} x^2 + 7x - 8 \\ \times -2y \\ \hline -2x^2y - 14xy + 16y \\ \hline \end{array}$$

II. Short Answer (SA) Questions

Q11. Simplify the following:

(*i*) $a^2(b^2 - c^2) + b^2(c^2 - a^2) + c^2(a^2 - b^2)$

(*ii*) $x^2(x - 3y^2) - xy(y^2 - 2xy) - x(y^3 - 5x^2)$

Sol. (*i*) $a^2(b^2 - c^2) + b^2(c^2 - a^2) + c^2(a^2 - b^2)$

$= \cancel{a^2b^2} - \cancel{a^2c^2} + \cancel{b^2c^2} - \cancel{b^2a^2} + \cancel{c^2a^2} - \cancel{c^2b^2}$

$= 0$

(*ii*) $x^2(x - 3y^2) - xy(y^2 - 2xy) - x(y^3 - 5x^2)$

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

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

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

Q12. Multiply $(3x^2 + 5y^2)$ by $(5x^2 - 3y^2)$

Sol. $(3x^2 + 5y^2) \times (5x^2 - 3y^2)$

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

$= 15x^4 - 9x^2y^2 + 25x^2y^2 - 15y^4$

$= 15x^4 + 16x^2y^2 - 15y^4$

Q13. Multiply $(6x^2 - 5x + 3)$ by $(3x^2 + 7x - 3)$

Sol. $(6x^2 - 5x + 3) \times (3x^2 + 7x - 3)$

$= 6x^2(3x^2 + 7x - 3) - 5x(3x^2 + 7x - 3) + 3(3x^2 + 7x - 3)$

$= 18x^4 + 42x^3 - 18x^2 - 15x^3 - 35x^2 + 15x + 9x^2 + 21x - 9$

$= 18x^4 + 42x^3 - 15x^3 - 18x^2 - 35x^2 + 9x^2 + 15x + 21x - 9$

$= 18x^4 + 27x^3 - 44x^2 + 36x - 9$

Q14. Simplify:

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

Sol. $2x^2(x + 2) - 3x(x^2 - 3) - 5x(x + 5)$

$= 2x^3 + 4x^2 - 3x^3 + 9x - 5x^2 - 25x$

$= 2x^3 - 3x^3 - 5x^2 + 4x^2 + 9x - 25x$

$= -x^3 - x^2 - 16x$

Q15. Multiply $x^2 + 2y$ by $x^3 - 2xy + y^3$ and find the value of the product for $x = 1$ and $y = -1$.

Sol. $(x^2 + 2y) \times (x^3 - 2xy + y^3)$

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

$= x^5 - \cancel{2x^3y} + x^2y^3 + \cancel{2x^3y} - 4xy^2 + 2y^4$

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

Put $x = 1$ and $y = -1$

$= (1)^5 + (1)^2(-1)^3 - 4(1)(-1)^2 + 2(-1)^4$

$= 1 + (1)(-1) - 4(1)(1) + 2(1)$

$= 1 - 1 - 4 + 2$

$= -2$

Q16. Using suitable identity find:

(*i*) 48^2 (*NCERT Exemplar*) (*ii*) 96^2

(*iii*) $231^2 - 131^2$ (*iv*) 97×103

(*v*) $181^2 - 19^2 = 162 \times 200$ (*NCERT Exemplar*)

Sol. (*i*) $(50 - 2)^2 = (50)^2 - 2 \times 50 \times 2 + (2)^2$

$= 2500 - 200 + 4$

$= 2504 - 200$

$= 2304$

(*ii*) $96^2 = (100 - 4)^2$

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

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

$= 10000 - 800 + 16$

$= 10016 - 800$

$= 9216$

(*iii*) $231^2 - 131^2$

$= (231 - 131)(231 + 131)$

$= (100)(362)$

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

$= 36200$

(*iv*) 97×103

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

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

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

$= 10000 - 9$

$= 9991$

(*v*) $181^2 - 19^2 = (181 - 19)(181 + 19)$

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

$= 162 \times 200 = 32400$

Q17. If $x^2 + \frac{1}{x^2} = 38$, find the values of:

(*i*) $x - \frac{1}{x}$ (*ii*) $x^4 + \frac{1}{x^4}$

Sol. (*i*) $\left(x - \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} - 2 \times x \times \frac{1}{x}$

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

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

$= 38 - 2 = 36$

$\therefore \quad x - \frac{1}{x} = \sqrt{36} = 6$

(ii) $\left(x^2 + \frac{1}{x^2}\right)^2$

$= x^4 + \frac{1}{x^4} + 2 \times x^2 \times \frac{1}{x^2}$

$\Rightarrow \quad (38)^2 = x^4 + \frac{1}{x^4} + 2$

$\left[\text{Given}\left(x^2 + \frac{1}{x^2}\right) = 38\right]$

$\Rightarrow \quad 1444 - 2 = x^4 + \frac{1}{x^4}$

$\Rightarrow \quad 1442 = x^4 + \frac{1}{x^4}$

$\therefore \quad x^4 + \frac{1}{x^4} = 1442$

Q18. Verify that $(11pq + 4q)^2 - (11pq - 4q)^2 = 176pq^2$ *(NCERT Exemplar)*

Sol. LHS $= (11pq + 4q)^2 - (11pq - 4q)^2$

$= (11pq + 4q + 11pq - 4q) \times (11pq + 4q - 11pq + 4q)$

[using $a^2 - b^2 = (a - b)(a + b)$, here $a = 11pq + 4q$ and $b = 11pq - 4q$]

$= (22pq)(8q) = 176pq^2$

RHS. Hence Verified

Q19. Find the value of $\frac{38^2 - 22^2}{16}$, using a suitable identity. *(NCERT Exemplar)*

Sol. Since $a^2 - b^2 = (a + b)(a - b)$, therefore

$38^2 - 22^2 = (38 - 22)(38 + 22)$

$= 16 \times 60$

So, $\frac{38^2 - 22^2}{16} = \frac{16 \times 60}{16}$

$= 60$

Q20. Find the value of x, if

$10000x = (9982)^2 - (18)^2$ *(NCERT Exemplar)*

Sol. RHS $= (9982)^2 - (18)^2$

$= (9982 + 18)(9982 - 18)$

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

$= (10000) \times (9964)$

LHS $= (10000) \times x$

Comparing L.H.S. and RHS, we get

$10000x = 10000 \times 9964$

or $\quad x = \frac{10000 \times 9964}{10000} = 9964$

Test Yourself

Q1. Using the identities, find the values of the following:

(a) 95×105 (b) 995^2 *(NCERT Exemplar)*

(c) 47×53 (d) $217^2 - 183^2$ *(NCERT Exemplar)*

Q2. Using identities, solve the following expressions:

(a) $\left(\frac{1}{2}x - \frac{3}{2}y\right)^2$ (b) $\left(2x - \frac{1}{x}\right)^2$

Q3. Multiply the following expressions:

(i) $4xy$, $5x^2y^2$ and $6x^3y^3$ (ii) $5x$ and $-4xyz$

Q4. Add: $4b(3b^2 + 5b - 7)$ and $2(b^3 - 4b^2 + 5)$ and find the value for $b = -1$.

Q5. Simplify: $(x + y)(2x - 3y + z) - (2x - 3y)z$

Q6. If $x^2 + \frac{1}{x^2} = 27$, find the values of

(i) $x - \frac{1}{x}$ (ii) $x^4 + \frac{1}{x^4}$

Q7. Using the identity $(x + a)(x + b) = x^2 + (a + b)x + ab$, find the values of

(i) $(4x - 5)(2x - 6)$ (ii) $(a^2 - 3)(a^2 + 5)$

Q8. If $x + \frac{1}{x} = 3$, find the value of

(a) $x^2 + \frac{1}{x^2}$ (b) $x^4 + \frac{1}{x^4}$

Q9. Simplify: (i) $279 \times 279 - 21 \times 21$ (ii) $91 \times 91 - 9 \times 9$ using the identities.

Q10. Find the value of x if

(i) $13x = 58^2 - 45^2$ (ii) $24x = 99^2 - 87^2$

Q11. Find the continued product:

(i) $(x - 1)(x + 1)(x^2 + 1)$

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

Q12. Simplify:

(i) $1.62 \times 1.62 - 0.38 \times 0.38$

(ii) $(203)^2 - (197)^2$

Q13. If $x - y = 9$ and $xy = 16$, find the value of $x^2 + y^2$.

Q14. Find the value of $16x^2 + 56x + 49$ if $x = -1$.

Q15. Find the value of

$$\frac{7.87 \times 7.87 - 1.72 \times 1.72}{6.15}$$

Q16. Find the values of the following:

(*a*) $(a + b)^2 + (a - b)^2$

(*b*) $(a + b)^2 - (a - b)^2$

Q17. Evaluate: $\dfrac{5.43 \times 5.43 - 1.57 \times 1.57}{3.86}$

Q18. Simplify: $\left(x^3 - \dfrac{1}{x^3}\right)\left(x^3 + \dfrac{1}{x^3}\right)\left(x^6 + \dfrac{1}{x^6}\right)$

Higher Order Thinking Skills (HOTs) Questions

Q19. Simplify: $\dfrac{4.359 \times 4.359 - 1.641 \times 1.641}{4.359 - 1.641}$

Q20. Simplify:

$$\frac{3.7 \times 3.7 + 2.3 \times 2.3 + 2 \times 3.7 \times 2.3}{4.6 \times 4.6 - 3.4 \times 3.4}$$

ANSWERS

1. (*a*) 9975 (*b*) 990025 (*c*) 2491 (*d*) 13600
2. (*a*) $\frac{1}{4}x^2 + \frac{9}{4}y^2 - \frac{3}{2}xy$ (*b*) $4x^2 + \frac{1}{x^2} - 4$
3. (*i*) $120x^6y^6$ (*ii*) $-20x^2yz$
4. $14b^3 + 12b^2 - 28b + 10$, 36
5. $2x^2 - 3y^2 - xy + 4yz - xz$
6. (*i*) 5 (*ii*) 727
7. (*i*) $8x^2 - 34x + 30$ (*ii*) $a^4 + 2a^2 - 15$
8. (*a*) 7 (*b*) 47
9. (*i*) 77400 (*ii*) 8200
10. (*i*) 103 (*ii*) 93
11. (*i*) $x^4 - 1$ (*ii*) $x^4 - 81$
12. (*i*) 2.48 (*ii*) 2400
13. 49
14. 9
15. 9.59
16. (*a*) $2a^2 + 2b^2$ (*b*) $4ab$
17. 7
18. $x^{12} - \frac{1}{x^{12}}$
19. 6
20. $\frac{15}{4}$

Internal Assessment

Q1. Answer True (T) or False (F)

(*a*) $x^2 + \frac{1}{x} = 5$ is a polynomial. (....)

(*b*) $(x - 4)^2 = x^2 - 8x + 16$ (....)

(*c*) Coefficient of x^2 in $\frac{1}{2}x^2 + x$ is $\frac{1}{2}$. (....)

(*d*) Degree of the polynomial $x^3 + x^2y - 5$ is 2. (...)

(*e*) $(a + b)^2 - (a - b)^2 = 4ab$. (...)

Q2. If $x - \frac{1}{x} = 2$, then the value of $x^2 + \frac{1}{x^2}$ is

(*i*) 4 (*ii*) 2

(*iii*) $\frac{1}{2}$ (*iv*) $\frac{1}{4}$

Q3. If $13x = (58)^2 - (45)^2$, then x equals to

(*i*) 101 (*ii*) 102

(*iii*) 103 (*iv*) 104

Q4. The value of $(x - 2)(x + 2)(x^2 + 4)$ is

(*i*) $x^2 - 16$ (*ii*) $x^2 + 4$

(*iii*) $x^4 - 16$ (*iv*) $x^4 + 16$

Q5. The value of $a(b - c) + b(c - a) + c(a - b)$ is

(*i*) $a^2 - b^2$ (*ii*) 0

(*iii*) 1 (*iv*) $a^4 - b^4$

Q6. The value of $(x - 4)(x + 5)$ is

(*i*) $x^2 + x - 20$ (*ii*) $x^2 - x + 20$

(*iii*) $x^2 + 9x - 20$ (*iv*) $x^2 - 9x + 20$

Q7. For $x = -1$, the value of $x^3 - 2x^2 - 1$ is

(*i*) –4 (*ii*) 0

(*iii*) 2 (*iv*) 6

Q8. Length and breadth of a rectangle are $(x + 3)$ and $(x + 2)$ respectively, then its area is

(*i*) $x^2 - 5x + 5$ (*ii*) $x^2 + x - 5$

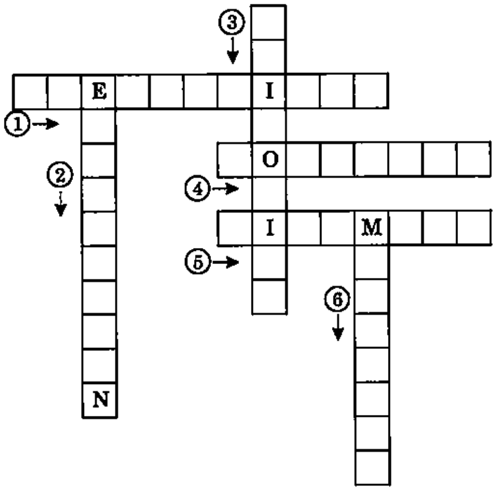
(*iii*) $x^2 + 5x + 6$ (*iv*) $x^2 - x - 5$

Q9. The value of $\dfrac{6.4 \times 6.4 - 3.6 \times 3.6}{2.8}$ is

(*i*) 10 (*ii*) 12

(*iii*) 16.4 (*iv*) 0

Q10. Complete the following crossword puzzle.



Hints

1. 5 is the __________ of $5x^2y$
2. $x^2 + x - 3$ is the algebraic __________ of degree 2.
3. $x + xy + yz$ is __________ expressions.
4. The __________ term in $x^2 + 1$ is 1.
5. $a + 2b$ is the __________ expression.
6. $-5x$ is the __________ expression.

ANSWERS

1. (*a*) False (*b*) True (*c*) True
   (*d*) False (*e*) True
2. (*i*) 3. (*iii*)
4. (*iii*) 5. (*ii*)
6. (*i*) 7. (*i*)
8. (*ii*) 9. (*i*)
10. 1. COEFFICIENT 2. EXPRESSION
    3. TRINOMIAL 4. CONSTANT
    5. BINOMIAL 6. MONOMIAL