MATHEMATICS

Chapter 12: Algebraic Expressions

Algebraic Expressions

Introduction to Algebraic Expressions

Constant

Constant is a quantity which has a fixed value.

Terms of Expression

Parts of an expression which are formed separately first and then added are known as terms. They are added to form expressions.

Example: Terms 4x and 5 are added to form the expression (4x +5).

Coefficient of a term

The numerical factor of a term is called coefficient of the term.

Example: 10 is the coefficient of the term 10xy in the expression 10xy+4y.

Algebra as Patterns

Writing Number patterns and rules related to them

If a natural number is denoted by n, its successor is (n + 1).
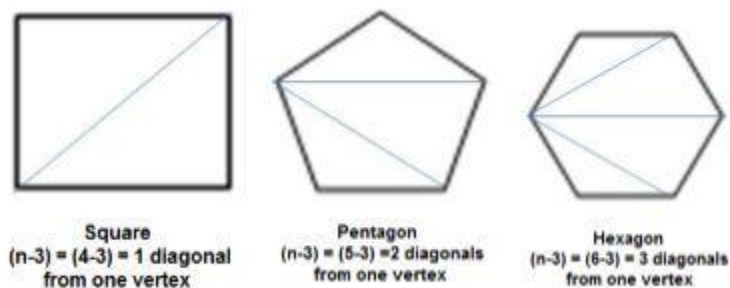
Example: Successor of n=10 is n+1 =11.

If a natural number is denoted by n, 2n is an even number and (2n+1) an odd number.

Example: If n=10, then 2n = 20 is an even number and 2n+1 = 21 is an odd number.

Writing Patterns in Geometry

Algebraic expressions are used in writing patterns followed by geometrical figures.

Example: Number of diagonals we can draw from one vertex of a polygon of n sides is (n - 3).

Square
(n-3) = (4-3) = 1 diagonal
from one vertex

Pentagon
(n-3) = (5-3) =2 diagonals
from one vertex

Hexagon
(n-3) = (6-3) = 3 diagonals
from one vertex

Definition of Variables

Any algebraic expression can have any number of variables and constants.

Variable

A variable is a quantity that is prone to change with the context of the situation.

a,x,p,… are used to denote variables.

Constant

- It is a quantity which has a fixed value.

- In the expression 5x + 4, the variable here is x and the constant is 4.

- The value 5x and 4 are also called terms of expression.

- In the term 5x, 5 is called the coefficient of x. Coefficients are any numerical factor of a term.

Factors of a term

Factors of a term are quantities which can not be further factorised. A term is a product of its factors.

Example: The term –3xy is a product of the factors –3, x and y.

Formation of Algebraic Expressions

- Variables and numbers are used to construct terms.

- These terms along with a combination of operators constitute an algebraic expression.

- The algebraic expression has a value that depends on the values of the variables.

- For example, let $6p^2 - 3p+5$ be an algebraic expression with variable p

  The value of the expression when p=2 is,

  $6(2)^2 - 3(2) + 5$

  $\Rightarrow 6(4) - 6 + 5 = 23$

  The value of the expression when p=1 is,

  $6(1)^2 - 3(1) + 5$

  $\Rightarrow 6 - 3 + 5 = 8$

Like and Unlike Terms

Like terms

Terms having same algebraic factors are like terms.

Example: 8xy and 3xy are like terms.

Unlike terms

Terms having different algebraic factors are unlike terms.

Example: 7xy and –3x are unlike terms.

Monomial, Binomial, Trinomial and Polynomial Terms

Types of expressions based on the number of terms

Based on the number of terms present, algebraic expressions are classified as:

- **Monomial:** An expression with only one term.

  Example: 7xy, −5m, etc.

- **Binomial:** An expression which contains two, unlike terms.

  Example: 5mn + 4, x + y, etc

- **Trinomial:** An expression which contains three terms.

  Example: x + y + 5, a + b + ab, etc.

Polynomials

An expression with one or more terms.

Example: x + y, 3xy + 6 + y, etc.
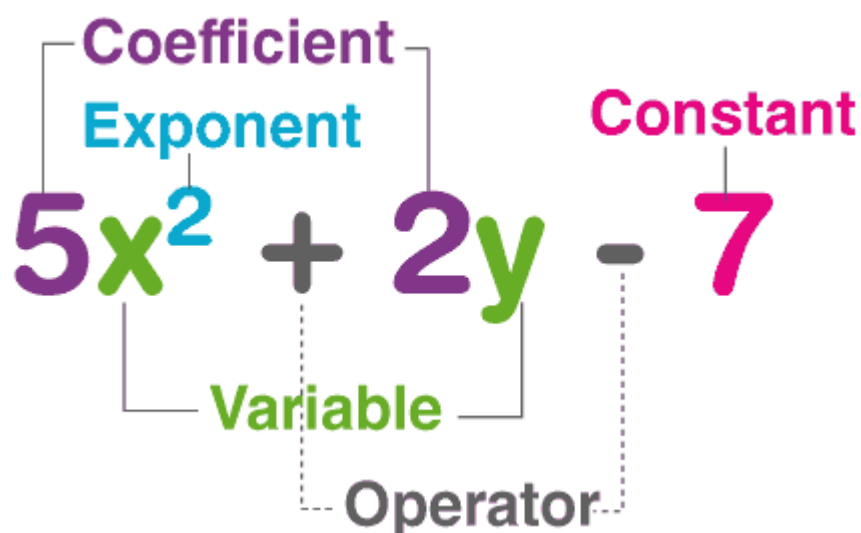
Notation

The polynomial function is denoted by P(x) where x represents the variable. For example,

$P(x) = x^2 - 5x + 11$

If the variable is denoted by a, then the function will be P(a)

Degree of a Polynomial

The degree of a polynomial is defined as the highest degree of a monomial within a polynomial. Thus, a polynomial equation having one variable which has the largest exponent is called a degree of the polynomial.

Polynomial	Degree	Example
Constant or Zero Polynomial	0	6
Linear Polynomial	1	$3x+1$
Quadratic Polynomial	2	$4x^2+1x+1$
Cubic Polynomial	3	$6x^3+4x^3+3x+1$
Quartic Polynomial	4	$6x^4+3x^3+3x^2+2x+1$

Properties of polynomial

Some of the important properties of polynomials along with some important polynomial theorems are as follows:

Property 1: Division Algorithm

If a polynomial P(x) is divided by a polynomial G(x) result in quotient Q(x) with remainder R(x), then,

P(x) = G(x) • Q(x) + R(x)

Property 2: Bezout's Theorem

Polynomial P(x) is divisible by binomial (x – a) if and only if P(a) = 0.

Property 3: Remainder Theorem

If P(x) is divided by (x – a) with remainder r, then P(a) = r.

Property 4: Factor Theorem

A polynomial P(x) divided by Q(x) results in R(x) with zero remainders if and only if Q(x) is a factor of P(x).

Property 5: Intermediate Value Theorem

If P(x) is a polynomial, and P(x) ≠ P(y) for (x < y), then P(x) takes every value from P(x) to P(y) in the closed interval [x, y].

Property 6

The addition, subtraction and multiplication of polynomials P and Q result in a polynomial where,

Degree (P ± Q) ≤ Degree (P or Q)

Degree (P × Q) = Degree (P) + Degree(Q)

Property 7

If a polynomial P is divisible by a polynomial Q, then every zero of Q is also a zero of P.

Property 8

If a polynomial P is divisible by two coprime polynomials Q and R, then it is divisible by (Q • R).

Property 9

If $P(x) = a_0 + a_1x + a_2x^2 + ... + a_nx^n$ is a polynomial such that deg(P) = n ≥ 0 then, P has at most "n" distinct roots.

Property 10: Descartes' Rule of Sign

The number of positive real zeroes in a polynomial function P(x) is the same or less than by an even number as the number of changes in the sign of the coefficients. So, if there are "K" sign changes, the number of roots will be "k" or "(k – a)", where "a" is some even number.

Property 11: Fundamental Theorem of Algebra

Every non-constant single-variable polynomial with complex coefficients has at least one complex root.

Property 12

If P(x) is a polynomial with real coefficients and has one complex zero (x = a – bi), then x = a + bi will also be a zero of P(x). Also, $x^2 – 2ax + a^2 + b^2$ will be a factor of P(x).

Polynomial Functions

A polynomial function is an expression constructed with one or more terms of variables with constant exponents. If there are real numbers denoted by a, then function with one variable and of degree n can be written as:

$$f(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + ... + a_{n-2}x^2 + a_{n-1}x + a_n$$

Addition and Subtraction of Algebraic Equations

- Mathematical operations like addition and subtraction can be applied to algebraic terms.

- For adding or subtracting two or more algebraic expression, like terms of both the expressions are grouped together and unlike terms are retained as it is.

- Sum of two or more like terms is a like term with a numerical coefficient equal to the sum of the numerical coefficients of all like terms.

- Difference between two like terms is a like term with a numerical coefficient equal to the difference between the numerical coefficients of the two like terms.

- For example, 2y + 3x – 2x + 4y

    ⇒ x (3 – 2) + y (2 + 4)

    ⇒ x + 6y

- Summation of algebraic expressions can be done in two ways:

Consider the summation of the algebraic expressions $5a^2 + 7a + 2ab$ and $7a^2 + 9a + 11b$

- **Horizontal method**

    Consider three algebraic expressions $5xy - 3x^2 - 12y + 5x$, $xy - 3x - 12yz + 5x^3$ and $y - 6x^2 - zy + 5x^3$.

    Step 1: Write the given algebraic expressions using an additional symbol.

    $(5xy - 3x^2 - 12y + 5x) + (xy - 3x - 12yz + 5x^3) + (y - 6x^2 - zy + 5x^3)$

    Step 2: Open the brackets and multiply the signs.

    $5xy - 3x^2 - 12y + 5x + xy - 3x - 12yz + 5x^3 + y - 6x^2 - zy + 5x^3$

    Step 3: Now, combine the like terms.

    $(5xy + xy) + (-3x^2 - 6x^2) + (-12y + y) + (5x - 3x) + (-12yz - yz) + (5x^3 + 5x^3)$

    Step 4: Add the coefficients. Keep the variables and exponents on the variables the same.

    $6xy - 9x^2 - 11y + 2x - 13yz + 10x^3$

Column Method

In this method, the given expression must be written column wise one below the other. For adding two or more algebraic expressions the like terms of both the expressions are grouped together. The coefficients of like terms are added together using simple addition techniques and the variable which is common is retained as it is. The, unlike terms, are retained as it is and the result obtained is the addition of two or more algebraic expressions.

$+5xy$	$-3x^2$	$-12y$	$+5x$	$+0yz$	$+0x^3$
$+xy$	$+0x^2$	$+0y$	$-3x$	$-12yz$	$+5x^3$
$+0xy$	$-6x^2$	$+1y$	$+0x$	$-yz$	$+5x^3$
$6xy$	$-9x^2$	$-11y$	$+2x$	$-13yz$	$+10x^3$

- **Vertical method**

    $5a^2 + 7a + 2ab$

    $7a^2 + 9a + 11b$

    $12a^2 + 16a + 2ab + 11b$

The knowledge of like and unlike terms is crucial while studying addition and subtraction of algebraic expressions because the operation of addition and subtraction can only be performed on like terms. The terms whose variables and their exponents are the same are known as like terms and the terms having different variables are unlike terms.

Example: $-5x^2 + 12xy - 3y + 7x^2 + xy$

In the given algebraic expression, $-5x^2$ and $7x^2$ are like since both the terms have x^2 as the common variable. Similarly, $12xy$ and xy are like terms.

Use of algebraic expressions in the formula of the perimeter of figures

Algebraic expressions can be used in formulating perimeter of figures.

Example: Let l be the length of one side then the perimeter of:

Equilateral triangle = 3l

Square = 4l

Regular pentagon = 5l

Use of algebraic expressions in formula of area of figures

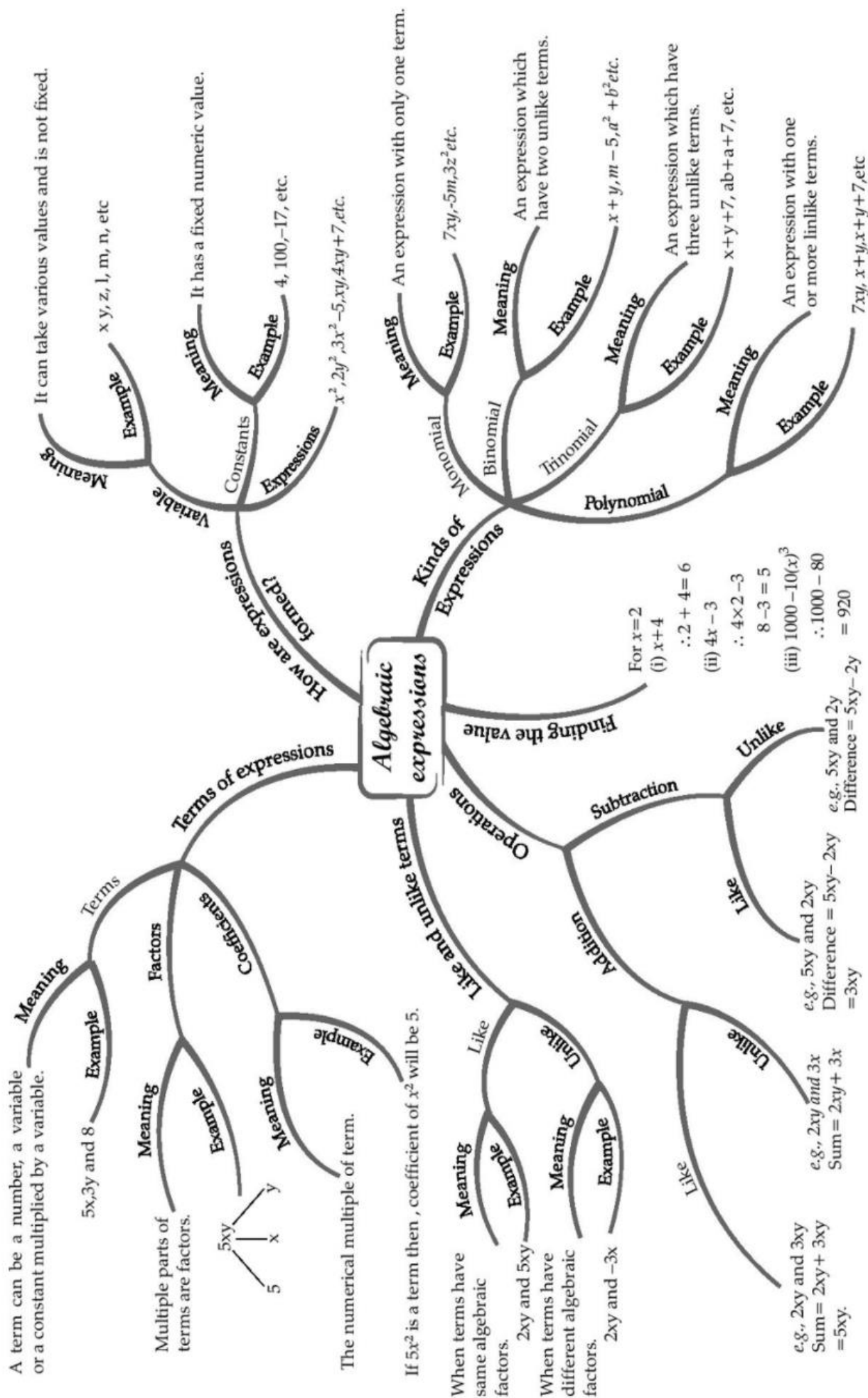Algebraic expressions can be used in formulation area of figures.

Example: Let l be the length and b be the breadth then the area of:

Square = l2

Rectangle = l × b = lb

Triangle = $\frac{b \times h}{2}$, where b and h are base and height, respectively.

CHAPTER – 12 ALGEBRAIC EXPRESSIONS

Algebraic expressions

How are expressions formed?

Variable

Meaning — It can take various values and is not fixed.

Example — x, y, z, l, m, n, etc

Constants

Meaning — It has a fixed numeric value.

Example — $4, 100, -17$, etc.

Expressions — $x^2, 2y^2, 3x^2 -5, xy, 4xy+7$, etc.

Kinds of Expressions

Monomial

Meaning — An expression with only one term.

Example — $7xy, -5m, 3z^2$ etc.

Binomial

Meaning — An expression which have two unlike terms.

Example — $x+y, m-5, a^2+b^2$ etc.

Trinomial

Meaning — An expression which have three unlike terms.

Example — $x+y+7, ab+a+7$, etc.

Polynomial

Meaning — An expression with one or more linlike terms.

Example — $7xy, x+y, x+y+7$, etc

Finding the value

For $x=2$
(i) $x+4$
$\therefore 2+4=6$

(ii) $4x-3$
$\therefore 4\times2-3$
$8-3=5$

(iii) $1000-10(x)^3$
$\therefore 1000-80$
$= 920$

Terms of expressions

Terms

Meaning — A term can be a number, a variable or a constant multiplied by a variable.

Example — $5x, 3y$ and 8

Factors

Meaning — Multiple parts of terms are factors.

Example —

$5xy$ — x, y, 5

Coefficients

Meaning — The numerical multiple of term.

Example — If $5x^2$ is a term then, coefficient of x^2 will be 5.

Like and unlike terms

Like

Meaning — When terms have same algebraic factors.

Example — $2xy$ and $5xy$

Unlike

Meaning — When terms have different algebraic factors.

Example — $2xy$ and $-3x$

Operations

Addition

Like — e.g., $2xy$ and $3xy$
Sum $= 2xy + 3xy$
$=5xy$.

Unlike — e.g., $2xy$ and $3x$
Sum $= 2xy + 3x$

Subtraction

Like — e.g., $5xy$ and $2xy$
Difference $= 5xy - 2xy$
$=3xy$

Unlike — e.g., $5xy$ and $2y$
Difference $= 5xy - 2y$

Important Questions

Multiple Choice Questions-

Question 1. How many terms are there in the expression $2x^2y$?

(a) 1

(b) 2

(c) 3

(d) 4

Question 2. How many terms are there in the expression 2y + 5?

(a) 1

(b) 2

(c) 3

(d) 4

Question 3. How many terms are there in the expression 1.2ab – 2.4b + 3.6a?

(a) 1

(b) 2

(c) 3

(d) 4

Question 4. How many terms are there in the expression $-2p^3 - 3p^2 + 4p + 7$?

(a) 1

(b) 2

(c) 3

(d) 4

Question 5. What is the coefficient of x in the expression 4x + 3y?

(a) 1

(b) 2

(c) 3

(d) 4

Question 6. What is the coefficient of x in the expression 2 – x + y?

(a) 2

(b) 1

(c) -1

(d) None of these

Question 7. What is the coefficient of x in the expression $y^2x + y$?

(a) y^2

(b) y

(c) 1

(d) 0

Question 8. What is the coefficient of x in the expression $2z - 3xz$?

(a) 3

(b) z

(c) 3z

(d) -3z

Question 9. What is the coefficient of x in the expression $1 + x + xz$?

(a) z

(b) 1 + z

(c) 1

(d) 1 + x

Question 10. What is the coefficient of x in the expression $2x + xy^2$?

(a) $2 + y^2$

(b) 2

(c) y^2

(d) None of these

Question 11. What is the coefficient of y^2 in the expression $4 - xy^2$?

(a) 4

(b) x

(c) -x

(d) None of these

Question 12. What is the coefficient of y^2 in the expression $3y^2 + 4x$?

(a) 1

(b) 2

(c) 3

(d) 4

Question 13. What is the coefficient of y^2 in the expression $2x^2y - 10xy^2 + 5y^2$?

(a) $5 - 10x$

(b) 5

(c) -10 x

(d) None of these

Question 14. What is the coefficient of x in the expression $ax^3 + bx^2 + d$?

(a) a

(b) b

(c) d

(d) 0

Question 15. What is the coefficient of x^2 in the expression $ax + b$?

(a) a

(b) b

(c) a + b

(d) 0

Very Short Questions:

1. Identify in the given expressions, terms which are not constants. Give their numerical coefficients.

    (i) $5x - 3$

    (ii) $11 - 2y^2$

    (iii) $2x - 1$

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

2. Group the like terms together from the following expressions:

    $-8x^2y, 3x, 4y, \dfrac{-3}{2}x, 2x^2y, -y$

3. Identify the pairs of like and unlike terms:

    (i) $\dfrac{-3}{2}x, y$

    (ii) $-x, 3x$

    (iii) $\dfrac{-1}{2}y2x, \dfrac{3}{2}xy^2$

    (iv) $1000, -2$

4. Classify the following into monomials, binomial and trinomials.

    (i) -6

    (ii) $-5 + x$

    (iii) $\dfrac{3}{2}x - y$

    (iv) $6x^2 + 5x - 3$

(v) $z^2 + 2$

5. Draw the tree diagram for the given expressions:

(i) -3xy + 10

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

6. Identify the constant terms in the following expressions:

(i) $-3 + \frac{3}{2}x$

(ii) $\frac{3}{2} - 5y + y^2$

(iii) $3x^2 + 2y - 1$

7. Add:

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

(ii) $a + b - 3$, $b + 2a - 1$

8. Subtract $3x^2 - x$ from $5x - x^2$.

9. Simplify combining the like terms:

(i) $a - (a - b) - b - (b - a)$

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

Short Questions :

1. Subtract $24xy - 10y - 18x$ from $30xy + 12y - 14x$.

2. From the sum of $2x^2 + 3xy - 5$ and $7 + 2xy - x^2$ subtract $3xy + x^2 - 2$.

3. Subtract $3x^2 - 5y - 2$ from $5y - 3x^2 + xy$ and find the value of the result if $x = 2$, $y = -1$.

4. Simplify the following expressions and then find the numerical values for $x = -2$.

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

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

5. Find the value of t if the value of $3x^2 + 5x - 2t$ equals to 8, when $x = -1$.

Long Questions :

1. Subtract the sum of $-3x^3y^2 + 2x^2y^3$ and $-3x^2y^3 - 5y^4$ from $x^4 + x^3y^2 + x^2y^3 + y^4$.

2. What should be subtracted from $2x^3 - 3x^2y + 2xy^2 + 3y^2$ to get $x^3 - 2x^2y + 3xy^2 + 4y^2$?

3. To what expression must $99x^3 - 33x^2 - 13x - 41$ be added to make the sum zero?

4. If P = $2x^2 - 5x + 2$, Q = $5x^2 + 6x - 3$ and R = $3x^2 - x - 1$. Find the value of

2P – Q + 3R.

5. If A = -(2x + 3), B = -3(x – 2) and C = -2x + 7. Find the value of k if (A + B + C) = kx.

6. Find the perimeter of the given figure ABCDEF.
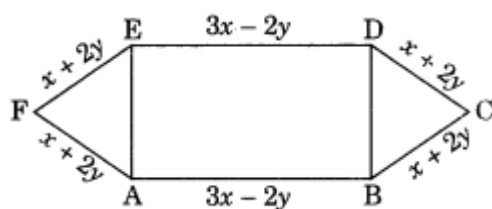
7. Rohan's mother gave him ₹ $3xy^2$ and his father gave him ₹ $5(xy^2 + 2)$. Out of this total money he spent ₹ $(10 – 3xy^2)$ on his birthday party. How much money is left with him?

Answer Key-

Multiple Choice questions-

1. (a) 1
2. (b) 2
3. (c) 3
4. (d) 4
5. (d) 4
6. (c) -1
7. (a) y^2
8. (d) -3z
9. (b) 1 + z
10. (a) $2 + y^2$
11. (c) -x
12. (c) 3
13. (a) 5 – 10x
14. (d) 0
15. (d) 0

Very Short Answer :

1.

Expression	Term which is not a constant	Numerical coefficient
(i) $5x - 3$	$5x$	5
(ii) $11 - 2y^2$	$-2y^2$	-2
(iii) $2x - 1$	$2x$	2
(iv) $4x^2y + 3xy^2 - 5$	$4x^2y$	4
	$3xy^2$	3

2. Group of like terms are:

(i) $-8x^2y$, $2x^2y$

(ii) $3x$, $\dfrac{-3}{2}x$

(iii) $4y$, $-y$

3. (i) $\dfrac{-3}{2}x$, $y \rightarrow$ Unlike Terms

(ii) $-x$, $3x \rightarrow$ Like Terms

(iii) $\dfrac{-1}{2}y2x$, $\dfrac{3}{2}xy^2 \rightarrow$ Like Terms

(iv) 1000, $-2 \rightarrow$ Like Terms

4. (i) -6 is monomial

(ii) $-5 + x$ is binomial

(iii) $\dfrac{3}{2}x - y$ is binomial

(iv) $6x^2 + 5x - 3$ is trinomial

(v) $z^2 + z$ is binomial

5.
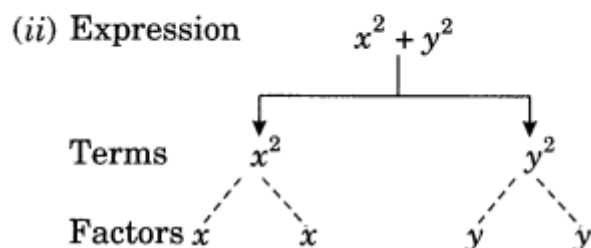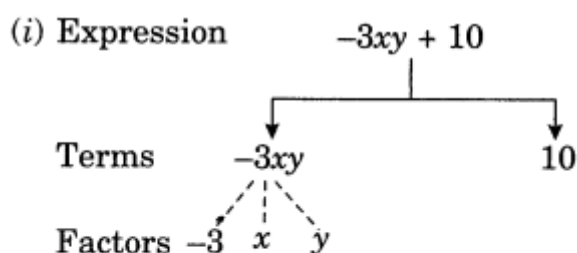
6. (i) Constant term $= -3$

(ii) Constant term $= \dfrac{3}{2}$

(iii) Constant term = -1

7.   (i) $3x^2y$, $-5x^2y$, $-x^2y$

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

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

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

     $= -3x^2y$

     (ii) $a + b - 3$, $b + 2a - 1$

     $= (a + b - 3) + (b + 2a - 1)$

     $= a + b - 3 + b + 2a - 1$

     $= a + 2a + b + b - 3 - 1$

     $= 3a + 2b - 4$

8. $(5x - x^2) - (3x^2 - x)$

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

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

     $= 6x - 4x^2$

9.   (i) $a - (a - b) - b - (b - a)$

     $= a - a + b - b - b + a$

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

     $= a - b$

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

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

     $= x^2 - y^2 - 4x$

Short Answer :

1. $(30xy + 12y - 14x) - (24xy - 10y - 18x)$

     $= 30xy + 12y - 14x - 24xy + 10y + 18x$

     $= 30xy - 24xy + 12y + 10y - 14x + 18x$

     $= 6xy + 22y + 4x$

2.   Sum of the given term is $(2x^2 + 3xy - 5) + (7 + 2xy - x^2)$

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

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

     $= x^2 + 5xy + 2$

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

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

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

$= 0 + 2xy + 4$

$= 2xy + 4$

3. $(5y - 3x^2 + xy) - (3x^2 - 5y - 2)$

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

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

$= -6x^2 + 10y + xy + 2$

Putting x = 2 and y = -1, we get

$-6(2)^2 + 10(-1) + (2)(-1) + 2$

$= -6 \times 4 - 10 - 2 + 2$

$= -24 - 10 - 2 + 2$

$= -34$

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

$= 6x - 12 + x^2 + 5$

$= x^2 + 6x - 7$

Putting x = -2, we get

$= (-2)^2 + 6(-2) - 7$

$= 4 - 12 - 7$

$= 4 - 19$

$= -15$

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

$= 6x - 10 - 2x - 8$

$= 6x - 2x - 10 - 8$

$= 4x - 18$

Putting x = -2, we get

$= 4(-2) - 18$

$= -8 - 18$

$= -26$

5. $3x^2 + 5x - 2t = 8$ at x = -1

$\Rightarrow 3(-1)^2 + 5(-1) - 2t = 8$

$\Rightarrow 3(1) - 5 - 2t = 8$

$\Rightarrow 3 - 5 - 2t = 8$

$\Rightarrow$ -2 $-$ 2t = 8

$\Rightarrow$ 2t = 8 + 2

$\Rightarrow$ -2t = 10

$\Rightarrow$ t = -5

Hence, the required value of t = -5.

Long Answer :

1. Sum of the given terms:

$$-3x^3y^2 + 2x^2y^3$$
$$+ \qquad \cdot -3x^2y^3 - 5y^4$$
$$\overline{-3x^3y^2 - x^2y^3 - 5y^4}$$

Now

$$x^4 + x^3y^2 + x^2y^3 + y^4$$
$$-3x^3y^2 - x^2y^3 - 5y^4$$
$$(+) \qquad (+) \qquad (+)$$
$$\overline{x^4 + 4x^3y^2 + 2x^2y^3 + 6y^4}$$

Required expression

2. We have

$$2x^3 - 3x^2y + 2xy^2 + 3y^2$$
$$x^3 - 2x^2y + 3xy^2 + 4y^2$$
$$(-) \quad (+) \ . \ (-) \qquad (-)$$
$$\overline{x^3 - x^2y - xy^2 - y^2}$$

Required expression

3. Given expression:

$99x^3 - 33x^2 - 13x - 41$

Negative of the above expression is

$-99x^3 + 33x^2 + 13x + 41$

$(99x^3 - 33x^2 - 13x - 41) + (-99x^3 + 33x^2 + 13x + 41)$

$= 99x^3 - 33x^2 - 13x - 41 - 99x^3 + 33x^2 + 13x + 41$

$= 0$

Hence, the required expression is $-99x^3 + 33x^2 + 13x + 41$

4. $2P - Q + 3R = 2(2x^2 - 5x + 2) - (5x^2 + 6x - 3) + 3(3x^2 - x - 1)$

$= 4x^2 - 10x + 4 - 5x^2 - 6x + 3 + 9x^2 - 3x - 3$

$= 4x^2 - 5x^2 + 9x^2 - 10x - 6x - 3x + 4 + 3 - 3$

$= 8x^2 - 19x + 4$

Required expression.

5. $A + B + C = -(2x + 13) - 3(x - 2) + (-2x + 7)$

$= -2x - 13 - 3x + 6 - 2x + 7$

$= -2x - 3x - 2x - 13 + 6 + 7$

$= -7x$

Since $A + B + C = kx$

$-7x = kx$

Thus, $k = -7$

6. Required perimeter of the figure

$ABCDEF = AB + BC + CD + DE + EF + FA$

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

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

$= 6x - 4y + 4x + 8y$

$= 6x + 4x - 4y + 8y$

$= 10x + 4y$

Required expression.

7. Money give by Rohan's mother = ₹ $3xy^2$

Money given by his father = ₹ $5(xy^2 + 2)$

Total money given to him = ₹ $3xy^2$ + ₹ $5(xy^2 + 2)$

$= ₹ [3xy^2 + 5(xy^2 + 2)]$

$= ₹ (3xy^2 + 5xy^2 + 10)$

$= ₹ (8xy^2 + 10).$

Money spent by him = ₹ $(10 - 3xy)^2$

Money left with him = ₹ $(8xy^2 + 10)$ − ₹ $(10 - 3xy^2)$

$= ₹ (8xy^2 + 10 - 10 + 3x^2y)$

$= ₹ (11xy^2)$

Hence, the required money = ₹ $11xy^2$