Chapter 3

Algebra

Polynomials

- An algebraic expression f (x) of the form $f(x) = a_0 + a_1x + a_2x^2 + ... + a_nx^n$. Where $a_0, a_1, a_2, ...,$ a_n are real numbers and all the index of x are non-negative integers is called a polynomials in x and the highest index n is called the degree of the polynomial. Here a_0 , a_1x , a_2x^2 , ..., a_nx^n are called the terms of the polynomial and a_0, a_1, a_2......... a_n are called various coefficients of the polynomial f (x).

  A symbol which takes various numerical values is known as a variable.
- **Polynomials in One Variable :**

  All the algebraic expressions which have only whole numbers as the exponents of the variable are called polynomials in one variable.
- **Check whether algebraic expression is polynomial or not:**

  If the exponent of any term of the algebraic expression is not a whole number then the expression is not a polynomial.
- **Degree of a Polynomial :**

  If a polynomial involves two or more variables, then the sum of the powers of all the variables in each term is taken up and the highest sum so obtained is the degree of the polynomial.
- **Value of a Polynomial :**

  The value of a polynomial f (x) at $x = \alpha$ is obtained by substituting $x = \alpha$ in the given polynomial and is denoted by $f(\alpha)$.
- **Zero of a polynomial :**

  A real number c is said to be a zero of a polynomial p (x), if p(c) = 0. The zeroes of polynomial p (x) are actually the x-coordinates of the points where the graph of y = p(x) intersects the x-axis.

  Note : A linear polynomial can have at most one zero. A quadratic or cubic polynomial can have at most two and three zeroes respectively.

Types of Polynomials :

- **Constant Polynomial :**

  A polynomial which has only constant term is called a constant polynomial.

  Note : The degree of a non-zero constant polynomial is zero.
- **Zero polynomial :**

  The constant polynomial 0 is called the zero polynomial.
- **Monomials :**

  Polynomials having only one term are called monomials.
- **Binomials :**

  Polynomials having only two terms are called binomials.
- **Trinomials :**

  Polynomials having only three terms are called trinomials.
- **Linear Polynomial :**

  A polynomial of degree one is called a linear polynomial.
- **Quadratic Polynomial :**

  A polynomial of degree two is called a quadratic polynomial.
- **Cubic Polynomial :**

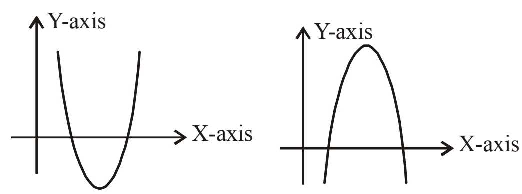
  A polynomial of degree three is called a cubic polynomial.
- **Graph of Polynomial :**

(i) Graph of a linear polynomial ax + b is a straight line.

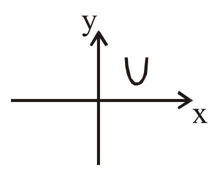
(ii) Graph of a quadratic polynomial $p(x) = ax^2 + bx + c$ is a parabola open upwards like $\cup$ if $a > 0$.

(iii) Graph of a quadratic polynomial $p(x) = ax^2 + bx + c$ is a parabola open downwards like $\cap$ if $a < 0$.

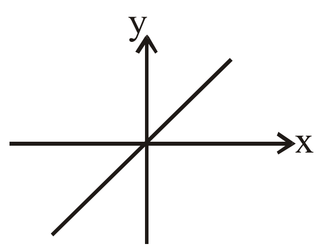
(iv) In general a polynomial p(x) of degree n crosses the x-axis at atmost n points.



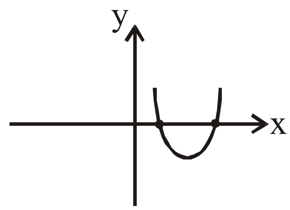
(v) When the graph of quadratic polynomial does not cut the x-axis at any point. The quadratic polynomial $ax^2 + bx + c$ has no zero.



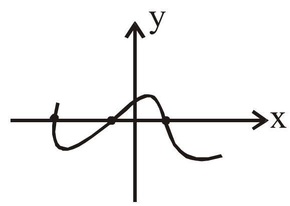
(vi) When the graph cut x-axis at exactly one point. There is only one zero for the quadratic polynomial $ax^2 + bx + c$.



(vii) When the graph cut x-axis at two distinct points there are two zeroes of quadratic polynomial $ax^2 + bx + c$.



(viii) When the graph cut x-axis at three distinct points there are three zeroes of cubic polynomial $ax^3 + bx^2 + (cx + d)$



- **Relation between Zeroes and Coefficients of Polynomial :**

(i) If α, β are zeroes of quadratic polynomial $p(x) = ax^2 + bx + c$, $a \neq 0$ then sum of zeroes $= \alpha + \beta = -\frac{b}{a}$, product of zeroes $= \alpha\beta = \frac{c}{a}$

(ii) If α, β and γ are zeroes of cubic polynomial, $p(x) = ax^3 + bx^2 + cx + d$, $a \neq 0$, then

$$\alpha + \beta + \gamma = -\frac{b}{a},\ \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a},\ \alpha\beta\gamma = -\frac{d}{a}$$

(iii) If α, β are roots of a quadratic polynomial p(x), then

$$p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$$

$\Rightarrow$ $p(x) = x^2 -$ (Sum of roots) x + Product of roots

- **Division Algorithm for Polynomials :**

(i) If p(x) and q(x) are any two polynomials then we always have polynomials q(x) and r(x) such that

$p(x) = g(x).\, q(x) + r(x)$

where $g(x) \neq 0$ and $r(x) = 0$ or

degree of r(x) < degree of g(x).

(ii) In particular if r(x) =0, then g(x) is a divisor of p(x) so, g(x) is a factor of p(x).

- **Remainder Theorem :**

Let $p(x)$ be any polynomial of degree greater than or equal to one and let a be any real number. If $p(x)$ is divided by the linear polynomial $x - a$, then the remainder is $p(a)$.

- **Factor of a Polynomial :**

To express a given polynomial as the product of linear factors or factors of degree less than that of the given polynomial such that no such a factor has a linear factor, is known as factorization.

- **Factor Theorem :**

If p(x) is a polynomial of degree $n \geq 1$ and a is any real number. Then

(i) $x - a$ is a factor of $p(x)$, if $p(a) = 0$, and

(ii) $p(a) = 0$, if $x - a$ is a factor of $p(x)$.

Note : If $p(a) \neq 0$ then $(x - a)$ will not be a factor of $p(x)$.

- **Factorization of the Quadratic Polynomial :**
$ax^2 + bx + c$ (where $a \neq 0$ and a, b, c are constants)

To factorise $ax^2 + bx + c$, we write b as the sum of two numbers whose product is ac.

- **Algebraic Identities**

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

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

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

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

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

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

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

(viii) $a^3 + b^3 + c^3 - 3abc =$
$(a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$

(ix) $a^3 + b^3 + c^3 = 3abc$ if $a + b + c = 0$

(x) $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Linear Equations and Pair of Linear Equation in Two Variables

- **Linear equation in two variables :**

An equation which can be put in the form $ax + by + c = 0$, where a, b and c are real numbers, and $a \neq 0$, $b \neq 0$, is called a linear equation in two variables x and y.

- **Solution of Linear Equation in two variables**

Solution of linear equation in two variables is a pair of values, one for x and the other for y, which makes the two sides of the equation equal.

Note :

(i) Every solution (x, y) of the equation $ax + by + c = 0$ is a point lies on the line representing the equation $ax + by + c = 0$.

(ii) The graph of the equation of the form y = kx is a line which always passes through the origin.

(iii) The graph of $x = a$ is a straight line parallel to the $y-$axis.

(iv) The graph of $y = a$ is a straight line parallel to the $x-$axis.

- **General form for pair of linear equation in two variables :**

The general form for a pair of linear equations in two variables x and y is

$a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$,

where a_1, b_1, c_1, a_2, b_2, c_2, are all real numbers and $a_1^2 + b_1^2 \neq 0$, $a_2^2 + b_2^2 \neq 0$

- **Methods of solving simultaneous linear equations in two variables :**

Graphical method :

It shows that the graph of pair of linear equations in two variables is represented by two lines.

(i) If the lines intersect at a point, then that point gives the unique solution of the two equations. In this case, the pair of equations is **consistent**.

(ii) If the lines coincide, then there are infinitely many solutions and each point on the line being a solution. In this case, the pair of equations is **dependent (consistent)**.

(iii) If the lines are parallel, then the pair of equations has no solution. In this case, the pair of equations is **inconsistent**.

Algebraic method :

There are three algebraic methods:

(i) Elimination method.

(ii) Substitution method

(iii) Cross multiplication method.

For two linear equation of the system :

$a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where

$a_1, b_1, a_2, b_2 \neq 0$. We have 3 cases as follows :

Case 1 : If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, the system of linear equation has unique solution and it is also called **consistent solution.**

Case 2 : If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, the system has **Infinite many solutions** and it is also called **coincident or dependent or consistent system.**

Case 3 : If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, the system of linear equation has **no solution** and it is also known as **Inconsistent system.**

- **Solving techniques for solvings pair of linear equations in two variables by :-**

(a) Elimination method

(b) Substitution method

(c) Cross multiplication method.

Let us consider any two equations

$$\frac{2x}{a} + \frac{y}{b} = 2 \qquad \ldots(A)$$

$$\frac{x}{a} - \frac{y}{b} = 4 \qquad \ldots(B)$$

- **By Elimination method :**

STEP 1 : Comparing coefficients (of)

$2bx + ay = 2ab$ …(i)

$bx - ay = 4ab$ …(ii)

STEP 2 : Multiplying equation (ii) by 2 on both sides we get equal ceofficients of x in both equations.

$2bx + ay = 2ab$ …(iii)

$2bx - 2ay = 8ab$ …(iv)

STEP 3 : By subtracting equation (iv) from equation (iii) we get,

$3ay = -6ab$ or $y = -2b$

STEP 4 : Putting value of y in any equation [(iii) or (iv)], we get

$$2bx - 2ab = 2ab \text{ or } x = \frac{4ab}{2b} = 2a \Rightarrow x = 2a$$

$\Rightarrow$ Solution $(x, y) = (2a, -2b)$

- **By substitution method :**

STEP 1 : Get value of x in terms of y from equation (A)

$$\frac{2x}{a} = 2 - \frac{y}{b} \Rightarrow \frac{2x}{a} = \frac{2b-y}{b}$$

$$\Rightarrow x = \frac{(2b-y)a}{2b} \qquad \ldots(v)$$

STEP 2 : Putting the value of x in equation (B)

$$\frac{(2b-y)a}{2b.a} - \frac{y}{b} = 4 \Rightarrow \frac{2b-y}{2b} - \frac{y}{b} = 4$$

$$\Rightarrow 1 - \frac{y}{2b} - \frac{y}{b} = 4 \Rightarrow -3 = \frac{y}{2b} + \frac{2y}{2b}$$

$$\Rightarrow \frac{3y}{2b} = -3 \Rightarrow y = -2b$$

STEP 3 : Putting value of y in equation (v). We get,

$$x = \frac{(2b+2b)a}{2b} = 2a$$

$\Rightarrow$ Solution $(x, y) = (2a, -2b)$

- **By cross multiplication method :**

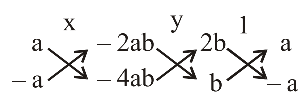
Given equations are $\frac{2x}{a} + \frac{y}{b} = 2$ …(A)

and $\frac{x}{a} - \frac{y}{b} = 4$ …(B)

or $2bx + ay - 2ab = 0$ …(1)

(Taking L.C.M and by cross multiplication), we get

$bx - ay - 4ab = 0$ …(2)



$$\frac{x}{-4a^2b - \{-a(-2ab)\}} = \frac{y}{-2ab^2 - \{2b(-4ab)\}} = \frac{1}{-2ab - ab}$$

$$\frac{x}{-4a^2b - 2a^2b} = \frac{y}{-2ab^2 + 8ab^2} = \frac{1}{-3ab}$$

$$\frac{x}{-6a^2b} = \frac{y}{6ab^2} = \frac{1}{-3ab}$$

STEP 1 : (a) below 'x', write the coefficients 'y' and the constant terms.

(b) below y, write constant terms and coeff of x.

(c) below 1, write the coeffs of x and y.

STEP 2 : $\dfrac{x}{-4a^2b-2a^2b} = \dfrac{y}{-2ab^2+8ab^2} = \dfrac{1}{-2ab-ab}$

or $\dfrac{x}{-6a^2b} = \dfrac{y}{6ab^2} = \dfrac{1}{-3ab}$

STEP 3 : On Simplification , Either $= \dfrac{x}{-6a^2b} = \dfrac{1}{-3ab}$

$\Rightarrow \quad -3abx = -6a^2b$ or $x = \dfrac{6a^2b}{3ab}$

$\Rightarrow \quad x = 2a$ or $\dfrac{y}{-6ab^2} = \dfrac{1}{-3ab} \Rightarrow -3aby = 6ab^2$

$\Rightarrow \quad y = -2b$. Thus, $\{x,y\} = \{2a, -2b\}$

Quadratic Equations

- **Solution of a Quadratic Equation by Factorisation :**
  A real number x is called a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ if $a\alpha^2 + b\alpha + c = 0$. In this case, we say $x = \alpha$ is a solution of the quadratic equation.
  Note : The zeroes of the quadratic polynomial $ax^2 + bx + c$ and the roots of the quadratic equation $ax^2 + bx + c = 0$ are the same.

Sequence

A collection of numbers arranged in a definite order according to some definite rule (rules) is called a **sequence**.
Each number of the sequence is called a **term** of the sequence. The sequence is called **finite** or **infinite** according as the number of terms in it is finite or infinite.

- **Arithmetic Progression :**
  A sequence is called an arithmetic progression (abbreviated A.P.) if and only if the difference of any term from its preceding term is constant.
  -ie- A sequence in which the common difference between successors and predecessors will be constant. i.e. a, $a + d$, $a + 2d$ ....
  This constant is usually denoted by 'd' and is called common difference.
  Note : The common difference 'd' can be positive, negative or zero.

- **n^{th} Term of an A.P. :**
  It is denoted by t_n and is given by the formula, $t_n = a + (n-1)d$ where 'a' is first term of the series, n is the number of terms of the series and 'd' is the common difference of the series.
  Note : An A.P which consists only finite number of terms is called a **finite A.P.** and which contains infinite number of terms is called **infinite A.P.**
  Remark : Each finite A.P has a last term and infinite A.Ps do not have a last term.
  Result : In general, for an A.P a_1, a_2 , ..., a_n, we have $d = a_{k+1} - a_k$ where a_{k+1} and a_k are the $(k + 1)$th and the kth terms respectively.

- **Sum of first n terms of an A.P.**
  It is represented by symbol S_n and is given by the formula,

$$S_n = \frac{n}{2}\{2a + (n-1)d\} \quad \text{or,} \quad S_n = \frac{n}{2}\{a + \ell\} \ ;$$

  where 'ℓ' denotes last term of the series and $\ell = a + (n-1)d$
  Remark : The n^{th} term of an A.P is the difference of the sum to first n terms and the sum to first $(n - 1)$ terms of it.
  -ie- $a_n = S_n - S_{n-1}$.

- **To find n^{th} term from end of an A. P. :**
  n^{th} term from end is given by formula

$$\ell - (n-1)\,d$$

  n th term from end of an A.P.
  $= $ n th term of $(\ell, \ell - d, \ell - 2d, \ldots\ldots\ldots.)$
  $= \ell + (n-1)(-d) = \ell - (n-1)d$.

- **Property of an A.P. :**
  If 'a', b, c are in A.P., then $b - a = c - b$ or $2b = a + c$
- **Three terms in A.P. :**
  Three terms of an A.P. if their sum and product is given, then consider $a - d$, a, $a + d$.
- **Four terms in A.P. :**
  Consider $a - 3d$, $a - d$, $a + d$, $a + 3d$.
  Note : The sum of first n positive integers is given by

$$S_n = \frac{n(n+1)}{2}$$

Exercise 1

DIRECTIONS : *This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.*

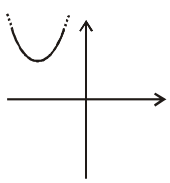
1. The zeroes of the quadratic polynomial $x^2 + 99x + 127$ are
(1) both positive.
(2) both negative.
(3) one positive and one negative.
(4) both equal.

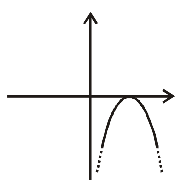
2. The zeroes of the quadratic polynomial $x^2 + kx + k,\ k \neq 0$,
(1) cannot both be positive.
(2) cannot both be negative.
(3) are always unequal.
(4) are always equal.

3. If the zeroes of the quadratic polynomial $ax^2 + bx + c,\ c \neq 0$ are equal, then
(1) c and a have opposite signs.
(2) c and b have opposite signs.
(3) c and a have the same sign.
(4) c and b have the same sign.

4. If one of the zeroes of a quadratic polynomial of the form $x^2 + ax + b$ is the negative of the other, then it
(1) has no linear term and the constant term is negative.
(2) has no linear term and the constant term is positive.
(3) can have a linear term but the constant term is negative.
(4) can have a linear term but the constant term is positive.

5. Which of the following is not the graph of a quadratic polynomial?

(1)


(2)


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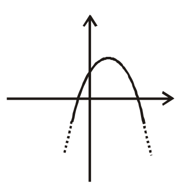
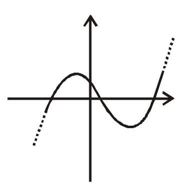


(4)


6. Which one of the following statement is correct?
(1) If $x^6 + 1$ is divided by $x + 1$, then the remainder is -2.
(2) If $x^6 + 1$ is divided by $x - 1$, then the remainder is 2.
(3) If $x^6 + 1$ is divided by $x + 1$, then the remainder is 1.
(4) If $x^6 + 1$ is divided by $x - 1$, then the remainder is -1.

7. If $p(x) = g(x) \,.\, q(x) + r(x)$, then degree of $p(x)$ is equal to
(1) product of degrees of $g(x)$ and $q(x)$.
(2) product of degrees of $g(x)$ and $r(x)$.
(3) sum of degrees of $g(x)$ and $q(x)$.
(4) sum of degrees of $g(x)$ and $r(x)$.

8. If $f(x) = 5x - 10$ is divided by $x - \sqrt{2}$, then the remainder will be
(1) non zero rational number
(2) an irrational number
(3) 0
(4) $f\left(\frac{1}{\sqrt{2}}\right)$

9. Factors of $(42 - x - x^2)$ are
(1) $(x - 7)(x - 6)$ (2) $(x + 7)(x - 6)$
(3) $(x + 7)(6 - x)$ (4) $(x + 7)(x + 6)$

10. If $4x^4 - 3x^3 - 3x^2 + x - 7$ is divided by $1 - 2x$ then remainder will be
(1) $\frac{57}{8}$ (2) $-\frac{57}{8}$
(3) $\frac{55}{8}$ (4) $-\frac{55}{8}$

11. Factors of $a^2 - b + ab - a$ are
(1) $(a - b)(a + 1)$ (2) $(a + b)(a - 1)$
(3) $(a - b)(a - 1)$ (4) $(a + b)(a + 1)$

12. If $x^2 - x - 42 = (x + k)(x + 6)$ then the value of k is
(1) 6 (2) -6
(3) 7 (4) -7

13. If one factor of $5 + 8x - 4x^2$ is $(2x + 1)$ then the second factor is
(1) $(5 + 2x)$ (2) $(2x - 5)$
(3) $(5 - 2x)$ (4) $-(5 + 2x)$

14. The polynomials $ax^3 + 3x^2 - 3$ and $2x^3 - 5x + a$ when divided by $(x - 4)$ leaves remainders R_1 and R_2 respectively then value of a if $2R_1 - R_2 = 0$, is
(1) $-\frac{18}{127}$ (2) $\frac{18}{127}$
(3) $\frac{17}{127}$ (4) $-\frac{17}{127}$

15. If $2x^2 + xy - 3y^2 + x + ay - 10 = (2x + 3y + b)(x - y - 2)$, then the values of a and b are
(1) 11 and 5 (2) 1 and -5
(3) -1 and -5 (4) -11 and 5

16. The pair of linear equations $3x + 2y = 5;\ 2x - 3y = 7$ have :
(1) One solution (2) Two solutions
(3) Many solutions (4) No solution

17. The line $3x - 4y = 9$ meets the x axis at

(1) $x = -3$ (2) $x = 3$

(3) $x = \frac{9}{4}$ (4) $x = \frac{3}{2}$

18. Which of the following sequence form an A.P?

(1) $3, 6, 12, 24, \ldots\ldots\ldots$

(2) $0.3, 0.33, 0.333, \ldots\ldots\ldots$

(3) $p, 2p+1, 3p+2, 4p+3, \ldots\ldots\ldots$

(4) $\sqrt{3}, \sqrt{6}, \sqrt{9}, \sqrt{12}, \ldots\ldots\ldots$

19. Three numbers a, b and c are in A.P if and only if

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

(3) $b = \frac{a+c}{2}$ (4) $b = 2(a-c)$

20. Which of the following lists of numbers does not form an A.P.?

(1) $-1.2, -3.2, -5.2, -7.2 \ldots\ldots$

(2) $0, -4, -8, -12, \ldots$

(3) $1^2, 3^2, 5^2, 7^2, \ldots\ldots$

(4) $1^2, 5^2, 7^2, \ldots\ldots\ldots$

21. In an A.P., if $a_{20} - a_{12} = -24$, then its common difference is

(1) 3 (2) –3

(3) 8 (4) – 8

22. The list of numbers –6, –3, 0, 3, ...

(1) does not form an A.P.

(2) is an A.P. with common difference –9

(3) is an A.P. with common difference –3

(4) is an A.P. with common difference 3

23. If the common difference of an A.P. is – 2, then $a_{30} - a_{12}$ is equal to

(1) 24 (2) 36

(3) – 36 (4) – 60

24. If the nth term of an A.P. is given by $a_n = 5n - 3$, then the sum of first 10 terms is

(1) 225 (2) 245

(3) 255 (4) 270

25. If the sum of n terms of an A.P. is $2n^2 + 5n$, then its nth term is

(1) $4n - 3$ (2) $3n - 4$

(3) $4n + 3$ (4) $3n + 4$

26. If the sum of first n even natural numbers is equal to k times the sum of first n odd natural numbers, then k =

(1) $\frac{1}{n}$ (2) $\frac{n-1}{n}$

(3) $\frac{n+1}{2n}$ (4) $\frac{n+1}{n}$

27. If S_r denotes the sum of the first r terms of an A.P. Then, $S_{3n} : (S_{2n} - S_n)$ is

(1) n (2) $3n$

(3) 3 (4) none of these

28. What is the condition for one root of the quadratic equation $ax^2 + bx + c = 0$ to be twice the other ?

(1) $b^2 = 4ac$ (2) $2b^2 = 9ac$

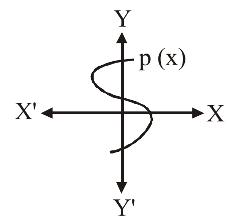
(3) $c^2 = 4a + b^2$ (4) $c^2 = 9a - b^2$

29. If the equation $2x^2 + x + k = 0$ and $x^2 + x/2 - 1 = 0$ have two common roots then the value of k is

(1) 1 (2) 3

(3) – 1 (4) – 2

30. In the figure, the graph of a polynomial $p(x)$ is shown. The number of zeroes of $p(x)$ is :



(1) 4 (2) 1

(3) 2 (4) 3

31. The graph of $y = x^2 - 6x + 9$ is :

(1) a parabola open upward.

(2) a parabola open downward.

(3) a straight line.

(4) None of these.

32. The graph of $y = 3x - 1$ intersects :

(1) y-axis at $\frac{1}{3}$ (2) x-axis at $\frac{1}{3}$

(3) x-axis at 3 (4) y-axis at 3

33. If α, β are the zeroes of the polynomial

$f(x) = x^2 + x + 1$, then $\frac{1}{\alpha} + \frac{1}{\beta} =$

(1) 1 (2) –1

(3) 0 (4) None of these

34. If the polynomial $f(x) = ax^3 + bx - c$ is divisible by the polynomial $g(x) = x^2 + bx + c$, then ab =

(1) 1 (2) $\frac{1}{c}$

(3) –1 (4) $-\frac{1}{c}$

35. Value of 'k' for the equations $(k - 1)x - y = 5$ and $(k + 1)x + (1 - k)y = 3k + 1$ have infinite number of solutions is

(1) 3 (2) 4

(3) – 4 (4) –3

36. Every point on the line representing the linear equation in two variables

(1) may not be a solution of the equation.

(2) is a solution of the equation.

(3) is a solution if it is also a point on x-axis.

(4) is a solution of the equation if it is also a point on y-axis.

Exercise 2

MCQ Based Questions

DIRECTIONS (Qs. 1 to 25) : *This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.*

1. For which value of 'm' does the following pair of equations has unique solution ?
$3x - 2y = -8$
$(2m-5)x + 7y - 6 = 0$
(1) $m = \frac{11}{4}$ (2) $m = -\frac{11}{4}$
(3) $m \neq -\frac{11}{4}$ (4) $m \neq \frac{11}{4}$

2. The present ages of a brother and sister in the ratio of 2 : 3. Ten years hence, the ratio will be 3 : 4. Their present ages are,
(1) 30, 40 (2) 24, 36
(3) 20, 30 (4) 24, 32

3. In a picnic there are boys and girls. Fifteen girls leave, then the boys and girls are left in the ratio of 2 : 1. Later 45 boys leave and the ratio changes to 1 : 5. The number of girls in the beginning was
(1) 40 (2) 43
(3) 29 (4) 50

4. A man can do a piece of work in 30 hours. He and his son together finish it in 20 hours. The son along will finish it in
(1) 60 hours (2) 50 hours
(3) 25 hours (4) 10 hours

5. If the point (3, 4) lies on the graph of the equation 3y = ax + 7, the value of a is
(1) $\frac{5}{3}$ (2) $\frac{3}{5}$
(3) 1 (4) $\frac{2}{5}$

6. If $f\left(\frac{-3}{4}\right) = 0$; then for $f(x)$, which of the following is a factor?
(1) $3x - 4$ (2) $4x + 3$
(3) $-3x + 4$ (4) $4x - 3$

7. If $(x - 1)$, $(x + 1)$ and $(x - 2)$ are factors of
$x^4 + (p-3)x^3 - (3p-5)x^2 + (2p-9)x + 6$ then the value of p is
(1) 1 (2) 2
(3) 3 (4) 4

8. A quadratic polynomial when divided by x + 2 leaves a remainder of 1 and when divided by x – 1, leaves a remainder of 4. What will be the remainder if it is divided by (x + 2) (x – 1) ?
(1) 1 (2) 4
(3) x + 3 (4) x – 3

9. If a, b, c, d, e and f are in AP, then $e - c$ is equal to
(1) $2(c - a)$ (2) $2(f - d)$
(3) $2(d - c)$ (4) $d - c$

10. If the numbers a, b, c, d, e form an AP, then the value of $a - 4b + 6c - 4d + e$ is
(1) 1 (2) 2
(3) 0 (4) none of these

11. An AP consist of 31 terms if its 16th term is m, then sum of all the terms of this AP is
(1) $16m$ (2) $47m$
(3) $31m$ (4) $52m$

12. The first term of an AP of consecutive integers is $p^2 + 1$. The sum of $2p + 1$ terms of this AP is
(1) $(p+1)^2$ (2) $(2p+1)(p+1)^2$
(3) $(p+1)^3$ (4) $p^3 + (p+1)^3$

13. The 10th term of the AP : 5, 8, 11, 14, ... is
(1) 32 (2) 35
(3) 38 (4) 185

14. In an AP if $a = -7.2$, $d = 3.6$, $a_n = 7.2$, then n is
(1) 1 (2) 3
(3) 4 (4) 5

15. The 11th term of the AP : $-5, \frac{-5}{2}, 0, \frac{5}{2}$.... is
(1) – 20 (2) 20
(3) –30 (4) 30

16. The first four terms of an AP, whose first term is –2 and the common difference is – 2, are
(1) –2, 0, 2, 4 (2) –2, 4, –8, 16
(3) –2, –4, –6, –8 (4) –2, –4, –8, –16

17. In an AP if $a = 1$, $a_n = 20$ and $S_n = 399$, then n is
(1) 19 (2) 21
(3) 38 (4) 42

18. The sum of first five multiples of 3 is
(1) 45 (2) 55
(3) 65 (4) 75

19. Which term of the AP: 21, 42, 63, 84 ... is 210?
(1) 9^{th} (2) 10^{th}
(3) 11^{th} (4) 12^{th}

20. The 21^{st} term of the AP whose first two terms are –3 and 4 is
(1) 17 (2) 137
(3) 143 (4) –143

21. The famous mathematician associated with finding the sum of the first 100 natural numbers is
(1) Pythagoras (2) Newton
(3) Gauss (4) Euclid

22. If 7 times the 7^{th} term of an AP is equal to 11 times its 11^{th} term, then its 18^{th} term will be
(1) 7 (2) 11
(3) 18 (4) 0

23. If the last term of the A.P. 5, 3, 1, –1, ... is –41, then the A.P. consists of
(1) 46 terms (2) 25 terms
(3) 24 terms (4) 23 terms

24. If α, β are roots of the equation $x^2 - 5x + 6 = 0$ then the equation whose roots are α + 3 and β + 3 is
(1) $2x^2 - 11x + 30 = 0$ (2) $-x^2 + 11x = 0$
(3) $x^2 - 11x + 30 = 0$ (4) $x^2 - 22x + 60 = 0$

25. Zeroes of polynomial $p(x) = x^2 - 3x + 2$ are
(1) 3 (2) 1
(3) 4 (4) –1

Matching Based Questions

DIRECTIONS (Qs. 26 to 33) : *Match the Column-I with Column-II and select the correct answer given below the columns.*

26.

Column - I (Polynomials)	Column - II (Zeroes)
(A) $4 - x^2$	(p) 7
(B) $x^3 - 2x^2$	(q) –2
(C) $6x^2 - 3 - 7x$	(r) 2
(D) $-x + 7$	(s) 3/2

(1) A → p, r; B → r; C → p; D → s
(2) A → q, r; B → r; C → s; D → p
(3) A → r, s; B → r; C → q; D → s
(4) A → p, q; B → r; C → s; D → q

27.

Column - I	Column - II
(A) The zeroes of the polynomial $x^2 + x - 2$ are	(p) $\frac{1}{3}, -4$
(B) The zeroes of the polynomial $2x^2 - 3x - 2$ are	(q) $\frac{1}{2}, \frac{1}{2}$
(C) The zeroes of the polynomial $3x^2 + 11x - 4$ are	(r) $-\frac{1}{2}, 2$
(D) The zeroes of the polynomial $4x^2 - 4x + 1$ are	(s) $1, -2$

(1) A → s; B → r; C → p; D → q
(2) A → q; B → p; C → r; D → s
(3) A → p; B → r; C → p; D → s
(4) A → r; B → s; C → p; D → q

28.

Column-I	Column-II
(A) $a^3 + b^3$	(p) $a^2 + b^2 + 2ab$
(B) $a^3 - b^3$	(q) $a^3 - b^3 - 3ab(a - b)$
(C) $(a + b)^3$	(r) $(a + b)(a^2 - ab + b^2)$
(D) $(a - b)^3$	(s) $a^3 + b^3 + 3ab(a + b)$
(E) $(a + b)^2$	(t) $(a - b)(a^2 + ab + b^2)$
(F) $(a - b)^2$	(u) $a^2 + b^2 - 2ab$

(1) (A) → (t), (2) → (u), (3) → (s), (4) → (q), (E) → (p), (F) → (r)
(2) (A) → (u), (2) → (q), (3) → (s), (4) → (r), (E) → (t), (F) → (p)
(3) (A) → (r), (2) → (t), (3) → (s), (4) → (q), (E) → (p), (F) → (u)
(4) (A) → (p), (2) → (t), (3) → (s), (4) → (q), (E) → (r), (F) → (u)

29.

Column-I	Column-II
(A) If $2x - y = 5$ and $3x + 2y = 11$, then $x + y =$	(p) no solution
(B) If $x + 2y = 5$, $2x + 3y = 8$, then $x + y =$	(q) 2
(C) If $2x + 3y = 7$, $6x + 9y = 1$, then	(r) 3
(D) If $3x - 4y = 7$, $5x + 2y = 3$, then $7x + 5y =$	(s) 4

(1) (A) → (q), (2) → (r), (3) → (s), (4) → (p)
(2) (A) → (s), (2) → (r), (3) → (p), (4) → (q)
(3) (A) → (r), (2) → (s), (3) → (p), (4) → (q)
(4) (A) → (s), (2) → (r), (3) → (q), (4) → (p)

30.

Column-I	Column-II
(A) The value of k for which the system of equations $3x + 5y = 0$ and $kx + 10y = 0$ has a non-zero solution is	(p) $k \neq 14$
(B) The value of k for which the system of equations $3x - 4y = 7$ and $6x - 8y = k$ has no solution	(q) $k = 2$
(C) The pair of linear equations $13x + ky = k$ and $39x + 6y = k + 4$ has infinitely many solutions, if k is	(r) $k = 14$
(D) The value of k for which $3x - 4y = 7$ and $6x - 8y = k$ has infinitly number of solution is	(s) $k = 6$
(E) The value of k for which $3x - 4y = 7$ and $6x - ky = 5$ has a unique solution is	(t) $k \neq 8$

(1) A → s; B → p; C → r; D → q; E → t
(2) A → p; B → s; C → q; D → r; E → t
(3) A → s; B → p; C → r; D → q; E → t
(4) A → s; B → p; C → q; D → r; E → t

31.

Column-I	Column-II
(A) $2x + 3y = 40$ and $6x + 5y = 10$	(p) Coincident lines
(B) $2x + 3y = 40$ and $6x + 9y = 50$	(q) Intersecting lines
(C) $2x + 3y = 10$ and $4x + 6y = 20$	(r) Parallel lines

(1) A → q; B → r; C → p
(2) A → r; B → q; C → p
(3) A → p; B → q; C → r
(4) A → r; B → p; C → q

32.

Column - I	Column - II
(A) Sum of first 11 terms of A.P: 2, 6, 10, 14, ... is	(p) 960
(B) Sum of first 13 terms of A.P: – 6, 0, 6, 12, ... is	(q) 286
(C) Sum of the first 15 multiples of 8 is	(r) 2460
(D) Sum of the first 40 positive integers divisible by 3	(s) 390
(E) Sum 34 + 32 + 30 + ... + 10 is	(t) 242

(1) A → s; B → t; C → p; D → q; E → r
(2) A → t; B → s; C → p; D → r; E → q
(3) A → t; B → s; C → r; D → p; E → q
(4) A → s; B → t; C → r; D → q; E → p

33.

	Column-I (A.P.)		Column-II (n^{th} term)
(A)	119, 136, 153, 170	(p)	13 – 3n
(B)	7, 11, 15, 19, ...	(q)	9 – 5n
(C)	4, –1, –6, –11, ...	(r)	3 + 4n
(D)	10, 7, 4, 3	(s)	17 n + 102

(1) A → s; B → r; C → q; D → p
(2) A → s; B → r; C → p; D → q
(3) A → r; B → s; C → p; D → q
(4) A → r; B → s; C → q; D → p

Statement Based Questions

34. Consider the following statements :
I. $x - 2$ is a factor of $x^3 - 3x^2 + 4x - 4$
II. $x + 1$ is a factor of $2x^3 + 4x + 6$
III. $x - 1$ is a factor of $x^5 + x^4 - x^3 + x^2 - x + 1$
Which of these statements given above are correct?
(1) Both I and II (2) Both II and III
(3) Both I and III (4) Neither I nor II

35. Consider the following statements :
I. In an *AP* with first term a and common difference *d*, the *n*th term (or the general term) is given by $a_n = a + (n - 1)\,d$.
II. If ℓ is the last term of the finite *AP*, say the *n*th term, then the sum of all terms of the *AP* is given by :

$$S = \frac{n}{2}(a + \ell)$$

III. 2, 4, 8, 16, ... is not an AP.
IV. 10^{th} term of AP : 2, 7, 12, ... is 45.
Which of these statements given above are correct?
(1) I, II and III (2) Only I and II
(3) Only II and III (4) Only I and III

36. Consider the following statements :

I. Summation of *n* terms of an A.P. is $\frac{n}{2}(a+l)$

II. Summation of *n* terms of an A.P. is $\frac{n}{2}\left[2a+(n-1)d\right]$

III. Summation of *n* terms of an A.P. is $\frac{a(r^n-1)}{(r-1)}$

IV. Summation of *n* terms of an A.P. is $\frac{a(1-r^n)}{(1-r)}$.

Which of these statements given above are correct?
(1) I and II (2) II and III
(3) III and IV (4) None of these

37. Consider the following statements :

I. If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., then *a*, *b*, *c* are in A.P.

II. If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., then a^2, b^2, c^2 are in A.P.

III. If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., then $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P.

IV. If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., then *bc*, *ac*, *ab* are in A.P.

Which of these statements given above are correct?
(1) I and II
(2) II and III
(3) III and IV
(4) All statements are correct.

Passage Based Questions

DIRECTIONS (Qs. 38 to 49) : *Read the passage(s) given below and answer the questions that follow.*

PASSAGE - 1

Let the polynomial be $f(x) = 2x^3 - 9x^2 + x + 12$

38. The degree of the given polynomial is
(1) 2 (2) 3
(3) 0 (4) 1

39. Zeroes of the given polynomial is
(1) (1, 3/2) (2) (–1, –3/2)
(3) (–1, 3/2) (4) (1, 3/2)

40. If $f(x)$ is divided by $\left(x - \frac{3}{2}\right)$, then the remainder is
(1) 1 (2) $\frac{3}{2}$
(3) 0 (4) none of these

PASSAGE - 2

If α, β, γ are the zeroes of $ax^3 + bx^2 + cx + d$, then

$$\sum\alpha = -\frac{b}{a},\ \sum\alpha\beta = \frac{c}{a},\ \alpha\beta\gamma = -\frac{d}{a}$$

41. If α, β, γ are the zeroes of $x^3 - 5x^2 - 2x + 24$ and $\alpha\beta = 12$, then γ =
(1) 2 (2) –2
(3) 3 (4) –3

42. If $a - b$, a, $a + b$ are the roots of $x^3 - 3x^2 + x + 1$, then $a + b^2 =$
(1) 3 (2) 4
(3) 5 (4) 2

43. If two zeroes of the polynomial $x^3 - 5x^2 - 16x + 80$ are equal in magnitude but opposite in sign, then zeroes are
(1) 4, –4, 5 (2) 3, –3, 5
(3) 2, –2, 5 (4) 1, –1, 5

PASSAGE - 3

Following two given series are in A.P.

2, 4, 6, 8 ....

3, 6, 9, 12 ....

First series contains 30 terms, while the second series contains 20 terms. Both of the above given series contains some terms, which are common to both of them.

44. The last term of both the above given A.P. is

(1) 57 (2) 60

(3) 50 (4) 54

45. The sum of both the above given A.P. are

(1) (930, 630) (2) (630, 930)

(3) (870, 580) (4) (580, 870)

46. No. of terms identical to both the above given A.P. is

(1) 5 (2) 1

(3) 0 (4) 10

PASSAGE - 4

Let us consider a quadratic equation

$$x^2 + 3ax + 2a^2 = 0$$

If the above equation has roots α, β and it is given that $\alpha^2 + \beta^2 = 5$

47. Value of a is

(1) 1 (2) – 1

(3) ± 1 (4) none of these

48. Value of D for the above quadratic equation is

(1) $D > 0$ (2) $D < 0$

(3) $D = 0$ (4) none of these

49. Product of roots is

(1) 2 (2) 1

(3) –3 (4) 3

Assertion Reason Based Questions

DIRECTIONS (Qs. 50 to 57) : *Following questions consist of two statements, one labelled as the* ***'Assertion' (A)*** *and the other as* ***'Reason' (R)****. You are to examine these two statements carefully and select the answer to these items using the code given below.*

Code :

(1) Both A and R are individually true and R is the correct explanation of A:

(2) Both A and R are individually true but R is not the correct explanation of A.

(3) A is true but R is false

(4) A is false but R is true.

50. Assertion : If 2, 3 are the zeroes of a quadratic polynomial, then polynomial is $x^2 - 5x + 6$

Reason : If α, β are the zeroes of a quadratic polynomial, then polynomial is $x^2 - (\alpha + \beta)x + \alpha\beta$.

51. Assertion : Zeroes of $f(x) = x^2 - 4x - 5$ are 5, –1

Reason : The polynomial whose zeroes are $2 + \sqrt{3}$, $2 - \sqrt{3}$ is $x^2 - 4x + 7$

52. Assertion : The polynomial $x^4 + 4x^2 + 5$ has four zeroes.

Reason : If $p(x)$ is divided by $(x - k)$, then the remainder = $p(k)$

53. Assertion : Degree of a zero polynomial is not defined.

Reason : Degree of a non-zero constant polynomial is '0'

54. Assertion : If α, β, γ are the zeroes of $x^3 - 2x^2 + qx - r$ and $\alpha + \beta = 0$, then $2q = r$

Reason : If α, β, γ are the zeroes of $ax^3 + bx^2 + cx + d$, then $\alpha+\beta+\gamma = -\frac{b}{a}$, $\alpha\beta+\beta\gamma+\gamma\alpha = \frac{c}{a}$, $\alpha\beta\gamma = -\frac{d}{a}$

55. Assertion : 11 11 ...... 1 (up to 91 terms) is a prime number.

Reason : If $\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P., then $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are also in A.P.

56. Assertion : let the positive numbers a, b, c be in A.P., then $\frac{1}{bc}, \frac{1}{ac}, \frac{1}{ab}$ are also in A.P.

Reason : If each term of an A.P. is divided by abc, then the resulting sequence is also in A.P.

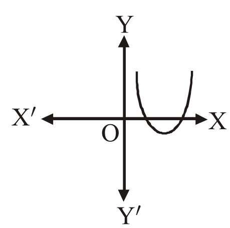
57. Assertion : The sum of the series with the nth term, $t_n = (9 - 5n)$ is (465), when no. of terms $n = 15$.

Reason : Given series is in A.P. and sum of n terms of an A.P. is $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

Feature Based Question

58. The graph of $y = f(x)$ is shown in the figure.

What type of polynomial $f(x)$ is?



(1) cubic (2) quadratic

(3) linear (4) none of these

Correct Definition Based Questions

59. Linear polynomials is

(1) A polynomial of degree two in one variable.

(2) A polynomial of degree three.

(3) A plynomial of degree 1 in one variable.

(4) A polynomial of degree zero.

60. The graph of $y = kx$, where k is a constant will always :

(1) intersect x-axis.

(2) intersect y-axis.

(3) passes through origin.

(4) intersect only y-axis.

61. For given two lines in a plane, which of the following is not possible?

(1) the two lines will intersect at a point.

(2) the two lines will be parallel.

(3) the two lines will be coincident.

(4) the two lines will either intersect or parallel.

62. If the system of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are inconsistent then :

(1) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (2) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(3) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ (4) none of these

63. The pair of linear equations $ax + by + c = 0$ and $px + qy + r = 0$ will represent parallel lines if

(1) $\frac{a}{p} \neq \frac{b}{q}$ (2) $\frac{a}{p} = \frac{b}{q}$

(3) $\frac{a}{p} = \frac{b}{q} \neq \frac{c}{r}$ (4) $\frac{a}{p} = \frac{b}{q} = \frac{c}{r}$

64. An inconsistent system of two linear equations in two variables will have

(1) one solution (2) two solutions

(3) no solution (4) more than two solutions

Hints SOLUTIONS

Exercise 1

1.	(2)	**2.**	(1)	**3.**	(3)	**4.**	(1)
5.	(4)	**6.**	(2)	**7.**	(3)	**8.**	(2)
9.	(3)	**10.**	(2)	**11.**	(2)	**12.**	(4)
13.	(2)	**14.**	(1)	**15.**	(4)		

16. (1) Here, $a_1 = 3, b_1 = 2, c_1 = 5,$
$a_2 = 2, b_2 = -3, c_2 = 7$

$\because \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ hence, equations have unique solution.

17. (2) The line $3x - 4y = 9$ meets the x axis at $y = 0$

$\therefore$ Substituting y = 0 in the given equation, we get

$3x - 4 \times 0 = 9 \Rightarrow 3x = 9 \Rightarrow x = 3$

18. (3) Common difference = $p + 1$ = constant

19. (3) $2b = a + c$

20. (3)

21. (2) $a_{20} - a_{12} = -24$

$\Rightarrow (20 - 12)\, d = -24$

$\Rightarrow d = \frac{-24}{8} = -3$

22. (4) – 6, – 3, 0, 3, ... is an A.P with common difference 3.

23. (3) $a_{30} - a_{12} = (30 - 12)\, d = 18 \times (-2) = -36$

24. (2) Given, $a_n = 5n - 3$

Put $n = 10$

$\Rightarrow a_{10} = 47$

Put $n = 1 \Rightarrow a = 2$

$\therefore S_{10} = \frac{10}{2}\left[2(2)+(10-1)5\right] \quad (\because d = 5)$

$= 245$

25. (3) $4n + 3$

26. (4) $\frac{n+1}{n}$

27. (3) $S_{2n} - S_n = 3$

28. (2) $\therefore \alpha + 2\alpha = -\frac{b}{a}$ and $\alpha \times 2\alpha = \frac{c}{a}$

$\Rightarrow 3\alpha = -\frac{b}{a} \Rightarrow \alpha = -\frac{b}{3a}$

and $2\alpha^2 = \frac{c}{a} \Rightarrow 2\left(\frac{-b}{3a}\right)^2 = \frac{c}{a}$

$\Rightarrow \frac{2b^2}{9a^2} = \frac{c}{a} \Rightarrow 2b^2 = 9ac$

Hence, the required condition is $2b^2 = 9\,ac$

29. (4) Since the given equation have two roots in common so from the condition

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{2}{1} = \frac{1}{1/2} = \frac{k}{-1} \quad \therefore k = -2$

30. (2) Since the graph cuts the x-axis at only one point, hence $p(x)$ has only one zero.

31. (1) The graph of $y = ax^2 + bx + c$ is a parabola open upward if $a > 0$. So, for $y = x^2 - 6x + 9$, $a = 1 > 0$, the graph is a parabola open upward.

32. (2) As, zero of $3x - 1$ is $\frac{1}{3}$, it means the graph of the line $y = 3x - 1$ meets the x-axis at $x = \frac{1}{3}$.

33. (2)

34. (1)

35. (1) For infinite solutions, we know

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\Rightarrow \frac{k-1}{k+1} = \frac{-1}{1-k} = \frac{5}{3k+1}$

$\Rightarrow -3k - 1 = 5 - 5k$

$\Rightarrow 2k = 6 \Rightarrow k = 3$

36. (2) Every point on the line representing the linear equation in two variables is a solution of the equation.

Exercise 2

1. (3) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{3}{2m-5} \neq \frac{-2}{7}$

or $-4m + 10 \neq 21$

or $-4m \neq 11$

or $m \neq -\frac{11}{4}$

2.	(3)	**3.**	(1)	**4.**	(1)	**5.**	(1)
6.	(2)	**7.**	(4)	**8.**	(3)	**9.**	(3)
10.	(3)	**11.**	(3)	**12.**	(4)	**13.**	(1)
14.	(4)	**15.**	(2)	**16.**	(3)	**17.**	(3)
18.	(1)	**19.**	(2)	**20.**	(2)	**21.**	(3)
22.	(4)	**23.**	(3)				

24. (3)

Let $\alpha + 3 = x$

$\therefore \alpha = x - 3$ (replace x by $x - 3$)

So the required equation

$(x - 3)^2 - 5\,(x - 3) + 6 = 0$

$\Rightarrow x^2 - 6x + 9 - 5x + 15 + 6 = 0$

$\Rightarrow x^2 - 11x + 30 = 0$

25. (2) $x^2 - 3x + 2 = 0$
$x^2 - 2x - x + 2 = 0$
$x(x-2) - 1(x-2) = 0$
$(x-1)(x-2) = 0$
$x = 1, x = 2$

26. (2) A → q, r; B → r; C → s; D → p

27. (1) (A) → s, (B) → r, (C) → p, (D) → q,

28. (3)

29. (2)

30. (4) (A) → s, (B) → p, (C) → q, (D) → r, (E) → (t)

31. (1) (A) → q, (B) → r, (C) → p

32. (2) (A) → t, (B) → s, (C) → p, (D) → r, (E) → q

33. (1) (A) → s, (B) → r, (C) → q, (D) → p

34. (1) Both statements 'I' and 'II' are correct.

35. (1) Statement (IV) is false

36. (1) 'I' and 'II' are correct

37. (3) Statement III and IV are correct

$\frac{b+c-a}{a}, \frac{c+a-b}{b}, \frac{a+b-c}{c}$ are in A.P.

Adding 2 to each term

$\frac{b+c-a}{a}+2, \frac{c+a-b}{b}, \frac{a+b-c}{c}+2$ are in A.P.

$\frac{a+b+c}{a}, \frac{a+b+c}{b}, \frac{a+b+c}{c}$ are in A.P.

Dividing each term by $(a+b+c)$,

$\frac{a+b+c}{a(a+b+c)}, \frac{a+b+c}{b(a+b+c)}, \frac{a+b+c}{c(a+b+c)}$ are in A.P.

$\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P.

Multiplying each term by abc

$\frac{abc}{a}, \frac{abc}{b}, \frac{abc}{c}$ are in A.P.

bc, ac, ab are in A.P.

38. (2) **39.** (3) **40.** (3)

41. (2) **42.** (1) **43.** (1)

44. (2) 2, 4, 6, 8 ....
Last term, $t_{30} = 2 + (30-1)2 = 2 + 2(29) = 60$
3, 6, 9, 12 ....
Last term, $t_{20} = 3 + (20-1)3 = 3 + 57 = 60$

45. (1) For 2, 4, 6, 8.........

$$S_{30} = \frac{30}{2}(2+60) = 930$$

For 3, 6, 9, 12 ....

$$S_{20} = \frac{20}{2}(3+60) = 630$$

46. (4) Let mth term of the first series is common with the nth term of the second series.

$t_m = t_n$
$2 + (m-1)2 = 3 + (n-1)3$
$2 + 2m - 2 = 3 + 3n - 3$
$2m = 3n$

$\frac{m}{3} = \frac{n}{2} = k$ (let)

	$1 \le m \le 30$	$1 \le n \le 20$
	$1 \le 3k \le 30$	$1 \le 2k \le 20$
$m = 3k, n = 2k$	$\frac{1}{3} \le k \le 10$	$\frac{1}{2} \le k \le 10$

Hence, $k = 1, 2, 3, ... 10$. For each value of k, we get one identical term.
Thus, no of identical terms = 10

47. (3) $\alpha + \beta = -3a$
$\alpha\beta = 2a^2$
$\alpha^2 + \beta^2 = 5$
$(\alpha+\beta)^2 - 2\alpha\beta = 5$
$9a^2 - 2(2a^2) = 5$
$5a^2 = 5$
$a = \pm 1$

48. (1) $(3a)^2 - 4(2a^2) = 9a^2 - 8a^2 = a^2 = 1 > 0$

49. (1) $\alpha\beta = 2a^2 = 2(1) = 2$

50. (1)

51. (3)

52. (4) Reason is true by Remainder Theorem.
Again, $x^4 + 4x^2 + 5 = (x^2+2)^2 + 1 > 0$ for all x.
∴ given polynomial has no zero ∴ Assertion is not true

53. (2)

54. (1) Clearly, Reason is true.
$\alpha + \beta + \gamma = -(-2) = 2 \Rightarrow 0 + \gamma = 2 \therefore \gamma = 2$.

$$\alpha\beta\gamma = -(-r) = r \therefore \alpha\beta(2) = r \Rightarrow \alpha\beta = \frac{r}{2}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = q \Rightarrow \frac{r}{2} + r(\alpha+\beta) = q$$

$$\Rightarrow \frac{g}{2} + \gamma(0) = q$$

$\Rightarrow \gamma = 2q$ ∴ Assertion is true
Since, Reason gives Assertion

55. (1) Since 11 11 …. 1 (up to 91 terms)

$$= \frac{(10^{91}-1)}{10-1} = \text{divisible by 9.}$$

⇒ the given number is not prime. But reason is true.

56. (1)

57. (4)

58. (2) Since, the graph of $y = f(x)$ is a parabola, therefore $f(x)$ is quadratic.

59. (3)

60. (3) Substituting $x = 0$ in $y = kx$, we get $y = 0$
So, (0, 0) satisfy the given equation.
Therefore, the graph of $y = kx$ always passes through origin.

61. (4) The two lines will either intersect or parallel.

62. (3) Condition for inconsistent equations is

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \ne \frac{c_1}{c_2}$$

63. (3)

64. (3)