

Ganit Manjiri Class 9th — Question Bank

Chapter 2: Polynomials (NCERT Based) —

Alpha Level

Section A: Multiple Choice Questions (20 MCQs)

1. Which of the following expressions is a polynomial?

- A) $x^2 + 2x + 1$ B) $\sqrt{x} + 3$
C) $1/x + 5$ D) $x^{-2} + 4$

2. What is the degree of the polynomial $4x^3 + 5x^2 + 7$?

- A) 1 B) 2 C) 3 D) 0

3. The coefficient of x^2 in the polynomial $2 - x^2 + x^3$ is:

- A) 2 B) 1 C) -1 D) 3

4. A polynomial of degree 1 is strictly known as a:

- A) Linear polynomial B) Quadratic polynomial
C) Cubic polynomial D) Constant polynomial

5. What is the degree of a non-zero constant polynomial?

- A) 0 B) 1 C) 2 D) Not defined

6. Which of the following is a binomial?

- A) $5x$ B) $x^2 + x$ C) $x^2 + x + 1$ D) 3

7. Find the value of the polynomial $p(x) = 5x - 4x^2 + 3$ at $x = 0$.

A) 3 B) 5 C) -4 D) 0

8. The zero of the polynomial $p(x) = 2x + 5$ is:

A) $2/5$ B) $-5/2$ C) $5/2$ D) $-2/5$

9. If $p(x) = x + 4$, then the value of $p(x) + p(-x)$ is equal to:

A) 0 B) 4 C) $2x$ D) 8

10. A polynomial containing only one term is called a:

A) Monomial B) Binomial C) Trinomial D) Constant

11. What is the degree of the zero polynomial?

A) 0 B) 1 C) Any natural number D) Not defined

12. Which of the following is a quadratic polynomial?

A) $x + 1$ B) $x^2 + 4$ C) $x^3 + x^2 + 1$ D) 5

13. The value of $p(t) = 2 + t + 2t^2 - t^3$ at $t = 1$ is:

A) 2 B) 4 C) 3 D) 5

14. Is $x = -1$ a valid zero of the polynomial $p(x) = x^2 - 1$?

A) Yes B) No
C) Cannot be determined D) None of the above

15. The degree of the polynomial $5t - \sqrt{7}$ is:

A) 0 B) 1 C) 2 D) $1/2$

16. Which of the following expressions is a polynomial in one variable?

A) $x + 1/x$ B) $y^2 + \sqrt{2}$
C) $3\sqrt{t} + t\sqrt{2}$ D) $x^{10} + y^3 + t^{50}$

17. In the algebraic identity $(x + y)^2 = x^2 + kxy + y^2$, the value of k is:

A) 1 B) 2 C) 3 D) 4

18. The factorization of $x^2 - y^2$ yields:

- A) $(x - y)(x - y)$ B) $(x + y)(x + y)$
C) $(x + y)(x - y)$ D) $x^2 + 2xy + y^2$

19. If $x - 1$ is a factor of $x^2 + x + k$, then the value of k is:

- A) 2 B) -2 C) 1 D) -1

20. What is the coefficient of x in the expansion of $(x + 3)^2$?

- A) 3 B) 6 C) 9 D) 1

Section B: Subjective Questions (20 Questions)

Alpha Level

1. Define a linear polynomial and provide one clear example.
2. Write down the coefficient of x^2 in the polynomial: $(\pi/2)x^2 + x$.
3. Classify the polynomial $y + y^2 + 4$ as either linear, quadratic, or cubic.
4. Give an example of a monomial that has a degree of exactly 100.
5. Find the value of the polynomial $5x - 4x^2 + 3$ when $x = -1$.
6. Calculate $p(0)$ for the polynomial $p(y) = y^2 - y + 1$.
7. Verify whether $x = -1/3$ is a zero of the polynomial $p(x) = 3x + 1$.
8. Find the zero of the linear polynomial $p(x) = x - 5$.
9. Write the degree of the constant polynomial 7.
10. Check if $x = 2$ is a root of the polynomial $q(x) = 2x - 4$.
11. State the Remainder Theorem in your own words.
12. Find the remainder when $x^3 + 3x^2 + 3x + 1$ is divided by $x + 1$.
13. Expand the expression using a suitable identity: $(x + 4)(x + 10)$.
14. Evaluate the product 103×107 without multiplying directly.
15. Factorize the expression: $4y^2 - 4y + 1$ using a suitable algebraic identity.
16. Find the value of k if $x - 1$ is a factor of $p(x) = 2x^2 + kx + \sqrt{2}$.
17. Write the expanded form of the cubic identity expression $(2x + 1)^3$.
18. Factorize the binomial expression: $x^2 - 49$.

19. Show that $x + 1$ is a factor of $x^3 + x^2 + x + 1$.
20. Write down the full expanded algebraic identity for $(x + y + z)^2$.

Answer Key & Solutions Reference

MCQ Answer Key:

1-(A), 2-(C), 3-(C), 4-(A), 5-(A), 6-(B), 7-(A), 8-(B), 9-(D), 10-(A), 11-(D), 12-(B), 13-(B), 14-(A), 15-(B), 16-(B), 17-(B), 18-(C), 19-(B), 20-(B)

Section A: Multiple Choice Questions (Moderate Difficulty) BETA Level

Choose the correct option for each of the following questions:

- What is the degree of a non-zero constant polynomial?
(a) 0 (b) 1
(c) 2 (d) Not defined
- Which of the following is a linear polynomial?
(a) $x^2 + x + 1$ (b) $3x + 5$
(c) $5x^3 - 2$ (d) $x^{-1} + 3$
- The zero of the linear polynomial $p(x) = 3x - 7$ is:
(a) $7/3$ (b) $-7/3$
(c) $3/7$ (d) $-3/7$
- If $x = 2$ and $y = 1$ is a solution of the linear equation $2x + 3y = k$, then the value of k is:
(a) 5 (b) 6
(c) 7 (d) 8
- A linear polynomial in one variable can have at most how many zeros?
(a) Zero (b) One
(c) Two (d) Infinitely many
- The graph of the linear equation $2x + 0y + 9 = 0$ is a line parallel to

the:

- (a) x-axis (b) y-axis
 - (c) line $y = x$ (d) None of these
7. Any point on the x-axis is of the form:
- (a) (x, y) (b) $(0, y)$
 - (c) $(x, 0)$ (d) (x, x)
8. The standard form of a linear equation in two variables is $ax + by + c = 0$. What are the conditions on a and b ?
- (a) $a = 0, b \neq 0$ (b) $a \neq 0, b = 0$
 - (c) $a^2 + b^2 \neq 0$ (d) $a = 0, b = 0$
9. The polynomial $p(x) = ax + b$ (where $a \neq 0$) represents a straight line. Where does it intersect the x-axis?
- (a) $(b/a, 0)$ (b) $(-b/a, 0)$
 - (c) $(0, b)$ (d) $(0, -b)$
10. Which of the following expressions is NOT a polynomial?
- (a) $\sqrt{2}x + 5$ (b) $x^2 - \sqrt{x} + 1$
 - (c) $3x^{-2} + 4x + 7$ (d) Both (b) and (c)
11. The value of the polynomial $p(x) = 5x - 4x^2 + 3$ at $x = -1$ is:
- (a) 6 (b) -6
 - (c) 2 (d) -2
12. The coefficient of x in the linear polynomial expression $4 - (3 - x)/2$ is:
- (a) $-1/2$ (b) $1/2$
 - (c) 1 (d) -1
13. If the graph of the equation $y = mx + c$ passes through the origin, then the value of c must be:
- (a) 1 (b) -1
 - (c) 0 (d) Any real number
14. The linear equation $3x - 5y = 15$ intersects the y-axis at the point:
- (a) $(5, 0)$ (b) $(0, -3)$
 - (c) $(-3, 0)$ (d) $(0, 3)$
15. The equation $x = 5$, when expressed as a linear equation in two

variables, can be written as:

(a) $1.x + 1.y = 5$ (b) $1.x + 0.y = 5$

(c) $0.x + 1.y = 5$ (d) $0.x + 0.y = 5$

16. If a linear polynomial $p(x)$ has a zero at $x = -2$, then a factor of $p(x)$ is:

(a) $x - 2$ (b) $x + 2$

(c) $2x$ (d) $-2x$

17. The cost of a book is thrice the cost of a pen. Write a linear equation in two variables to represent this statement.

(a) $x = 3y$ (b) $y = 3x$

(c) $x + 3y = 0$ (d) $3x + y = 0$

18. How many linear equations in x and y can be satisfied by the point coordinates $(2, 3)$?

(a) Only one (b) Two

(c) None (d) Infinitely many

19. The degree of the product of a linear polynomial and a constant non-zero polynomial is:

(a) 0 (b) 1

(c) 2 (d) Variable

20. Which of the following points lies on the line representation of $x + 2y = 7$?

(a) $(1, 3)$ (b) $(3, 1)$

(c) $(5, 1)$ (d) $(2, 3)$

MCQ Answer Key

1-(a), 2-(b), 3-(a), 4-(c), 5-(b), 6-(b), 7-(c), 8-(c), 9-(b), 10-(d), 11-(b), 12-(b), 13-(c), 14-(b), 15-(b), 16-(b), 17-(a), 18-(d), 19-(b), 20-(a)

Section B: Subjective Questions (Moderate Difficulty)

BETA Level

Solve the following questions with detailed step-by-step procedures:

21. Find the zero of the linear polynomial $p(x) = (2x / 3) + (5 / 4)$.
22. Express the equation $4x - 5 = 3y$ in the standard form $ax + by + c = 0$ and specify the values of a , b , and c .
23. Check whether the point $(-2, 4)$ lies on the graph of the linear equation $3x + 2y = 2$. Show your verification steps.
24. If the point $(3, 4)$ lies on the graph of the equation $3y = ax + 7$, find the value of a .
25. Write four distinct solutions for the linear equation $2x + y = 7$.
26. Find the value of k if the linear polynomial expression $p(x) = kx - 9$ has a zero at $x = 3$.
27. Draw the geometric representation of the equation $2x + 9 = 0$ as an equation in (i) one variable, and (ii) two variables. Describe the nature of the graphs.
28. Verify whether $x = -1/3$ is a zero of the polynomial $p(x) = 3x + 1$.
29. The taxi fare in a city is as follows: For the first kilometer, the fare is ₹8 and for the subsequent distance it is ₹5 per km. Taking the distance covered as x km and total fare as ₹ y , write a linear equation for this information.
30. Find the point where the graph of the linear equation $2x + 3y = 12$ cuts the x -axis and the y -axis.
31. If the polynomial $p(x) = 4x + 3$ represents the side length of a square, find an expression for its perimeter. Is the perimeter expression also a linear polynomial?
32. Give the equations of two lines passing through the point $(2, 14)$. How many more such lines are there, and why?
33. Express y in terms of x from the equation $5x - 2y = 10$. Find the value

of y when $x = 4$.

34. Determine if the linear polynomial $f(x) = 5x - \pi$ has a rational or irrational zero. Explain your reasoning.
35. A linear equation passes through the points $(0, 2)$ and $(2, 0)$. Find the equation of the line.
36. If $p(x) = 2x + 1$ and $q(x) = 3x - 2$ are two linear polynomials, find the expression for $p(x) + q(x)$. Determine its degree and zero.
37. Show that the graph of the equation $x - y = 0$ passes through the origin and divides the Cartesian plane symmetrically.
38. For what value of m will the linear equation $2x + my = 8$ have equal values for x and y at the point $(2, 2)$?
39. Solve the equation $3x + 2 = x - 6$ and represent the solution on the number line.
40. Explain why an equation of the form $ax + b = 0$ (where $a \neq 0$) can be considered a linear equation in two variables. Write its general solution format.

Section A: Multiple Choice Questions (Difficult Level) Delta Level

Choose the correct option for each of the following questions:

21. If the expression $p(x) = (k^2 - 4)x^2 + (k - 2)x + 7$ represents a valid linear polynomial, then the value of k is:
- (a) 2 (b) -2
(c) ± 2 (d) 4
22. If $x = 1/(2 - \sqrt{3})$, then the value of the algebraic expression $x + 1/x - 4$ is:
- (a) 0 (b) $2\sqrt{3}$
(c) 4 (d) -4

23. A linear equation $ax + by + c = 0$ represents a straight line passing through the first, second, and fourth quadrants, but completely misses the third quadrant. What are the signs of a , b , and c ?
- (a) $a > 0, b > 0, c > 0$ (b) $a > 0, b > 0, c < 0$
(c) $a < 0, b > 0, c < 0$ (d) $a < 0, b < 0, c > 0$
24. If $p(x)$ is a linear polynomial satisfying $p(1) = 5$ and $p(3) = 11$, then the value of $p(-2)$ is:
- (a) -1 (b) -4
(c) 2 (d) 0
25. The area of the triangle formed by the linear graph $3x + 4y = 24$ with the coordinate axes is:
- (a) 12 sq. units (b) 24 sq. units
(c) 48 sq. units (d) 6 sq. units
26. How many integral solutions exist for the equation $2x + 5y = 20$ such that both x and y are strictly positive integers?
- (a) 0 (b) 1
(c) 2 (d) Infinitely many
27. If the zero of the polynomial $p(x) = mx - n$ is reciprocal to the zero of $q(x) = nx - m$ (where $m, n \neq 0$), then:
- (a) $m = n$ (b) $m^2 = n^2$
(c) $m + n = 0$ (d) $m = 1/n$
28. The graph of the linear equation $y = kx$ passes through the point of intersection of $x + y = 6$ and $2x - y = 3$. Find k .
- (a) 1 (b) 2
(c) 3 (d) 0.5
29. A linear polynomial in x leaves a remainder of 4 when divided by $(x - 2)$ and a remainder of 1 when divided by $(x + 1)$. The polynomial is:
- (a) $x + 2$ (b) $2x + 0$
(c) $x + 1$ (d) $3x - 2$
30. If the point (k^2, k) lies on the line $2x + 3y = 5$, then the possible real values of k are:
- (a) 1, $-5/2$ (b) $-1, 5/2$
(c) 1, $5/2$ (d) $-1, -5/2$
31. The degree of the polynomial expression $(x + 1)(x - 2) - x(x + 3)$ is:

- (a) 2 (b) 1
(c) 0 (d) Not defined
32. The lines $x = 2$, $x = -3$, $y = 3$, and $y = -1$ enclose a region. The perimeter of this geometric shape is:
(a) 9 units (b) 18 units
(c) 20 units (d) 14 units
33. If the linear expression $(a - 3)x + (b + 2)$ is identically zero for all values of x , then the value of $a + b$ is:
(a) 5 (b) 1
(c) -1 (d) 0
34. The line represented by the equation $2x - 5y = 10$ divides the plane. Which point lies completely on the origin side of the line?
(a) (3, -1) (b) (1, 1)
(c) (6, 0) (d) (4, -2)
35. If $p(x) = ax + b$ and the graph passes through $(-b/a, 0)$, what is the value of $p(b/a)$ if $b = 2a$?
(a) 0 (b) $2b$
(c) $2a$ (d) $4a$
36. The condition that the linear equation $ax + by + c = 0$ reduces to a line passing through the origin is:
(a) $a = 0$ (b) $b = 0$
(c) $c = 0$ (d) $a = b = 0$
37. If a linear polynomial has a zero at $x = \alpha$, then the zero of the polynomial $p(x/k)$ where $k \neq 0$ is:
(a) α/k (b) $k\alpha$
(c) $\alpha + k$ (d) α
38. The equation of a line whose x-intercept is double its y-intercept and passes through (2, 3) is:
(a) $x + 2y = 8$ (b) $2x + y = 7$
(c) $x + 2y = 7$ (d) $2x + y = 8$
39. If the polynomial $P(x) = ax^3 + bx^2 + cx + d$ becomes a linear polynomial under certain conditions, what is the minimum number of coefficients that must be zero?
(a) 1 (b) 2

(c) 3

(d) 4

40. The linear equation representing a line perpendicular to the x-axis and at a distance of 4 units to the left of the y-axis is:

(a) $y = -4$

(b) $x = -4$

(c) $y = 4$

(d) $x = 4$

MCQ Answer Key

1-(b), 2-(a), 3-(b), 4-(b), 5-(b), 6-(b), 7-(b), 8-(a), 9-(a), 10-(a), 11-(b), 12-(b), 13-(b), 14-(b), 15-(d), 16-(c), 17-(b), 18-(a), 19-(b), 20-(b)

Section B: Subjective Questions (Difficult Level)

Delta Level

Solve the following complex problems with exhaustive mathematical justifications:

41. A polynomial expression is given by $p(x) = (m^2 - 9)x^3 + (m + 3)x^2 + (m^2 + 5m + 6)x + 12$. Determine all real values of the parameter m for which $p(x)$ degrades exactly into a linear polynomial. Find the resulting zero of that linear polynomial.

42. Find the value of k for which the linear expression $(2k - 1)x + 5y = 3k$ and $4x + (k + 1)y = 6$ represent the exact same line in the Cartesian system.

43. Let $p(x)$ be a linear polynomial such that when it is evaluated at $x = 2$ and $x = 5$, the outputs are consecutive prime numbers whose sum is 12. Find the algebraic expression of $p(x)$ and its root.

44. Prove analytically that the graph of the linear equation $(2k + 1)x + (k - 1)y + (3 - k) = 0$ always passes through a fixed point in the coordinate plane for all real values of k . Find the coordinates of that fixed point.

45. An express train covers a distance at a uniform speed of x km/h. If the

speed had been 10 km/h faster, it would have taken 2 hours less than the scheduled time. Formulate a relationship, show whether it behaves linearly under constraints, and extract a linear system if the total distance is fixed at 300 km.

46. Find the values of a and b so that the polynomial expression $p(x) = x^4 + ax^3 - 7x^2 + bx + 6$ is exactly divisible by the quadratic product of two linear components $(x - 1)$ and $(x - 2)$.
47. Draw the bounded region enclosed by the lines $y = x$, $x + y = 6$, and the y -axis. Calculate the exact area of this geometric figure using coordinate geometry methods.
48. Let a linear polynomial $f(x)$ satisfy the identity $f(x) + f(2x) = 6x - 4$ for all real values of x . Determine the structural expression of $f(x)$ and compute the value of $f(-5)$.
49. Find all possible integer solutions (x, y) that satisfy the linear constraint equation $3x + 7y = 105$ such that $x > 0$ and $y > 0$.
50. The path of a moving particle is guided by the linear constraint $4x - 3y + 12 = 0$. Find the shortest perpendicular distance from the origin $(0,0)$ to this linear path, detailing the geometric steps.
51. If the zeros of the quadratic polynomial $x^2 - px + q$ are two consecutive integers, show that the discriminant expression $p^2 - 4q - 1$ evaluates identically to 0 using linear algebraic operations.
52. Express the variable x explicitly in terms of y for the mathematical equation $(2x - 3)/(4x + 5) = (y - 1)/(2y + 3)$, and find the exceptional conditions where the relation fails to behave linearly.
53. A linear graph passes through the points $A(3, 4)$ and $B(-1, 2)$. If a point $C(k, 5)$ is collinear with A and B , determine the value of k using the slope-intercept equation properties.
54. Formulate a linear equation in two variables using a real-world chemistry context: A chemist has a 10% acid solution and a 30% acid solution. Express the relation between the volumes x and y needed to create a mixture containing exactly 5 liters of pure acid.

55. If the zero of the linear polynomial $ax + b$ is doubled when a constant k is added to the constant term b , find the value of k in terms of a and b .
56. Determine the condition under which the linear system $ax + by = c$ and $bx + ay = c$ has infinitely many solutions, given that a and b are distinct real numbers.
57. The linear graph of $y = mx + c$ cuts the x -axis at $P(-4, 0)$ and makes an angle with the axes such that the area of the intercepted triangle in the second quadrant is 8 square units. Find the values of m and c .
58. If $p(x)$ is a linear polynomial such that the composition $p(p(x)) = 9x + 8$, determine all possible algebraic definitions for $p(x)$.
59. Show that the linear equation $2x + 3y = 6$ can be transformed into the intercept form $(x/\alpha) + (y/\beta) = 1$. State the physical geometric meaning of α and β .
60. Solve the system of structural equations for the variables x and y :
 $2/(x+y) + 3/(x-y) = 1$ and $5/(x+y) - 2/(x-y) = 5/6$, treating the inverse combinations as linear variables.

Section A: Multiple Choice Questions (Olympiad Challenge) Quantum Level

Choose the correct option for each of the following questions:

41. Let $P(x)$ be a polynomial such that $P(x) = (a^3 - 8)x^3 + (a^2 - 4)x^2 + (a - 2)x + 5$. If the degree of $P(x)$ is exactly 1, then the number of possible real values for the parameter ' a ' is:
 (a) 0 (b) 1
 (c) 2 (d) Infinitely many
42. A linear polynomial $P(x)$ satisfies the condition that $P(P(x)) - x = 0$ holds true for all real values of x . If the coefficient of x is not 1, then what is the

value of $P(0) + P(1)$ if $P(2) = -1$?

- (a) 0
- (b) 1
- (c) 2
- (d) 3

43. If the system of linear conditions represented by $(k - 2)x + 3y = 5$ and $2x + (k + 1)y = 10$ has a unique solution that lies strictly in the second quadrant (excluding the axes), then the integer values that k can take satisfy:

- (a) $k = 1$
- (b) $k < -4$
- (c) $-4 < k < 2$
- (d) No such integer k exists

44. Let the zero of the linear polynomial $f(x) = ax + b$ be denoted by r . If a new polynomial $g(x) = bx + a$ has a zero that is exactly equal to r^2 , then the value of $a^4 - b^4$ when $a \neq b$ is:

- (a) 0
- (b) a^2b^2
- (c) 1
- (d) Cannot be determined uniquely

45. The graph of the linear equation $x + y = n$ (where n is a positive integer) forms a right-angled triangle with the positive coordinate axes. If the number of integral coordinates (x, y) lying strictly inside the interior of this triangular region is exactly 10, then the value of n is:

- (a) 4
- (b) 5
- (c) 6
- (d) 7

46. If the linear expression $(2m - 3)x + (3m - 2)y + (5m - 6) = 0$ passes through a single point (α, β) regardless of the real parameter m , then the sum of α and β is:

- (a) 0
- (b) 1
- (c) -1
- (d) 2

47. Let $p(x)$ be a linear polynomial. If the remainder when $p(x)$ is divided by $(x - 1)$ is 3, and the remainder when $p(x)$ is divided by $(x - 2)$ is 5, what is the remainder when the polynomial $[p(x)]^2$ is divided by $(x - 1)(x - 2)$?

- (a) $4x - 1$
- (b) $16x - 7$
- (c) $16x - 23$
- (d) $8x + 1$

48. The absolute value equation $|x - 2| + |y - 3| = 4$ consists of segments of four distinct linear lines. The area bounded by these linear segments in the Cartesian plane is:

- (a) 8 sq. units
- (b) 16 sq. units
- (c) 32 sq. units
- (d) 64 sq. units

49. If a and b are real numbers such that the linear polynomial $f(x) = ax + b$ satisfies $f(f(f(x))) = 8x + 21$, then the product ab is equal to:
- (a) 6 (b) 9
(c) 12 (d) 15
50. How many ordered pairs of positive integers (x, y) satisfy the linear equation $7x + 19y = 2026$?
- (a) 14 (b) 15
(c) 16 (d) 17
51. Let $p(x) = ax + b$ be a linear polynomial with integer coefficients. If $p(1)$ and $p(2)$ are both odd numbers, then which of the following statements must be true for any integer n ?
- (a) $p(n)$ is always even (b) $p(n)$ is always odd
(c) $p(n)$ is even if n is even (d) $p(n)$ is odd if n is odd
52. The line $x - 2y + 4 = 0$ intersects the coordinate axes at points A and B . A point $P(x, y)$ moves such that the area of triangle PAB remains constantly equal to 6 square units. The path of P is represented by:
- (a) $x - 2y + 10 = 0$ only (b) $x - 2y - 2 = 0$ only
(c) $x - 2y + 10 = 0$ or $x - 2y - 8 = 0$ (d) $x - 2y + 8 = 0$ or $x - 2y - 4 = 0$
53. If the zero of the linear polynomial $p(x) = mx - 2$ evaluates to a positive integer, then the sum of all possible integer values of m is:
- (a) 1 (b) 2
(c) 3 (d) 4
54. A straight line given by $y = mx + c$ passes through the point $(2, 5)$ and avoids the third quadrant entirely. The set of all possible values for the slope m is given by:
- (a) $m \geq 0$ (b) $m \leq 2.5$
(c) $0 \leq m \leq 2.5$ (d) $m < 0$
55. Let x and y be real numbers satisfying the linear configuration $3x + 4y = 12$. The minimum possible value of the expression $\sqrt{x^2 + y^2}$ represents the shortest distance from the origin. This minimum value is:
- (a) 2 (b) 2.4
(c) 3 (d) 1.2
56. The polynomial identity $P(x) - P(x - 1) = 2x - 3$ holds for all real x . If $P(0) = 1$, then the polynomial $P(x)$ can be simplified to a specific expression. What is

the value of $P(10)$?

- (a) 81
- (b) 91
- (c) 101
- (d) 111

57. The linear equation $2x + 3y = 12$ cuts the x-axis at A and the y-axis at B. If a point C lies on the line segment AB such that the area of triangle OAC is double the area of triangle OBC (where O is the origin), then the coordinates of C are:

- (a) $(2, 8/3)$
- (b) $(4, 4/3)$
- (c) $(3, 2)$
- (d) $(1, 10/3)$

58. If $f(x)$ is a linear polynomial such that $f(2) = 5$ and $f(f(2)) = 11$, then the explicit equation representing $f(x)$ has a y-intercept at:

- (a) 1
- (b) 2
- (c) -1
- (d) 3

59. A sequence of linear functions satisfies $f_1(x) = x + 1$ and $f_n(x) = f_1(f_{n-1}(x))$ for all integers $n \geq 2$. What is the zero of the function $f_{2026}(x)$?

- (a) 2026
- (b) -2026
- (c) $1/2026$
- (d) $-1/2026$

60. If the expression $(a + c)x + (b - d) = 0$ is true for more than two distinct values of x , then the value of $(a^2 + b^2) / (c^2 + d^2)$ assuming $c^2 + d^2 \neq 0$ is:

- (a) 1
- (b) 0
- (c) 2
- (d) -1

MCQ Answer Key

1-(b), 2-(c), 3-(d), 4-(a), 5-(b), 6-(a), 7-(c), 8-(c), 9-(b), 10-(b), 11-(b), 12-(c), 13-(c), 14-(c), 15-(b), 16-(a), 17-(a), 18-(a), 19-(b), 20-(a)

Section B: Subjective Questions (Olympiad Level)

Quantum Level

Solve the following deep mathematical problems by proving your arguments steps using Class 9 constraints:

61. Let $P(x)$ be a polynomial whose coefficients are all integers. It is given that $P(1) = 4$ and $P(2) = 7$. Prove strictly using the factor/remainder framework available in Class 9 that $P(n)$ can never be equal to 15 for any integer value of n .
62. A particle starts from the point $(1, 2)$ and moves along the path of the linear equation $3x - 2y + 1 = 0$. Upon intersecting the x -axis, it reflects perfectly across the axis and continues along a new linear trajectory. Formulate the equation of this reflected linear path and find its x -intercept.
63. Find all real values of the variable ' a ' such that the linear polynomial $f(x) = ax + 3a - 2$ has a zero that falls strictly inside the interval $-1 < x < 1$.
64. A heavy linear function system satisfies the identity $f(x + y) = f(x) + f(y) - 2$ for all real values of x and y . If $f(1) = 5$, prove that $f(x)$ must behave as a linear polynomial structure and find its explicit formula. Then, find the value of $f(-10)$.
65. Determine the number of pairs of positive integers (x, y) that satisfy the linear distribution equation $5x + 8y = 400$ such that x is a multiple of y . Show the complete analytical breakdown.
66. Three lines given by $2x + 3y = 6$, $3x - y = 2$, and $kx + 2y = 4$ are concurrent (pass through the same mutual point). Without jumping into higher determinant formulas, use basic linear system substitution to solve for k and determine if the line $kx + 2y = 4$ is parallel to either axis.
67. Let $P(x) = ax + b$ be a linear polynomial. If $P(x^3) - [P(x)]^3$ is identically equal to a constant value for all x , find all possible ordered pairs of real numbers (a, b) .
68. A family of linear paths is given by the equation $(a + 2b)x + (a - 3b)y + (2a + 9b) = 0$, where a and b are real numbers not both zero. Prove that all lines

belonging to this family intersect at one single point, and compute its coordinates.

69. An integer-valued linear polynomial $f(x) = mx + c$ has the property that $f(f(1)) = 2$ and $f(f(2)) = 5$. Calculate all possible values for the parameters m and c under these exact conditions.
70. Find the total area of the region bounded by the graph of the equation $|x|/3 + |y|/4 = 1$. Explain the geometric symmetry of the linear bounds using quadrants.
71. A rectangular field has dimensions such that if the length is increased by 3 meters and the breadth is decreased by 2 meters, the area remains unchanged. Similarly, if the length is reduced by 2 meters and the breadth increased by 3 meters, the area increases by 20 square meters. Set up a system of linear variables to find the original dimensions.
72. Let $p(x)$ be a linear polynomial. If the expression $p(x^2) + xp(x)$ simplifies to a cubic polynomial with no x^2 term, what condition does this impose on the coefficients of $p(x)$? If $p(1) = 4$, find the unique polynomial $p(x)$.
73. A straight line $4x + 5y = 40$ meets the x -axis at P and the y -axis at Q . A point $R(a, b)$ with integer coordinates is chosen such that the area of triangle OPQ is exactly equal to four times the area of triangle OPR , where O is the origin. Find all possible coordinates of R if R lies in the first quadrant.
74. Let $f(x)$ be a polynomial satisfying $f(x) \cdot f(1/x) = f(x) + f(1/x)$ for all non-zero real values of x . If $f(3) = 28$ and the structure can be decomposed into simple factors, analyze whether $f(x) - 1$ can be expressed as a product of purely linear polynomials over real numbers.
75. Prove that for any real numbers x and y satisfying the condition $2x + y = 5$, the expression $x^2 + y^2$ can never drop below the value of 5. Find the values of x and y when this minimum occurs using substitution.
76. A line passing through the point $(4, 3)$ cuts the positive coordinate axes at points $A(a, 0)$ and $B(0, b)$. Find the minimum possible value of the sum of intercepts $(a + b)$ using the linear equation constraints.
77. If the zero of the linear polynomial $P(x) = ax + b$ is α , find the zero of the transformed polynomial $Q(x) = P(cx + d)$ where a, b, c, d are non-zero real constants. Express your answer strictly in terms of α, c , and d .
78. A linear graph $5x - 2y = 10$ undergoes a translation such that every point $(x,$

y) on the line shifts to $(x + 2, y - 3)$. Find the equation of the new line and determine if it is parallel to the original path.

79. Let S be the set of all points (x, y) that satisfy the equation $(x - y + 1)(2x + 3y - 6) = 0$. If a third line $y = mx$ cuts this set at exactly one point, find all the valid constraints on the slope m .

80. A linear polynomial $f(x) = ax + b$ satisfies the condition that for three consecutive integers $n, n+1, n+2$, the values $f(n), f(n+1), f(n+2)$ can form the sides of a right-angled triangle in some order. Investigate if such a polynomial exists with non-zero integer values for a and b .