UNIQUE STUDY POINT

By Sumeet Sahu

www.uniquestudyonline.com

Unique Study Point, Amitesh Nagar, Indore, MP | Contact: 8103405051

Class: X	**Subject:** Mathematics	**Session:** 2025-26
Chapter: 02 - Polynomials	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

1. If α and β are the zeroes of the polynomial $f(x) = x^2 + x - 2$, then the value of $(1/\alpha + 1/\beta)$ is:
(a) -1/2
(b) 1/2
(c) -2
(d) 2

2. The zeroes of the polynomial $p(x) = 3x^2 - 2$ are:
(a) $\pm\sqrt{(2/3)}$
(b) $\pm\sqrt{(3/2)}$
(c) $\pm\sqrt{6}$
(d) $\pm 2/3$

3. If one zero of the polynomial $2x^2 + 3x + k$ is -1, then the value of k is:
(a) 1
(b) -1
(c) 2
(d) -2

4. A quadratic polynomial whose zeroes are 3 and -4 is:
(a) $x^2 - x - 12$
(b) $x^2 + x - 12$
(c) $x^2 + x + 12$
(d) $x^2 - x + 12$

5. If the sum of zeroes of the polynomial $3x^2 - kx + 6$ is 3, then the value of k is:
(a) 3
(b) 6
(c) 9
(d) 12

6. The graph of y = p(x) is given. The number of zeroes of p(x) from the graph is:
[A parabola opening upward with vertex below the x-axis, intersecting the x-axis at two points]

(a) 0

(b) 1

(c) 2

(d) 3

7. If α, β are the zeroes of polynomial $f(x) = x^2 - 5x + 6$, then the value of $\alpha^2 + \beta^2$ is:

(a) 13

(b) 25

(c) 5

(d) 12

8. The zeroes of the polynomial $x^2 - 9$ are:

(a) 3, 3

(b) -3, -3

(c) 3, -3

(d) No real zeroes

9. Assertion (A): If the sum of zeroes of the quadratic polynomial $x^2 - 2x + k$ is equal to half their product, then k = 4.
Reason (R): For quadratic polynomial $ax^2 + bx + c$, sum of zeroes = -b/a and product of zeroes = c/a.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

10. Assertion (A): The polynomial $p(x) = 4x^2 - 1$ has two distinct real zeroes.
Reason (R): A quadratic polynomial can have at most two zeroes.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

SECTION B - Short Answer Questions (2 marks each)

11. Find the zeroes of the polynomial $x^2 + 7x + 12$ and verify the relationship between zeroes and coefficients.

12. If α and β are the zeroes of the polynomial $t^2 - 4t + 3$, find the value of $\alpha^2 + \beta^2$.

13. Find a quadratic polynomial whose zeroes are $2 + \sqrt{3}$ and $2 - \sqrt{3}$.

14. If one zero of the polynomial $(a^2 + 9)x^2 + 13x + 6a$ is reciprocal of the other, find the value of a.

SECTION C - Short Answer Questions (3 marks each)

15. If α and β are the zeroes of the polynomial $2x^2 + 7x + 5$, find the value of $\alpha^2 + \beta^2 + \alpha\beta$.

16. Find a quadratic polynomial whose zeroes are $1/(2\alpha)$ and $1/(2\beta)$, where α and β are the zeroes of the polynomial $4x^2 - 5x + 1$.

17. If α and β are the zeroes of the polynomial $x^2 - 6x + k$ such that $\alpha^2 + \beta^2 = 28$, find the value of k.

SECTION D - Long Answer Question (5 marks)

18. If α and β are the zeroes of the polynomial $6x^2 + x - 2$, find:
(i) $\alpha + \beta$
(ii) $\alpha\beta$
(iii) $\alpha^2 + \beta^2$
(iv) $1/\alpha + 1/\beta$
(v) $\alpha^2\beta + \alpha\beta^2$

SECTION E - Case Study Based Questions (4 marks each)

19. Case Study-1: Garden Design

A landscape architect is designing a rectangular garden. The length of the garden (in meters) is represented by one zero of a quadratic polynomial, and the width is represented by the other zero. The polynomial describing the dimensions is $p(x) = x^2 - 12x + 35$.

(i) Find the zeroes of the polynomial $p(x) = x^2 - 12x + 35$. (1 mark)
(ii) What are the dimensions of the garden? (1 mark)
(iii) Find the perimeter of the garden. (2 marks)
OR
(iii) If the cost of fencing is ₹150 per meter, find the total cost of fencing the garden. (2 marks)

20. Case Study-2: Projectile Motion

The height h (in meters) of a ball thrown upward is given by the polynomial $h(t) = -5t^2 + 20t + 1$, where t is the time in seconds.

(i) Is this polynomial quadratic? Give reason. (1 mark)
(ii) What is the value of the discriminant of this polynomial? (1 mark)
(iii) Find the sum and product of the zeroes of the polynomial. (2 marks)
OR
(iii) At what time(s) will the ball be at a height of 16 meters? (2 marks)

DETAILED ANSWER KEY - PAPER 01

SECTION A - Answers to MCQs

1. (b) 1/2

Solution:
Given: $f(x) = x^2 + x - 2$
Sum of zeroes $(\alpha + \beta) = -b/a = -1/1 = -1$
Product of zeroes $(\alpha\beta) = c/a = -2/1 = -2$
$1/\alpha + 1/\beta = (\alpha + \beta)/(\alpha\beta) = (-1)/(-2) = 1/2$

2. (a) $\pm\sqrt{(2/3)}$

Solution:
$p(x) = 3x^2 - 2 = 0$
$3x^2 = 2$
$x^2 = 2/3$
$x = \pm\sqrt{(2/3)}$

3. (a) 1

Solution:
If $x = -1$ is a zero, then $p(-1) = 0$
$2(-1)^2 + 3(-1) + k = 0$
$2 - 3 + k = 0$
$k = 1$

4. (b) $x^2 + x - 12$

Solution:
If zeroes are $\alpha = 3$ and $\beta = -4$
Sum $(\alpha + \beta) = 3 + (-4) = -1$
Product $(\alpha\beta) = 3 \times (-4) = -12$
Polynomial $= x^2 - (\text{sum})x + \text{product}$
$= x^2 - (-1)x + (-12)$
$= x^2 + x - 12$

5. (c) 9

Solution:
Sum of zeroes $= -b/a = -(-k)/3 = k/3$
Given: $k/3 = 3$
$k = 9$

6. (c) 2

Solution:
The parabola intersects the x-axis at two points, so there are 2 zeroes.

7. (a) 13

Solution:
$f(x) = x^2 - 5x + 6$
$\alpha + \beta = 5$ and $\alpha\beta = 6$
$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
$= (5)^2 - 2(6)$
$= 25 - 12 = 13$

8. (c) 3, -3

Solution:
$x^2 - 9 = 0$
$(x + 3)(x - 3) = 0$
$x = -3$ or $x = 3$

9. (a) Both A and R are true and R is the correct explanation of A

Solution:
For $x^2 - 2x + k$:
Sum = $-(-2)/1 = 2$
Product = $k/1 = k$
Given: $2 = k/2$
$k = 4$
Both assertion and reason are correct, and R explains A.

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

Solution:
$4x^2 - 1 = 0$ gives $x = \pm 1/2$ (two distinct real zeroes)
A quadratic polynomial can have at most two zeroes (true)
However, R doesn't specifically explain why THIS polynomial has two distinct zeroes.

SECTION B - Answers to Short Answer Questions

11.

Solution:
$x^2 + 7x + 12 = 0$
$x^2 + 3x + 4x + 12 = 0$
$x(x + 3) + 4(x + 3) = 0$
$(x + 3)(x + 4) = 0$
Zeroes: $\alpha = -3$, $\beta = -4$

Verification:
Sum of zeroes = $\alpha + \beta = -3 + (-4) = -7 = -b/a = -7/1$ ✓
Product of zeroes = $\alpha\beta = (-3)(-4) = 12 = c/a = 12/1$ ✓

12.

Solution:
For polynomial $t^2 - 4t + 3$:
Sum of zeroes $(\alpha + \beta) = -(-4)/1 = 4$
Product of zeroes $(\alpha\beta) = 3/1 = 3$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
$= (4)^2 - 2(3)$
$= 16 - 6$
$= 10$

13.

Solution:
Given zeroes: $\alpha = 2 + \sqrt{3}$ and $\beta = 2 - \sqrt{3}$
Sum = $\alpha + \beta = (2 + \sqrt{3}) + (2 - \sqrt{3}) = 4$
Product = $\alpha\beta = (2 + \sqrt{3})(2 - \sqrt{3}) = 4 - 3 = 1$

Required polynomial = x^2 - (sum)x + product
$= x^2 - 4x + 1$

14.

Solution:
If one zero is reciprocal of other, then product of zeroes = 1
Product of zeroes = c/a = $6a/(a^2 + 9)$

$6a/(a^2 + 9) = 1$
$6a = a^2 + 9$
$a^2 - 6a + 9 = 0$
$(a - 3)^2 = 0$
$a = 3$

SECTION C - Answers to Short Answer Questions

15.

Solution:
For polynomial $2x^2 + 7x + 5$:
$\alpha + \beta = -b/a = -7/2$
$\alpha\beta = c/a = 5/2$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
$= (-7/2)^2 - 2(5/2)$
$= 49/4 - 10/2$
$= 49/4 - 20/4$
$= 29/4$

$\alpha^2 + \beta^2 + \alpha\beta = 29/4 + 5/2$
$= 29/4 + 10/4$
$= 39/4$

16.

Solution:
For $4x^2 - 5x + 1$:
$\alpha + \beta = 5/4$ and $\alpha\beta = 1/4$

New zeroes are $1/(2\alpha)$ and $1/(2\beta)$
Sum of new zeroes = $1/(2\alpha) + 1/(2\beta)$
$= (\alpha + \beta)/(2\alpha\beta)$
$= (5/4)/(2 \times 1/4)$
$= (5/4)/(1/2)$
$= 5/2$

Product of new zeroes = $1/(2\alpha) \times 1/(2\beta)$
$= 1/(4\alpha\beta)$
$= 1/(4 \times 1/4)$
$= 1$

Required polynomial = x^2 - (sum)x + product
$= x^2 - (5/2)x + 1$
$= 2x^2 - 5x + 2$

17.

Solution:
For $x^2 - 6x + k$:
$\alpha + \beta = 6$
$\alpha\beta = k$

Given: $\alpha^2 + \beta^2 = 28$
$(\alpha + \beta)^2 - 2\alpha\beta = 28$
$(6)^2 - 2k = 28$
$36 - 2k = 28$
$2k = 8$
$k = 4$

SECTION D - Answer to Long Answer Question

18.

Solution:
For polynomial $6x^2 + x - 2$:

(i) $\alpha + \beta = -b/a = -1/6$

(ii) $\alpha\beta = c/a = -2/6 = -1/3$

(iii) $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
$= (-1/6)^2 - 2(-1/3)$
$= 1/36 + 2/3$
$= 1/36 + 24/36$
$= 25/36$

(iv) $1/\alpha + 1/\beta = (\alpha + \beta)/(\alpha\beta)$
$= (-1/6)/(-1/3)$
$= (-1/6) \times (-3/1)$
$= 1/2$

(v) $\alpha^2\beta + \alpha\beta^2 = \alpha\beta(\alpha + \beta)$
$= (-1/3)(-1/6)$
$= 1/18$

SECTION E - Answers to Case Study Based Questions

19.

Solution:
(i) $p(x) = x^2 - 12x + 35$
$x^2 - 7x - 5x + 35 = 0$
$x(x - 7) - 5(x - 7) = 0$
$(x - 5)(x - 7) = 0$
Zeroes: $x = 5$ and $x = 7$

(ii) Dimensions of garden:
Length = 7 meters
Width = 5 meters

(iii) Perimeter = 2(length + width)
$= 2(7 + 5)$
$= 2(12)$
$= 24$ meters

OR
(iii) Cost of fencing = Perimeter × Rate
Perimeter = 24 meters

Cost = 24 × ₹150
= ₹3,600

20.

Solution:
Given: $h(t) = -5t^2 + 20t + 1$

(i) Yes, this is a quadratic polynomial because the highest degree of the variable t is 2.

(ii) Discriminant = $b^2 - 4ac$
Here a = -5, b = 20, c = 1
$D = (20)^2 - 4(-5)(1)$
$D = 400 + 20$
$D = 420$

(iii) Sum of zeroes = -b/a = -20/(-5) = 4
Product of zeroes = c/a = 1/(-5) = -1/5

OR
(iii) When h = 16:
$-5t^2 + 20t + 1 = 16$
$-5t^2 + 20t - 15 = 0$
$t^2 - 4t + 3 = 0$
$(t - 1)(t - 3) = 0$
t = 1 second or t = 3 seconds
The ball will be at 16 meters height at 1 second and 3 seconds.
