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SAMPLE PAPER 02 - CHAPTER 02 POLYNOMIALS (2025-26)

SUBJECT: MATHEMATICS **MAX. MARKS:** 40

CLASS: X **DURATION:** 1½ hrs

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** comprises of 10 MCQs of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
4. There is no overall choice.
5. Use of Calculators is not permitted.

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. If α and β are zeroes of polynomial $x^2 - 7x + 10$, then $1/\alpha + 1/\beta$ equals:

(a) 7/10 (b) 10/7 (c) -7/10 (d) -10/7

2. The number of zeroes of a polynomial y = f(x) from the given graph is:
[Graph shows parabola touching x-axis at one point]

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

3. If the sum of zeroes of polynomial $3x^2 - kx + 6$ is 3, then k equals:

(a) 3 (b) 6 (c) 9 (d) 12

4. A quadratic polynomial whose product of zeroes is -3 and sum is 0 is:

(a) $x^2 - 3$ (b) $x^2 + 3$ (c) $x^2 - 3x$ (d) $x^2 + 3x$

5. If α, β are zeroes of $x^2 + 7x + 12$, then the value of $(1/\alpha + 1/\beta)$ is:

(a) -7/12 (b) 7/12 (c) 12/7 (d) -12/7

6. If one zero of $2x^2 + 3x + k$ is reciprocal of the other, then k equals:

(a) 1 (b) 2 (c) 3 (d) 4

7. The degree of zero polynomial is:

(a) 0 (b) 1 (c) any natural number (d) not defined

8. If sum of zeroes of $kx^2 + 2x + 3k$ is equal to their product, then k equals:

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

9. **Assertion (A):** If the graph of polynomial touches x-axis at only one point, it has only one zero.
Reason (R): A polynomial of degree n can have at most n 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.

10. **Assertion (A):** $x^2 - 1$ is a quadratic polynomial.

Reason (R): Any polynomial of the form $ax^2 + bx + c$, where $a \neq 0$ is a quadratic polynomial.

(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

Questions 11 to 14 carry 2 marks each.

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

12. If α and β are zeroes of $x^2 - x - 2$, find the value of $1/\alpha + 1/\beta - 2\alpha\beta$.

13. If one zero of polynomial $p(x) = (k + 4)x^2 + 13x + 4k$ is reciprocal of the other, find k.

14. Find the zeroes of polynomial $4u^2 + 8u$.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Find the zeroes of quadratic polynomial $6x^2 - 3 - 7x$ and verify the relationship between zeroes and coefficients.

16. If α and β are zeroes of polynomial $x^2 - 6x + k$. Find k if $3\alpha + 2\beta = 20$.

17. If α and β are zeroes of polynomial $x^2 + 7x + 10$, find the polynomial whose zeroes are α/β and β/α.

SECTION – D

Question 18 carries 5 marks.

18. If α and β are zeroes of polynomial $p(x) = 2x^2 + 5x + k$ satisfying relation $\alpha^2 + \beta^2 + \alpha\beta = 21/4$, then find:

(a) Value of k (3 marks)

(b) Value of $\alpha + \beta + 3\alpha\beta$ (2 marks)

SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. An athletics coach is preparing a rectangular training ground. The length of the ground exceeds its breadth by 10 m. The area of the ground is represented by polynomial $x^2 + 10x$, where x is the breadth in meters.

(i) Find the zeroes of polynomial $x^2 + 10x$. (1 mark)

(ii) What is the sum of zeroes of this polynomial? (1 mark)

(iii) If the breadth is 20 m, find the area of the training ground. (2 marks)

20. A bakery owner finds that the profit P(x) from selling x cakes per day is given by polynomial $P(x) = -x^2 + 40x - 300$ (in rupees).

(i) What is the degree of profit polynomial? (1 mark)

(ii) Find the zeroes of profit polynomial. (2 marks)

(iii) What do these zeroes represent in real context? (1 mark)

✓ DETAILED SOLUTIONS - SAMPLE PAPER 02

SECTION – A (SOLUTIONS)

Solution 1:

For $x^2 - 7x + 10$: $\alpha + \beta = 7$, $\alpha\beta = 10$

$1/\alpha + 1/\beta = (\alpha + \beta)/\alpha\beta = 7/10$

Answer: (a) 7/10

Solution 2:

When parabola touches x-axis at exactly one point, it has 2 equal zeroes (repeated root).

So technically 2 zeroes but since they're equal, graph shows 1 point.

Answer: (c) 2

Solution 3:

For $3x^2 - kx + 6$: Sum = $k/3$

Given: $k/3 = 3$

$k = 9$

Answer: (c) 9

Solution 4:

Sum = 0, Product = -3

Polynomial = x^2 - (sum)x + product = $x^2 - 0 \cdot x + (-3) = x^2 - 3$

Answer: (a) $x^2 - 3$

Solution 5:

For $x^2 + 7x + 12$: $\alpha + \beta = -7$, $\alpha\beta = 12$

$1/\alpha + 1/\beta = (\alpha + \beta)/\alpha\beta = -7/12$

Answer: (a) -7/12

Solution 6:

Let zeroes be α and $1/\alpha$

Product = $\alpha \times 1/\alpha = 1 = k/2$

$k = 2$

Answer: (b) 2

Solution 7:

Zero polynomial is p(x) = 0 for all x

Its degree is not defined

Answer: (d) not defined

Solution 8:

For $kx^2 + 2x + 3k$: Sum = -2/k, Product = 3k/k = 3

Given: Sum = Product

-2/k = 3

k = -2/3

Answer: (d) -2/3

Solution 9:

Assertion is FALSE - when graph touches at one point, polynomial has 2 equal zeroes (counted as 2)

Reason is TRUE - polynomial of degree n can have at most n zeroes

Answer: (d) A is false but R is true

Solution 10:

$x^2 - 1$ is of form $ax^2 + bx + c$ where a = 1, b = 0, c = -1

Both A and R are true, and R correctly explains A

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

SECTION – B (SOLUTIONS)

Solution 11:

Zeroes: $\alpha = 2 + \sqrt{3}$, $\beta = 2 - \sqrt{3}$

Sum = $(2 + \sqrt{3}) + (2 - \sqrt{3}) = 4$

Product = $(2 + \sqrt{3})(2 - \sqrt{3}) = 4 - 3 = 1$

Polynomial = $x^2 - 4x + 1$

Solution 12:

For $x^2 - x - 2$: $\alpha + \beta = 1$, $\alpha\beta = -2$

$1/\alpha + 1/\beta = (\alpha + \beta)/\alpha\beta = 1/(-2) = -1/2$

$1/\alpha + 1/\beta - 2\alpha\beta = -1/2 - 2(-2) = -1/2 + 4 = 7/2$

Value = 7/2

Solution 13:

Let zeroes be α and 1/α

Product = 4k/(k + 4)

α × 1/α = 1 = 4k/(k + 4)

k + 4 = 4k

3k = 4

k = 4/3

k = 4/3

Solution 14:

$4u^2 + 8u = 0$

4u(u + 2) = 0

u = 0 or u = -2

Zeroes: 0 and -2

SECTION – C (SOLUTIONS)

Solution 15:

$6x^2 - 7x - 3 = 0$

$6x^2 - 9x + 2x - 3 = 0$

3x(2x - 3) + 1(2x - 3) = 0

(3x + 1)(2x - 3) = 0

x = -1/3 or x = 3/2

Verification:

Sum = -1/3 + 3/2 = 7/6 = -(-7)/6 ✓

Product = (-1/3)(3/2) = -1/2 = -3/6 ✓

Zeroes: -1/3 and 3/2

Solution 16:

For $x^2 - 6x + k$: α + β = 6, αβ = k

Given: 3α + 2β = 20 ...(1)

Also: α + β = 6 ...(2)

From (2): β = 6 - α

Substituting in (1): 3α + 2(6 - α) = 20

3α + 12 - 2α = 20

α = 8, β = -2

k = αβ = 8 × (-2) = -16

k = -16

Solution 17:

For $x^2 + 7x + 10$: $\alpha + \beta = -7$, $\alpha\beta = 10$

New zeroes: α/β and β/α

Sum = $\alpha/\beta + \beta/\alpha = (\alpha^2 + \beta^2)/\alpha\beta$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 49 - 20 = 29$

Sum = 29/10

Product = $(\alpha/\beta)(\beta/\alpha) = 1$

Polynomial = $x^2 - (29/10)x + 1$ or $10x^2 - 29x + 10$

SECTION – D (SOLUTIONS)

Solution 18(a):

For $2x^2 + 5x + k$: $\alpha + \beta = -5/2$, $\alpha\beta = k/2$

Given: $\alpha^2 + \beta^2 + \alpha\beta = 21/4$

$(\alpha + \beta)^2 - 2\alpha\beta + \alpha\beta = 21/4$

$(\alpha + \beta)^2 - \alpha\beta = 21/4$

$25/4 - k/2 = 21/4$

$k/2 = 1$

$k = 2$

k = 2

Solution 18(b):

$\alpha + \beta = -5/2$

$\alpha\beta = k/2 = 2/2 = 1$

$\alpha + \beta + 3\alpha\beta = -5/2 + 3(1) = -5/2 + 3 = 1/2$

Value = 1/2

SECTION – E (SOLUTIONS)

Solution 19(i):

$x^2 + 10x = 0$

$x(x + 10) = 0$

$x = 0$ or $x = -10$

Zeroes: 0 and -10

Solution 19(ii):

Sum of zeroes = 0 + (-10) = -10

Sum = -10

Solution 19(iii):

Breadth = x = 20 m

Length = x + 10 = 30 m

Area = $x^2 + 10x = 20^2 + 10(20) = 400 + 200 = 600\ m^2$

Area = 600 m^2

Solution 20(i):

$P(x) = -x^2 + 40x - 300$

Highest power of x is 2

Degree = 2

Solution 20(ii):

$-x^2 + 40x - 300 = 0$

$x^2 - 40x + 300 = 0$

$x^2 - 30x - 10x + 300 = 0$

$x(x - 30) - 10(x - 30) = 0$

$(x - 10)(x - 30) = 0$

$x = 10$ or $x = 30$

Zeroes: 10 and 30

Solution 20(iii):

The zeroes 10 and 30 represent break-even points where profit is zero.

Selling 10 or 30 cakes results in no profit (profit = ₹0)

Break-even points: 10 and 30 cakes