UNIQUE STUDY POINT

By Sumeet Sahu | Made with ❤ for Students

SAMPLE PAPER 01 - 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** each 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 one zero of the polynomial $p(x) = 3x^2 + 8x + 2k + 1$ is seven times the other, then the value of k is:

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

2. If α and β are the zeroes of the polynomial $f(x) = x^2 - 5x + k$ such that $\alpha - \beta = 1$, then the value of k is:

(a) 5 (b) 6 (c) 7 (d) 8

3. The zeroes of the quadratic polynomial $x^2 + 99x + 127$ are:

(a) both positive (b) both negative (c) one positive and one negative (d) both equal

4. A quadratic polynomial whose zeroes are 3 and -6 is:

(a) $x^2 - 3x - 18$ (b) $x^2 + 3x - 18$ (c) $x^2 - 3x + 18$ (d) $x^2 + 3x + 18$

5. If the sum of zeroes of the polynomial $p(x) = (k^2 - 14)x^2 - 2x - 12$ is 1, then the value of k is:

(a) ±4 (b) ±3 (c) ±2 (d) ±1

6. If α and β are the zeroes of the polynomial $2x^2 + 7x + 5$, then $\alpha + \beta + \alpha\beta$ equals:

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

7. If the product of zeroes of the polynomial $ax^2 - 6x - 6$ is 4, then the value of a is:

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

8. The degree of the polynomial $p(x) = (x + 1)(x^2 - x - x^4 + 1)$ is:

(a) 3 (b) 4 (c) 5 (d) 6

9. **Assertion (A):** If one zero of polynomial $3x^2 - 8x + 2k + 1$ is seven times the other, then k = 3/2.
Reason (R): 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 $p(x) = 3x^2 - 2$ is a quadratic polynomial.
Reason (R): A polynomial of degree 2 is called 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. If α and β are the zeroes of the polynomial $x^2 - 6x + k$, find the value of k such that $\alpha^2 + \beta^2 = 40$.

12. If one zero of the polynomial $p(x) = 5x^2 + 13x + k$ is reciprocal of the other, find the value of k.

13. Find a quadratic polynomial whose sum of zeroes is 8 and product of zeroes is 12.

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

SECTION - C

Questions 15 to 17 carry 3 marks each.

15. Find the zeroes of the quadratic polynomial $4x^2 - 4x - 3$ and verify the relationship between the zeroes and the coefficients.

16. If α and β are the zeroes of the polynomial $f(x) = x^2 - p(x + 1) - c$, show that $(\alpha + 1)(\beta + 1) = 1 - c$.

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

SECTION - D

Question 18 carries 5 marks.

18. If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - 3x - 2$, find a quadratic polynomial whose zeroes are:
(a) $2\alpha + 3$ and $2\beta + 3$ (3 marks)
(b) $\alpha - 1/\alpha$ and $\beta - 1/\beta$ (2 marks)

SECTION - E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. A sports goods company manufactures cricket bats. The cost function C(x) and revenue function R(x) for producing and selling x bats are given by:
$C(x) = x^2 + 4x + 10$
$R(x) = 3x^2 + 2x$
The profit function $P(x) = R(x) - C(x)$

(i) Find the profit polynomial P(x). (1 mark)

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

(iii) Find the zeroes of the profit polynomial and interpret them. (2 marks)

20. A garden is in the shape of a rectangle whose length is 4 m more than its width. The area of the garden is represented by the polynomial $x^2 + 4x$ square meters, where x is the width in meters.

(i) What are the dimensions (length and width) if $x = 6$ m? (1 mark)

(ii) Find the zeroes of the polynomial $x^2 + 4x$. (1 mark)

(iii) If α and β are zeroes of $x^2 + 4x + 3$, verify that $\alpha + \beta = -4$ and $\alpha\beta = 3$. (2 marks)

✓ DETAILED SOLUTIONS - SAMPLE PAPER 01

SECTION - A (SOLUTIONS)

Solution 1:

Let one zero be α, then other zero = 7α

For $p(x) = 3x^2 + 8x + 2k + 1$

Product of zeroes = c/a

$\alpha \times 7\alpha = (2k + 1)/3$

$7\alpha^2 = (2k + 1)/3$

Sum of zeroes = -b/a

$\alpha + 7\alpha = -8/3$

$8\alpha = -8/3$

$\alpha = -1/3$

Substituting in product equation:

$7(-1/3)^2 = (2k + 1)/3$

$7/9 = (2k + 1)/3$

$7/3 = 2k + 1$

$2k = 7/3 - 1 = 4/3$

$k = 2/3$

Answer: (a) 2/3

Solution 2:

For $f(x) = x^2 - 5x + k$

$\alpha + \beta = 5$ and $\alpha\beta = k$

Given: $\alpha - \beta = 1$

We know: $(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$

$1^2 = 5^2 - 4k$

$1 = 25 - 4k$

$4k = 24$

$k = 6$

Answer: (b) 6

Solution 3:

For $p(x) = x^2 + 99x + 127$

Sum of zeroes = -99 (negative)

Product of zeroes = 127 (positive)

When product is positive and sum is negative, both zeroes must be negative.

Answer: (b) both negative

Solution 4:

Given zeroes: $\alpha = 3$, $\beta = -6$

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

$= x^2 - (3 + (-6))x + (3)(-6)$

$= x^2 - (-3)x + (-18)$

$= x^2 + 3x - 18$

Answer: (b) $x^2 + 3x - 18$

Solution 5:

For $p(x) = (k^2 - 14)x^2 - 2x - 12$

Sum of zeroes = $-(-2)/(k^2 - 14) = 2/(k^2 - 14)$

Given: Sum = 1

$2/(k^2 - 14) = 1$

$2 = k^2 - 14$

$k^2 = 16$

$k = \pm 4$

Answer: (a) ±4

Solution 6:

For $2x^2 + 7x + 5$:

$\alpha + \beta = -7/2$

$\alpha\beta = 5/2$

$\alpha + \beta + \alpha\beta = -7/2 + 5/2 = -2/2 = -1$

Answer: (b) -1

Solution 7:

For $ax^2 - 6x - 6$:

Product of zeroes = $c/a = -6/a$

Given: Product = 4

$-6/a = 4$

$-6 = 4a$

$a = -6/4 = -3/2$

Answer: (a) -3/2

Solution 8:

$p(x) = (x + 1)(x^2 - x - x^4 + 1)$

$= (x + 1)(-x^4 + x^2 - x + 1)$

The highest power after multiplication will be $x \times (-x^4) = -x^5$

Degree = 5

Answer: (c) 5

Solution 9:

From Solution 1, we found k = 2/3, not 3/2

So Assertion (A) is FALSE

Reason (R) states the correct formulas for sum and product of zeroes, so R is TRUE

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

Solution 10:

$p(x) = 3x^2 - 2$ is indeed a polynomial of degree 2

A polynomial of degree 2 is called quadratic

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:

For $x^2 - 6x + k$:

$\alpha + \beta = 6$ and $\alpha\beta = k$

Given: $\alpha^2 + \beta^2 = 40$

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

$40 = 6^2 - 2k$

$40 = 36 - 2k$

$2k = -4$

$k = -2$

k = -2

Solution 12:

Let one zero be α, then other = $1/\alpha$

For $5x^2 + 13x + k$:

Product of zeroes = c/a

$\alpha \times 1/\alpha = k/5$

$1 = k/5$
$k = 5$

$k = 5$

Solution 13:

Given: Sum of zeroes = 8, Product of zeroes = 12

Quadratic polynomial = $k[x^2 - (sum)x + product]$

$= k[x^2 - 8x + 12]$
Taking $k = 1$:

$p(x) = x^2 - 8x + 12$

Solution 14:

For $x^2 - 2x - 15$:
$\alpha + \beta = 2$ and $\alpha\beta = -15$
$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
$= 2^2 - 2(-15)$
$= 4 + 30 = 34$

$\alpha^2 + \beta^2 = 34$

SECTION - C (SOLUTIONS)

Solution 15:

$4x^2 - 4x - 3 = 0$
$4x^2 - 6x + 2x - 3 = 0$
$2x(2x - 3) + 1(2x - 3) = 0$
$(2x + 1)(2x - 3) = 0$
$x = -1/2$ or $x = 3/2$

Verification:
Sum of zeroes = $-1/2 + 3/2 = 1 = -(-4)/4 = -b/a$ ✓
Product of zeroes = $(-1/2)(3/2) = -3/4 = c/a$ ✓

Zeroes are -1/2 and 3/2

Solution 16:

$f(x) = x^2 - p(x + 1) - c$
$= x^2 - px - p - c$
For this polynomial:
$\alpha + \beta = p$
$\alpha\beta = -p - c$

$(\alpha + 1)(\beta + 1) = \alpha\beta + \alpha + \beta + 1$

$= (-p - c) + p + 1$

$= 1 - c$

Hence proved: $(\alpha + 1)(\beta + 1) = 1 - c$

Solution 17:

Let one zero be α, then other = $1/\alpha$

For $(a^2 + 9)x^2 + 13x + 6a$:

Product of zeroes = $6a/(a^2 + 9)$

$\alpha \times 1/\alpha = 6a/(a^2 + 9)$

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

$a^2 + 9 = 6a$

$a^2 - 6a + 9 = 0$

$(a - 3)^2 = 0$

$a = 3$

$a = 3$

SECTION – D (SOLUTIONS)

Solution 18(a):

For $f(x) = x^2 - 3x - 2$:

$\alpha + \beta = 3$ and $\alpha\beta = -2$

New zeroes: $2\alpha + 3$ and $2\beta + 3$

Sum = $(2\alpha + 3) + (2\beta + 3) = 2(\alpha + \beta) + 6 = 2(3) + 6 = 12$

Product = $(2\alpha + 3)(2\beta + 3) = 4\alpha\beta + 6\alpha + 6\beta + 9$

$= 4\alpha\beta + 6(\alpha + \beta) + 9 = 4(-2) + 6(3) + 9 = -8 + 18 + 9 = 19$

Required polynomial = $x^2 - 12x + 19$

Solution 18(b):

New zeroes: $\alpha - 1/\alpha$ and $\beta - 1/\beta$

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

$= (\alpha + \beta) - (\alpha + \beta)/\alpha\beta = 3 - 3/(-2) = 3 + 3/2 = 9/2$

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

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

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 9 - 2(-2) = 13$

$= -2 - 13/(-2) + 1/(-2) = -2 + 13/2 - 1/2 = -2 + 6 = 4$

Required polynomial = $x^2 - (9/2)x + 4$ or $2x^2 - 9x + 8$

SECTION - E (SOLUTIONS)

Solution 19(i):

$P(x) = R(x) - C(x)$

$= (3x^2 + 2x) - (x^2 + 4x + 10)$

$= 3x^2 + 2x - x^2 - 4x - 10$

$= 2x^2 - 2x - 10$

$P(x) = 2x^2 - 2x - 10$

Solution 19(ii):

The highest power of x in $2x^2 - 2x - 10$ is 2

Degree = 2

Solution 19(iii):

$2x^2 - 2x - 10 = 0$

$x^2 - x - 5 = 0$

Using quadratic formula:

$x = [1 \pm \sqrt{(1 + 20)}]/2 = [1 \pm \sqrt{21}]/2$

$x = (1 + \sqrt{21})/2 \approx 2.79$ or $x = (1 - \sqrt{21})/2 \approx -1.79$

Interpretation: The company breaks even (zero profit) when producing approximately 2.79 bats. The negative value is not meaningful in this context.

Zeroes: $(1 + \sqrt{21})/2$ and $(1 - \sqrt{21})/2$

Solution 20(i):

Width = x = 6 m

Length = x + 4 = 6 + 4 = 10 m

Dimensions: Length = 10 m, Width = 6 m

Solution 20(ii):

$x^2 + 4x = 0$

$x(x + 4) = 0$

$x = 0$ or $x = -4$

Zeroes are 0 and -4

Solution 20(iii):

For $x^2 + 4x + 3$:

$x^2 + 4x + 3 = 0$

$(x + 1)(x + 3) = 0$

$x = -1$ or $x = -3$

So $\alpha = -1$, $\beta = -3$

Verification:

$\alpha + \beta = -1 + (-3) = -4$ ✓

$\alpha\beta = (-1)(-3) = 3$ ✓

Verified: $\alpha + \beta = -4$ and $\alpha\beta = 3$