CBSE Class 10 Mathematics — Chapter 2: Polynomials PYQs

Dedicated Chapter Question Bank (2020-2026)

Bifurcated by Standard (041) & Basic (241) Curriculums

Part A: Standard Mathematics (041) Question Bank

Question 1 [2025 Exam] (1 Mark - MCQ)

If α and β are the zeroes of the polynomial $p(x) = x^2 - ax - b$, then the value of $(\alpha + \beta + \alpha\beta)$ equals:

(A) a + b (B) -a - b (C) a - b (D) -a + b

> [Marking Scheme] Correct identification of sum and product: 0.5 Mark | Correct evaluation: 0.5 Mark.

Answer: Given, $p(x) = x^2 - ax - b$

Compare with standard quadratic form, $ax^2 + bx + c$

So, a=1; b=-a; c= -b

We know,

$(\alpha + \beta) = \frac{-b}{a} = \frac{-(-a)}{1} = a$

$(\alpha\beta) = \frac{c}{a} = \frac{-b}{1} = -b$

Sum $(\alpha + \beta) = a$

Product $(\alpha\beta) = -b$

Therefore, $\alpha + \beta + \alpha\beta = a + (-b) = a - b$

Hence, the correct **option is (C).**

Question 2 [2024 Exam] (3 Marks - Short Answer)

If α and β are the zeroes of the quadratic polynomial $f(x) = 3x^2 - 4x + 1$, find a quadratic polynomial whose zeroes are $\frac{\alpha^2}{\beta}$ and $\frac{\beta^2}{\alpha}$

[Marking Scheme] Finding base properties (α+β, αβ): 1 Mark | Calculating new sum and product of fractional roots: 1 Mark | Framing the final integer polynomial: 1 Mark.

Answer: $f(x)= 3x^2 - 4x + 1$ compare with $ax^2 + bx + c$;

Here, a= 3, b= -4, c=1

$\alpha + \beta = \frac{-b}{a} = \frac{4}{3}$ and $\alpha\beta = \frac{c}{a} = \frac{1}{3}$

New Sum (S) $= \frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha} = \frac{\alpha^3 + \beta^3}{\alpha\beta}$

$= \frac{(\alpha + \beta)\,[(\alpha + \beta)^2 - 3\alpha\beta]}{(\alpha\beta)}$ .... (using formula for $\alpha^3 + \beta^3$)

$S = \frac{\frac{4}{3}[\frac{16}{9} - 3(\frac{1}{3})]}{(\frac{1}{3})} = 4 \times [\frac{16-9}{9}] = \frac{28}{9}$.

New Product (P) $= \frac{\alpha^2}{\beta} \times \frac{\beta^2}{\alpha} = \alpha\beta = 1/3$.

Required Polynomial: $x^2 - Sx + P = x^2 - (\frac{28}{9})x + \frac{1}{3}$.

Clearing fractions: $9x^2 - 28x + 3$.

Question 3 [2023 Exam] (2 Marks - Short Answer)

Find the value of k if the sum of the zeroes of the polynomial

$x^2 - (k + 6)x + 2(2k - 1)$ is equal to half of their product.

[Marking Scheme] Expressing sum and product expressions: 1 Mark | Setting up the equation and solving for k: 1 Mark.

Answer: $f(x)= x^2 - (k + 6)x + 2(2k - 1)$ compare with $ax^2 + bx + c$;

Here, a= 1, b= - (k + 6), c=2(2k - 1)

$\alpha + \beta = \frac{-b}{a}$ = (k + 6) and $\alpha\beta = \frac{c}{a}$ = 2(2k - 1)

Here, Sum ($\alpha + \beta$) = k + 6, and Product ($\alpha\beta$) = 2(2k - 1).

Given condition: Sum = $\frac{1}{2}$ × Product

k + 6 = $\frac{1}{2}$ × [2(2k - 1)]

k + 6 = 2k - 1

6 + 1 = 2k - k

k = 7.

Question 4 [2022 Exam] (3 Marks - Short Answer)

If α and β are the zeroes of the quadratic polynomial p(x) = $2x^2 + 5x + k$ such that $\alpha^2 + \beta^2 + \alpha\beta = \frac{21}{4}$, then find the value of k.

> [Marking Scheme] Expressing expression as $(\alpha+\beta)^2 - \alpha\beta$: 1 Mark | Substituting sum and product values: 1 Mark | Solving for k: 1 Mark.

Answer: f(x)= $2x^2 + 5x + k$ compare with $ax^2 + bx + c$;

Here, a= 2, b= 5, c=k

$\alpha + \beta = \frac{-b}{a} = \frac{-5}{2}$ and $\alpha\beta = \frac{c}{a} = \frac{k}{2}$

Here, $\alpha + \beta = \frac{-5}{2}$ and $\alpha\beta = \frac{k}{2}$.

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

Therefore, $(\frac{-5}{2})^2 - \frac{k}{2} = \frac{21}{4}$

$\frac{25}{4} - \frac{k}{2} = \frac{21}{4}$

$\frac{25}{4} - \frac{21}{4} = \frac{k}{2}$

$\frac{4}{4} = \frac{k}{2}$

$1 = \frac{k}{2}$; here, k = 2

Question 5 [2020 Exam] (3 Marks - Proof)
If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - p(x + 1) - c$, show that $(\alpha + 1)(\beta + 1) = 1 - c$.

> [Marking Scheme] Rearranging polynomial to standard form: 1 Mark | Expanding target algebraic layout: 1 Mark | Substituting values to prove: 1 Mark.

Answer: Rearrange f(x) into standard form $ax^2 + bx + c$;
$f(x) = x^2 - px - p - c$

$= x^2 - px - (p + c)$

Here a= 1 , b= -p, c= -(p+c)
Thus, $\alpha + \beta = \frac{-b}{a} = p$ and $\alpha\beta = \frac{c}{a} = -(p + c)$.

Expand LHS: $(\alpha + 1)(\beta + 1) = \alpha\beta + \alpha + \beta + 1$
Substitute values: $-(p + c) + p + 1$

$= -p - c + p + 1$

$= 1 - c$ = RHS. Hence Proved.

Question 6 [2025 Exam] (3 Marks - Short Answer)
If the zeroes of the quadratic polynomial $x^2 - px + q$ are two consecutive integers, prove that $p^2 - 4q = 1$.

> [Marking Scheme] Assuming roots as α and α+1: 1 Mark | Setting sum and product expressions: 1 Mark | Evaluating $p^2 - 4q$ to complete proof: 1 Mark.

Answer: Let the zeroes be α and α + 1……(consecutive integers)

Compare $x^2 - px + q$ with $ax^2 + bx + c$

Here, a= 1, b= -p, c= q

Sum of zeros = $\frac{-b}{a}$ =p and product of zeros = $\frac{c}{a}$ = q

Sum of zeroes: $\alpha + (\alpha + 1) = p$

$2\alpha + 1 = p$……………(A)

Product of zeroes: $\alpha(\alpha + 1) = q$

$\alpha^2 + \alpha = q$…………(B)

Substitute values of p and q into LHS

$p^2 - 4q = (2\alpha + 1)^2 - 4(\alpha^2 + \alpha)$

$= 4\alpha^2 + 4\alpha + 1 - 4\alpha^2 - 4\alpha$ ………(using formula $(a=b)^2$)

$= 1$ = RHS. Hence Proved.

Question 7 [2024 Exam] (2 Marks - Short Answer)

If α and β are zeroes of the polynomial $p(x) = 2x^2 - 7x + 3$, find the value of $\alpha^2\beta + \alpha\beta^2$.

[Marking Scheme] Finding sum and product coefficients: 1 Mark | Factoring and evaluating expression: 1 Mark.

Answer: From $p(x) = 2x^2 - 7x + 3$ comparing with $ax^2 + bx + c$

Here, a=2, b=-7, c=3

Sum $(\alpha + \beta) = \frac{-b}{a} = \frac{7}{2}$, Product $(\alpha\beta) = \frac{c}{a} = \frac{3}{2}$.

We expand the expression: $\alpha^2\beta + \alpha\beta^2 = \alpha\beta(\alpha + \beta)$.

Substituting the values: $\frac{3}{2} \times \frac{7}{2} = \frac{21}{4}$.

Question 8 [2023 Exam] (3 Marks - Short Answer)
If α and β are the zeroes of the quadratic polynomial $x^2 - 5x + k$ such that $\alpha - \beta = 1$, find the value of k.

> [Marking Scheme] Stating sum relationship: 1 Mark | Solving equations for individual roots: 1 Mark | Finding k using product property: 1 Mark.

Answer: $p(x) = x^2 - 5x + k$ comparing with $ax^2 + bx + c$

Here, a=1, b=-5, c=k

Sum $(\alpha + \beta) = \frac{-b}{a} = 5$, Product $(\alpha\beta) = \frac{c}{a} = k$
We know $\alpha + \beta = 5$ and we are given $\alpha - \beta = 1$.
Adding the equations: $(\alpha + \beta) + (\alpha - \beta) = 5 + 1$

$$2\alpha = 6$$

$$\alpha = 3.$$

Substituting $\alpha = 3$ into $\alpha + \beta = 5$ gives $\beta = 2$.
Since $\alpha\beta = k$, we have $k = 3 \times 2 = 6$.

Question 9 [2021 Exam] (2 Marks - Short Answer)
If one zero of the quadratic polynomial $f(x) = 4x^2 - 8kx - 9$ is negative of the other, find the value of k.

> [Marking Scheme] Expressing roots relation as α and -α: 1 Mark | Using the sum formula to isolate k: 1 Mark.

Answer: Let one zero be α, then the other zero is -α.
Sum of zeroes = $\alpha + (-\alpha) = 0$.
Using polynomial coefficients, Sum of zeros=$\frac{-b}{a}$

$$= \frac{8k}{4} = 2k$$...[after comparing with f(x)]

Therefore, $2k = 0 \Rightarrow k = 0$.

Part B: Basic Mathematics (241) Question Bank

Question 10 [2024 Exam] (2 Marks - Short Answer)

If α and β are the zeroes of the polynomial $x^2 - 7x + 12$, find the value of $\frac{1}{\alpha} + \frac{1}{\beta}$.

> [Marking Scheme] Stating sum and product values: 1 Mark | Evaluating fraction algebraic expression: 1 Mark.

Answer: For the given polynomial,

$p(x) = x^2 - 7x + 12$ comparing with $ax^2 + bx + c$

Here, a=1, b=-7, c=12

Sum $(\alpha + \beta) = \frac{-b}{a} = 7$, Product $(\alpha\beta) = \frac{c}{a} = 12$

Sum $(\alpha + \beta) = 7$, Product $(\alpha\beta) = 12$.

Expression: $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{(\alpha + \beta)}{(\alpha\beta)}$.

Substituting the values gives $\frac{7}{12}$.

Question 11 [2025 Exam] (2 Marks - Short Answer)

Find the quadratic polynomial whose sum and product of zeroes are $\frac{1}{4}$ and -1 respectively.

> [Marking Scheme] Identifying polynomial structure: 1 Mark | Writing standard integer form layout: 1 Mark.

Answer: Standard form of a polynomial is $[x^2 - (\text{Sum})x + \text{Product}]$.

Substituting values: $x^2 - (\frac{1}{4})x + (-1) = x^2 - \frac{x}{4} - 1$.

Multiplying by 4 to get integer coefficients: $4x^2 - x - 4$.

Required quadratic equation is, $4x^2 - x - 4$.

Question 12 [2024 Exam] (2 Marks - Short Answer)
Find the condition that the zeroes of the polynomial $ax^2 + bx + c$ are reciprocal of each other.

[Marking Scheme] Denoting roots as α and 1/α: 1 Mark | Equating product formula to 1 and showing c = a: 1 Mark.

Answer: Let the zeroes be α and $\frac{1}{\alpha}$.
Product of zeroes = $\alpha \times (\frac{1}{\alpha}) = 1$…………(A)
From the polynomial form, Product = $\frac{c}{\alpha}$…….(B)
Therefore, $\frac{c}{\alpha} = 1$ ……..(From A and B)

c = a. The condition is that constant term equals the coefficient of x^2.

Question 13 [2022 Exam] (1 Mark - MCQ)
If a zero of the quadratic polynomial $x^2 - 3x + k$ is 5, then the value of k is:
(A) -10 (B) 10 (C) 2 (D) -2

[Marking Scheme] Substituting value 5 directly into equation to solve: 1 Mark.

Answer: Since 5 is a zero of the quadratic equation,

substituting x = 5 satisfies the polynomial:
$(5)^2 - 3(5) + k = 0$
$25 - 15 + k = 0$
$10 + k = 0$

k = -10.
Hence, the correct option is (A).

Question 14 [2020 Exam] (2 Marks - Short Answer)
Find a quadratic polynomial whose zeroes are 0 and $\sqrt{5}$.

> [Marking Scheme] Calculating sum and product properties: 1 Mark | Writing down final polynomial format: 1 Mark.

Answer: Sum of zeroes (S) = $0 + \sqrt{5} = \sqrt{5}$.
Product of zeroes (P) = $0 \times \sqrt{5} = 0$.
Required polynomial layout: $x^2 - Sx + P$

$$= x^2 - \sqrt{5}x + 0$$

$$= x^2 - \sqrt{5}x.$$

Question 15 [2023 Exam] (1 Mark - Objective)
Find the number of zeroes for a quadratic polynomial whose graph touches the x-axis at exactly one point.

> [Marking Scheme] Identifying graphical intersection meaning: 1 Mark.

Answer: The number of zeroes of a polynomial is equal to the number of points where its graph intersects or touches the x-axis. Since it touches at exactly one point, it has 1 unique real zero. (with a multiplicity of 2, meaning equal roots).
