ANSWER KEY & MARKING SCHEME · CBSE CLASS 10

Polynomials

Mathematics · Chapter 2 · Use this with the Board Paper · Companion to Quick Drill

HOW TO USE

Attempt the Board Paper first (closed-book, full time). Then come here. For 2-mark+ questions, compare your answer to the model. For 3-4 mark questions, also consult the **Topper Templates** below — these show the exact step-by-step structure that scores full marks per CBSE marking-scheme conventions.

MODEL ANSWERS · BOARD PAPER

Section A — MCQs (1 mark each)

Q1. Degree of the polynomial $7x^4 - 3x^2 + 2$ is: [1 mark]

Ans: 4 (highest power of x with non-zero coefficient).

Q2. Sum of zeroes of $x^2 - 9x + 20$ is: [1 mark]

Ans: 9 ($-b/a = -(-9)/1 = 9$).

Q3. Product of zeroes of $2x^2 + 7x - 15$ is: [1 mark]

Ans: $-15/2$ ($c/a = -15/2$).

Q4. Number of real zeroes a quadratic polynomial can have is at most: [1 mark]

Ans: 2.

Q5. If the graph of p(x) does not cut the x-axis, the number of real zeroes is: [1 mark]

Ans: 0.

Q6. A polynomial with zeroes 1 and −1 (leading coefficient 1) is: [1 mark]

Ans: $x^2 - 1$ (sum 0, product −1).

Section B — Short Answer I (2 marks each)

Q7. Find a quadratic polynomial whose zeroes are 3 and −2. Verify the sum and product. [2 marks]

Ans: Sum = 1, Product = −6 ⇒ $p(x) = x^2 - x - 6$. Verify: zeroes of $x^2 - x - 6$ are obtained from $(x - 3)(x + 2)$; sum $3 + (-2) = 1$ ✓; product $3 \cdot (-2) = -6$ ✓.

Q8. If α, β are zeroes of $x^2 - 5x + 6$, find $\alpha^2 + \beta^2$. [2 marks]

Ans: $\alpha + \beta = 5$, $\alpha\beta = 6$. $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta = 25 - 12 = 13$.

Q9. Find the sum and product of zeroes of $4x^2 - 4x + 1$. [2 marks]

Ans: Sum = $-b/a = -(-4)/4 = 1$. Product = $c/a = 1/4$.

Q10. Find the zeroes of the polynomial $x^2 - 2x - 8$. [2 marks]

Ans: $x^2 - 2x - 8 = (x - 4)(x + 2)$; zeroes 4 and −2.

Section C — Short Answer II (3 marks each)

Q11. Find the zeroes of $6x^2 - 7x - 3$ and verify the relationship between zeroes and coefficients. [3 marks]

Ans: Splitting middle term: $6x^2 - 7x - 3 = (3x + 1)(2x - 3)$. Zeroes: $-1/3$ and $3/2$. a=6, b=−7, c=−3. Sum = $(-1/3) + (3/2) = 7/6 = -(-7)/6 = -b/a$ ✓. Product = $(-1/3)(3/2) = -1/2 = -3/6 = c/a$ ✓.

Q12. If α and β are zeroes of $x^2 - 6x + a$ and $3\alpha + 2\beta = 20$, find a. [3 marks]

Ans: $\alpha + \beta = 6 \Rightarrow \beta = 6 - \alpha$. Substitute: $3\alpha + 2(6 - \alpha) = 20 \Rightarrow \alpha + 12 = 20 \Rightarrow \alpha = 8$, $\beta = -2$. Then $a = \alpha\beta = 8 \times (-2) = -16$.

Q13. Find the values of α, β, γ if α, β, γ are zeroes of $2x^3 - 5x^2 - 14x + 8$ and find $\alpha + \beta + \gamma$, $\alpha\beta\gamma$. [3 marks]

Ans: a=2, b=−5, c=−14, d=8. $\alpha + \beta + \gamma = -b/a = 5/2$. $\alpha\beta\gamma = -d/a = -8/2 = -4$. (Sum of products $\alpha\beta + \beta\gamma + \gamma\alpha = c/a = -14/2 = -7$.)

Section D — Long Answer (5 marks)

Q14. (a) If one zero of the polynomial $(a^2 + 9)x^2 + 13x + 6a$ is the reciprocal of the other, find a. [3] (b) Form a quadratic polynomial whose zeroes are $5 + \sqrt{2}$ and $5 - \sqrt{2}$. [4] [7 marks]

Ans: (a) Reciprocal zeroes $\Rightarrow \alpha\beta = 1$. From polynomial: $c/a = 6a/(a^2 + 9) = 1 \Rightarrow 6a = a^2 + 9 \Rightarrow a^2 - 6a + 9 = 0 \Rightarrow (a - 3)^2 = 0 \Rightarrow a = 3$. (b) Sum $= (5 + \sqrt{2}) + (5 - \sqrt{2}) = 10$. Product $= (5 + \sqrt{2})(5 - \sqrt{2}) = 25 - 2 = 23$. Polynomial $= k[x^2 - 10x + 23]$. Taking $k = 1$: $x^2 - 10x + 23$.

★ TOPPER ANSWER TEMPLATES

5 TEMPLATES · MEMORISE THE FORMAT

★ TOPPER TEMPLATE —

Step State a, b, c **[0.5 mark]**	Comparing with $ax^2 + bx + c$: $a = 1$, $b = -5$, $c = 6$.
Step Find zeroes by factorisation **[1 mark]**	$x^2 - 5x + 6 = (x - 2)(x - 3) = 0 \Rightarrow \alpha = 2, \beta = 3$.
Step Verify sum **[0.75 mark]**	$\alpha + \beta = 2 + 3 = 5$. From coefficients: $-b/a = -(-5)/1 = 5$. ✓
Step Verify product **[0.75 mark]**	$\alpha\beta = 2 \times 3 = 6$. From coefficients: $c/a = 6/1 = 6$. ✓

COMMON LOSS OF MARKS:

- Forgetting the minus sign in $-b/a$
- Not stating a, b, c at the start
- Skipping the explicit 'verified' tick line — examiner needs to see the comparison

★ TOPPER TEMPLATE —

Step Write the standard form **[0.5 mark]**	Required polynomial $= k[x^2 - (\text{sum})x + \text{product}]$, where k is any non-zero real.
Step Substitute **[1 mark]**	$= k[x^2 - (-3)x + 2] = k(x^2 + 3x + 2)$.
Step Choose k **[0.5 mark]**	Taking $k = 1$, the polynomial is $x^2 + 3x + 2$.

COMMON LOSS OF MARKS:

- Writing $-(-3)$ as -3 (sign slip)
- Not mentioning k or claiming the answer is unique

★ TOPPER TEMPLATE —

Step Split the middle term [0.75 mark]	$6x^2 - 7x - 3$. Need two numbers whose product = $6 \times (-3) = -18$ and sum = -7: numbers -9 and $+2$.
Step Factorise [0.75 mark]	$= 6x^2 - 9x + 2x - 3 = 3x(2x - 3) + 1(2x - 3) = (3x + 1)(2x - 3)$.
Step Read zeroes [0.5 mark]	Zeroes: $3x + 1 = 0 \Rightarrow x = -1/3$; $2x - 3 = 0 \Rightarrow x = 3/2$.
Step Verify [1 mark]	Sum $= -1/3 + 3/2 = (-2 + 9)/6 = 7/6 = -(-7)/6 = -b/a$. ✓ Product $= (-1/3)(3/2) = -1/2 = -3/6 = c/a$. ✓

COMMON LOSS OF MARKS:

- Splitting middle term wrong (sign confusion)
- Verification half-done — only sum, not product
- Arithmetic in fractions

★ TOPPER TEMPLATE —

Step Set up reciprocal condition [1 mark]	If zeroes are α and $1/\alpha$, then product $\alpha\beta = \alpha \cdot (1/\alpha) = 1$.
Step Apply product formula [1 mark]	From the polynomial: product $= c/a = 6a / (a^2 + 9)$. Set equal to 1.
Step Solve quadratic in a [1 mark]	$6a = a^2 + 9 \Rightarrow a^2 - 6a + 9 = 0 \Rightarrow (a - 3)^2 = 0 \Rightarrow a = 3$.

COMMON LOSS OF MARKS:

- Not stating $\alpha\beta = 1$ as the trigger
- Algebra error in the quadratic in a
- Stopping at $6a = a^2 + 9$ without solving

★ TOPPER TEMPLATE —

Step Identify a, b, c, d [0.5 mark]	Standard form $ax^3 + bx^2 + cx + d$: a = 2, b = −5, c = −14, d = 8.
Step Sum of zeroes [0.75 mark]	$\alpha + \beta + \gamma = -b/a = -(-5)/2 = 5/2$.
Step Sum of products taken two at a time [0.75 mark]	$\alpha\beta + \beta\gamma + \gamma\alpha = c/a = -14/2 = -7$.
Step Product of zeroes [1 mark]	$\alpha\beta\gamma = -d/a = -8/2 = -4$.

COMMON LOSS OF MARKS:

- Sign slip on b or d (most common loss)
- Confusing 'sum of products taken 2 at a time' with 'sum of zeroes'
- Writing −d/a as d/a

MARKING SCHEME — GENERAL NOTES

- Section A: 1 mark for correct option only — no part marks.
- Section B: Award 1 mark for correct method (writing sum/product formulas, attempting factorisation) and 1 mark for correct final answer with verification or explicit values of zeroes.
- Section C: 1 mark for setting up (a, b, c identification or condition translation), 1 mark for correct algebraic work, 1 mark for correct final answer with verification step.
- Section D: For 3-mark part — 1 mark for stating $\alpha\beta = 1$ (reciprocal condition), 1 mark for substituting product formula, 1 mark for solving and writing a = 3. For 4-mark part — 1 mark for sum, 1 mark for product (recognising conjugate-pair multiplication), 1 mark for writing standard form, 1 mark for final polynomial.
- Deduct 0.5 mark per sign error in −b/a (a common loss across all sections).
- If a student writes a different but mathematically equivalent polynomial in 'form a polynomial' questions (e.g., $2x^2 - 2x - 12$ instead of $x^2 - x - 6$), award full marks provided k is mentioned or implied.