Affiliated to CBSE, New Delhi (Affiliation No. 1030642)

GNPS

GOMTI NANDAN PUBLIC SCHOOL

Gandhi Ward, Bina (M.P.) 470113. | 9165 609 333. | info@mygnps.com | www.mygnps.com

CLASS X · MATHEMATICS STANDARD (041) · CBSE BOARD EXAMINATION 2027

CHAPTER 2

Polynomials

Chapter Practice Booklet · Questions only · Answers in the separate Answer Booklet

65 practice questions | 4 case studies | Board question index | Original diagrams

INSIDE THIS BOOKLET

1	**Chapter Notes** Zeroes, graphs, relationship with coefficients, model answers + exam snapshot	2
A	**NCERT Practice** 16 questions	6
B	**Exemplar Practice** 12 questions	7
C	**Board Pattern Practice** 31 questions, with frequency stars	8
D	**Case-Based Questions** 4 case studies	11
E	**Challenge Questions** 6 questions for 95+	13
F	**Board PYQ Index** Real board questions by type	14
G	**My Mistakes** Your error log	15

STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

BOOKLET STARTED ON _____

CHAPTER TEST SCORE _____ / 20

1

READ THIS FIRST

Chapter Notes

The whole chapter in short-note form: every definition, formula, method and model answer. Revise from here – you should not need the textbook again.

1 Words you must know

- **Polynomial in x:** a sum of terms $a\,x^n$ where n is a whole number (0, 1, 2, …). $3x^2 - 5x + \frac{1}{2}$ is a polynomial; $\frac{1}{x}$, $\sqrt{x}$, x^{-2} are **not**.
- **Degree:** the highest power of x. Degree 1 = **linear**, 2 = **quadratic**, 3 = **cubic**.

Linear	$ax + b,\ a \neq 0$
Quadratic	$ax^2 + bx + c,\ a \neq 0$
Cubic	$ax^3 + bx^2 + cx + d,\ a \neq 0$

In $ax^2 + bx + c$: a = coefficient of x^2, b = coefficient of x, c = constant term. Write the polynomial in this order before reading a, b, c.

2 Value and zero of a polynomial

- **Value** of $p(x)$ at $x = k$: put k in place of x. For $p(x) = x^2 - 3x - 4$: $p(2) = 4 - 6 - 4 = -6$.
- k is a **zero** of $p(x)$ if $p(k) = 0$. Here $p(4) = 16 - 12 - 4 = 0$, so 4 is a zero.

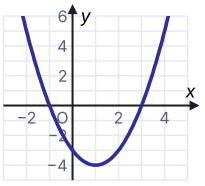
> Zero of the linear polynomial $ax + b$ is $x = -\dfrac{b}{a} = \dfrac{-\text{constant}}{\text{coefficient of } x}$

- A polynomial of degree n has **at most** n zeroes: linear 1, quadratic at most 2, cubic at most 3.
- If k is a zero, then $(x - k)$ is a **factor**. Factor $(x - 5)$ ↔ zero 5; factor $(2x + 1)$ ↔ zero $-\frac{1}{2}$.

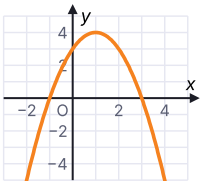
3 Geometrical meaning of zeroes

> The zeroes of $p(x)$ are the **x-coordinates of the points where the graph of $y = p(x)$ meets the x-axis**.

- Linear $y = ax + b$: a straight line, meets the x-axis once → exactly 1 zero.
- Quadratic $y = ax^2 + bx + c$: a curve called a **parabola**. It opens **up** if $a > 0$ and **down** if $a < 0$.



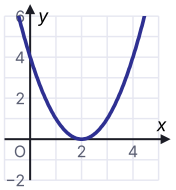
a > 0, two zeroes



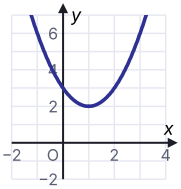
a < 0, opens down

For $y = x^2 - 2x - 3$ (left) the curve meets the x-axis at -1 and 3: these are its zeroes.

4 How many zeroes? Read the graph



one zero (touches)



no zero

- A parabola can meet the x-axis at **2** points, **touch** it at **1** point, or **not meet** it → 0 zeroes.
- A cubic graph meets the x-axis at 1, 2 or 3 points.
- **Count only points on the x-axis.** The point where the graph cuts the y-axis is $(0, c)$: it is **not** a zero.
- "Number of zeroes" = number of **distinct** points where the graph meets the x-axis.

5 Finding zeroes: splitting the middle term

1. Write $p(x)$ as $ax^2 + bx + c$. Find the product ac.
2. Find two numbers whose **product is** ac and **sum is** b.
3. Split bx, group in pairs, take out the common factor.
4. Put each factor $= 0$ to get the zeroes.

EXAMPLE

$6x^2 - 7x - 3$: $ac = -18$; numbers -9 and 2.
$6x^2 - 9x + 2x - 3 = 3x(2x - 3) + 1(2x - 3) = (2x - 3)(3x + 1)$
Zeroes: $\frac{3}{2}$ and $-\frac{1}{3}$.

$x^2 - k$ **(no x term)**	$x = \pm\sqrt{k}$, e.g. $x^2 - 18 \to \pm 3\sqrt{2}$
$ax^2 + bx$ **(no constant)**	$x(ax + b) \to 0$ and $-\frac{b}{a}$
Fractions in $p(x)$	multiply by the LCM first; the zeroes do not change

6 Relationship between zeroes and coefficients

If α, β are the zeroes of $ax^2 + bx + c$:

$$\alpha + \beta = -\frac{b}{a} = \frac{-\text{coefficient of } x}{\text{coefficient of } x^2}$$

$$\alpha\beta = \frac{c}{a} = \frac{\text{constant term}}{\text{coefficient of } x^2}$$

VERIFY

$2x^2 - 8x + 6 = 2(x - 1)(x - 3)$: zeroes 1 and 3.
Sum $= 4$ and $-\frac{b}{a} = -\frac{-8}{2} = 4$ ✓ Product $= 3$ and $\frac{c}{a} = \frac{6}{2} = 3$ ✓

Sign trap: the sum has a minus sign, the product does not. Read b and c **with their signs**.

7 Forming a quadratic polynomial

A quadratic polynomial with sum of zeroes S and product P:
$p(x) = k\left[x^2 - Sx + P\right]$, k any non-zero number (take $k = 1$ or the LCM).

EXAMPLE

$S = -\frac{1}{4}$, $P = \frac{1}{4}$: $x^2 + \frac{1}{4}x + \frac{1}{4}$; multiply by $4 \to 4x^2 + x + 1$.

FROM THE ZEROES

Zeroes 3 and -5: $S = -2$, $P = -15 \to x^2 + 2x - 15$.

Infinitely many polynomials have the same zeroes: $x^2 + 2x - 15$ and $2x^2 + 4x - 30$ both have zeroes 3 and –5.

8 Expressions in α and β (no need to find α, β)

$\alpha^2 + \beta^2$	$(\alpha + \beta)^2 - 2\alpha\beta$
$(\alpha - \beta)^2$	$(\alpha + \beta)^2 - 4\alpha\beta$
$\frac{1}{\alpha} + \frac{1}{\beta}$	$\frac{\alpha + \beta}{\alpha\beta}$
$\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$	$\frac{\alpha^2 + \beta^2}{\alpha\beta}$
$\frac{1}{\alpha^2} + \frac{1}{\beta^2}$	$\frac{\alpha^2 + \beta^2}{(\alpha\beta)^2}$
$\alpha^2\beta + \alpha\beta^2$	$\alpha\beta(\alpha + \beta)$
$\alpha^3 + \beta^3$	$(\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$
$\left(\alpha + \frac{1}{\beta}\right)\left(\beta + \frac{1}{\alpha}\right)$	$\alpha\beta + 2 + \frac{1}{\alpha\beta}$

EXAMPLE

$x^2 - 5x + 3$: $\alpha + \beta = 5$, $\alpha\beta = 3$. $\alpha^2 + \beta^2 = 25 - 6 = 19$.

9 Finding an unknown coefficient (k)

One zero r is given	put $x = r$: $p(r) = 0$, solve for k
Sum or product is given	equate it to $-\frac{b}{a}$ or $\frac{c}{a}$
Zeroes are reciprocals ($\alpha\beta = 1$)	$c = a$
Zeroes equal and opposite ($\alpha + \beta = 0$)	$b = 0$
One zero is 0	$c = 0$
One zero is m times the other	take zeroes α, $m\alpha$; use sum to find α, then product

EXAMPLE

One zero of $x^2 + 3x + k$ is 2: $4 + 6 + k = 0 \Rightarrow k = -10$. Other zero $= -3 - 2 = -5$.

10 Signs of the zeroes – a 10-second check

Both positive	sum > 0, product > 0
Both negative	sum < 0, product > 0
Opposite signs	product < 0, i.e. a and c have opposite signs
Equal zeroes	product $= \alpha^2 > 0$: a and c have the same sign

Spot a zero: if $a + b + c = 0$, then 1 is a zero (other zero $\frac{c}{a}$).
If $a - b + c = 0$ (i.e. $a + c = b$), then -1 is a zero (other zero $-\frac{c}{a}$).

$4x^2 - 9x + 5$: $4 - 9 + 5 = 0$, so the zeroes are 1 and $\frac{5}{4}$.

11 Cubic polynomials (for reading)

If α, β, γ are the zeroes of $ax^3 + bx^2 + cx + d$:

$$\alpha + \beta + \gamma = -\frac{b}{a}, \quad \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}, \quad \alpha\beta\gamma = -\frac{d}{a}$$

The 2026–27 syllabus asks the relationship for **quadratic** polynomials only. Cubic graphs still appear in "count the zeroes" questions. The division algorithm has been removed from the syllabus.

12 Model answer: zeroes and verification (3 marks)

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

1. $3x^2 - 4x + 3x - 4 = x(3x - 4) + 1(3x - 4) = (3x - 4)(x + 1)$ 1
2. Zeroes: $\frac{4}{3}$ and -1 1
3. Sum $= \frac{4}{3} - 1 = \frac{1}{3} = -\frac{(-1)}{3} = -\frac{b}{a}$ ½
4. Product $= \frac{4}{3} \times (-1) = -\frac{4}{3} = \frac{c}{a}$ ½

13 Model answer: expression in α, β (3 marks)

If α, β are the zeroes of $2x^2 - 6x + 3$, find $\alpha^2 + \beta^2$ and $\frac{1}{\alpha} + \frac{1}{\beta}$.

1. $\alpha + \beta = -\frac{-6}{2} = 3, \quad \alpha\beta = \frac{3}{2}$ 1
2. $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 9 - 3 = 6$ 1
3. $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{3}{3/2} = 2$ 1

Write the identity first, then substitute. A bare answer loses the step marks.

Exam snapshot

What the board asks, and how to prepare

SYLLABUS 2026–27

- Zeroes of a polynomial, and their geometrical meaning (reading a graph).
- Relationship between the zeroes and the coefficients of a **quadratic** polynomial.

Not asked: division algorithm for polynomials (deleted). Cubic relationships are for reading only.

BOARD WEIGHTAGE

20 / 80

Unit II Algebra (Polynomials, Linear Equations, Quadratic Equations, AP) together. Polynomials alone gave 3–5 marks in every paper checked: two 1-mark questions (a graph or an assertion–reason) plus a 2- or 3-mark question on α and β.

MOST ASKED IN BOARD PAPERS, 2024–2026 + SAMPLE PAPER 2026–27 (4 PAPERS CHECKED)

How often	Question type	Marks	Papers
★★★	Value of an expression in α, β: $\frac{1}{\alpha}+\frac{1}{\beta}$, $\alpha^2+\beta^2$, $\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)$	1–3	3 of 4
★★★	Find an unknown coefficient (k, p) from a condition on the zeroes	1–2	3 of 4
★★★	Number of zeroes from a graph, or zeroes common to two graphs	1	3 of 4
★★★	Assertion–reason on zeroes (how many zeroes, reciprocal zeroes)	1	3 of 4
★☆☆	Find the zeroes (fractional coefficients) and verify the relationship	2	1 of 4
★☆☆	Spot a zero from the coefficients ($a+c=b$ gives the zero -1)	1	1 of 4

MISTAKES THAT COST MARKS

- Taking $\alpha+\beta=\frac{b}{a}$. The sum is $-\frac{b}{a}$; only the product has no minus sign.
- Forgetting to divide by a when $a \neq 1$: for $2x^2-8x+5$, $\alpha\beta=\frac{5}{2}$, not 5.
- Counting the point on the y-axis as a zero. Zeroes are only where the graph meets the x-axis.
- Writing x^2+Sx+P when forming a polynomial. It is x^2-Sx+P.
- Giving the factor $(x-5)$ as the zero. The zero is 5.
- Leaving fractions in $p(x)$ while splitting the middle term. Multiply by the LCM first.

HOW TO USE THIS BOOKLET

1. **Day 1:** Notes, then Part A (NCERT) and Part B (Exemplar). Do every MUST DO question first.
2. **Day 2:** Part C (board pattern) and Part D (case studies).
3. **Day 3:** Part E (challenge) and the real board questions in Part F.
4. **Wed 9 Dec: zero-period chapter test – 20 marks in 40 minutes, without the booklet.**
5. Check every answer in the Answer Booklet. Write each mistake on the My Mistakes page.

FORMULAS AT A GLANCE

Sum of zeroes	$-\frac{b}{a}$	Product	$\frac{c}{a}$
Polynomial	x^2-Sx+P	Linear zero	$-\frac{b}{a}$
$\alpha^2+\beta^2$	S^2-2P	$(\alpha-\beta)^2$	S^2-4P
$\frac{1}{\alpha}+\frac{1}{\beta}$	$\frac{S}{P}$	$\alpha^3+\beta^3$	S^3-3PS

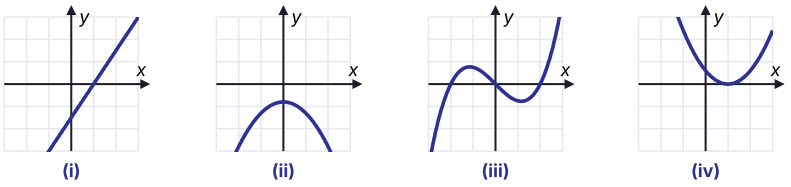
PART A · NCERT PRACTICE

A NCERT Practice

The same skills as the NCERT examples and exercises, with new numbers. Finish every question before moving on.

Zeroes from a graph

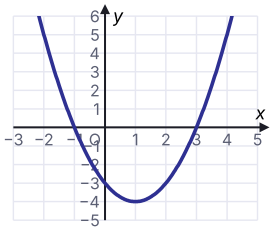
A1. The graphs of $y = p(x)$ are given below. Find the number of zeroes of $p(x)$ in each case. [2] MUST DO



A2. The graph of $y = p(x)$ meets the x-axis at $(-2, 0)$, $(1, 0)$ and $(3, 0)$ only. The number of zeroes of $p(x)$ is: [1]

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

A3. The graph of $y = p(x)$ is shown. The zeroes of $p(x)$ are: [1]



(a) -3 and 1 (b) -1 and 3 (c) 1 and 3 (d) -3 only

Find the zeroes and verify the relationship

A4. Find the zeroes of $x^2 - 3x - 10$ and verify the relationship between the zeroes and the coefficients. [2] MUST DO

A5. Find the zeroes of $4s^2 - 4s + 1$ and verify the relationship between the zeroes and the coefficients. [2]

A6. Find the zeroes of $8x^2 - 2x - 3$ and verify the relationship between the zeroes and the coefficients. [3] MUST DO

A7. Find the zeroes of $5u^2 + 15u$ and verify the relationship between the zeroes and the coefficients. [2]

A8. Find the zeroes of $y^2 - 18$ and verify the relationship between the zeroes and the coefficients. [2]

A9. Find the zeroes of $3x^2 - x - 4$ and verify the relationship between the zeroes and the coefficients. [3]

Form a quadratic polynomial

A10. Find a quadratic polynomial, the sum and product of whose zeroes are given: [3] MUST DO

(i) $5,\ 6$ (ii) $-\frac{2}{3},\ -\frac{1}{3}$ (iii) $\sqrt{3},\ -1$

A11. Find a quadratic polynomial, the sum and product of whose zeroes are given: [3]

(i) $0,\ \sqrt{7}$ (ii) $\frac{1}{4},\ -1$ (iii) $4,\ 4$

A12. One zero of a quadratic polynomial is -2 and the sum of its zeroes is 1. Find the polynomial. [2]

Use the relationship

A13. If one zero of $x^2 - 6x + k$ is 2, then k is: [1]

(a) -8 (b) 8 (c) 4 (d) 6

A14. If α and β are the zeroes of $x^2 - 5x + 4$, find the value of $\frac{1}{\alpha} + \frac{1}{\beta} - 2\alpha\beta$. [2]

A15. Verify that 3 and $-\frac{1}{2}$ are the zeroes of $2x^2 - 5x - 3$. Also verify the relationship between the zeroes and the coefficients. [2]

A16. The number of zeroes of $p(x) = x^2 + 4$ is: [1]

(a) 0 (b) 1 (c) 2 (d) 4

B PART B · EXEMPLAR PRACTICE — Exemplar Practice

Exemplar-style questions on the same ideas, one step harder. Give a reason for every 2-mark answer.

Multiple choice

1 mark each

B1. If one zero of $2x^2 + 3x + k$ is $\frac{1}{2}$, the value of k is: [1]

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

B2. A quadratic polynomial whose zeroes are -3 and 4 is: [1]

(a) $x^2 - x + 12$ (b) $x^2 + x + 12$ (c) $\frac{x^2}{2} - \frac{x}{2} - 6$ (d) $2x^2 + 2x - 24$

B3. The zeroes of $x^2 + 99x + 127$ are: [1]

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

B4. If the zeroes of $x^2 + (a+1)x + b$ are 2 and -3, then: [1]

(a) $a = -7,\ b = -1$ (b) $a = 5,\ b = -1$ (c) $a = 2,\ b = -6$ (d) $a = 0,\ b = -6$

B5. If the zeroes of $ax^2 + bx + c$ $(a \neq 0)$ are equal, then: [1]

(a) c and a have opposite signs (b) c and b have opposite signs
(c) c and a have the same sign (d) c and b have the same sign

B6. If the zeroes of $2x^2 + (k-3)x + 7$ are equal in magnitude but opposite in sign, then k is: [1]

(a) 3 (b) -3 (c) 7 (d) 0

Short answer with reasons

2–3 marks

B7. State whether each statement is true or false. Give a reason. [2]

(i) If both zeroes of $ax^2 + bx + c$ are positive, then a, b and c all have the same sign.

(ii) If the graph of a polynomial meets the x-axis at only one point, it cannot be a quadratic polynomial.

B8. Find the zeroes of $2x^2 - (1 + 2\sqrt{2})x + \sqrt{2}$ and verify the relationship between the zeroes and the coefficients. [3]

B9. Find the zeroes of $v^2 + 4\sqrt{3}\,v - 15$ and verify the relationship between the zeroes and the coefficients. [3]

B10. Find the zeroes of $7y^2 - \frac{11}{3}y - \frac{2}{3}$ and verify the relationship between the zeroes and the coefficients. [3]

B11. The zeroes of $x^2 + px + q$ are double the zeroes of $2x^2 - 5x - 3$. Find p and q. [2]

B12. If α and β are the zeroes of $x^2 - 2x - 8$, find a quadratic polynomial whose zeroes are 2α and 2β. [2]

C

PART C · BOARD PATTERN

Board Pattern Practice

Question types from real 2024–2026 board papers and the 2026–27 Sample Paper, grouped by type. ★★★ = asked in 3 or 4 of the 4 papers checked · ★★ = 2 papers · ★ = 1 paper.

ASSERTION–REASON: HOW TO ANSWER

(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.

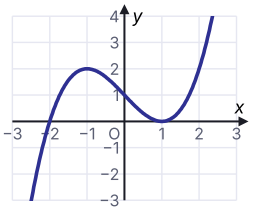
(c) A is true, but R is false.

(d) A is false, but R is true.

Zeroes from a graph

★★★ 3 of 4 papers · 1 mark

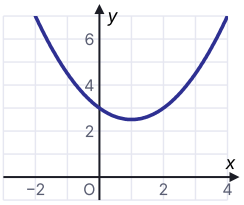
C1. The graph of $y = p(x)$ is shown. The number of zeroes of $p(x)$ is: [1]



MUST DO

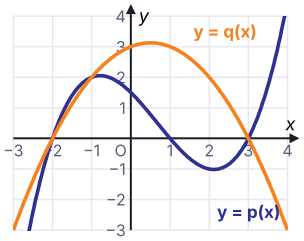
(a) 1 (b) 2 (c) 3 (d) 0

C2. The graph of $y = p(x)$ lies wholly above the x-axis and cuts the y-axis at $(0, 3)$, as shown. The number of zeroes of $p(x)$ is: [1]



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

C3. The graphs of $y = p(x)$ and $y = q(x)$ are drawn on the same axes. How many zeroes do $p(x)$ and $q(x)$ have in common? [1]



(a) 1 (b) 2 (c) 3 (d) 5

C4. ASSERTION–REASON [1]

Assertion (A): The graph of $y = x^2 - 6x + 9$ meets the x-axis at exactly one point.

Reason (R): A quadratic polynomial has at most two zeroes.

C5. ASSERTION–REASON [1]

Assertion (A): If the graph of a polynomial touches the x-axis at only one point, the polynomial cannot be quadratic.

Reason (R): A polynomial of degree n ($n > 1$) has at most n zeroes.

C6. The graph of $y = ax^2 + bx + c$ is a parabola that opens downwards and cuts the x-axis at two points on opposite sides of the origin. Then: [1]

(a) $a > 0,\ c > 0$ (b) $a < 0,\ c > 0$ (c) $a < 0,\ c < 0$ (d) $a > 0,\ c < 0$

Find the zeroes (and verify)

★☆☆ 1 of 4 papers · 2–3 marks

C7. Find the zeroes of $p(x) = x^2 + \frac{1}{6}x - \frac{1}{3}$. MUST DO [2]

C8. Find the zeroes of $4x^2 - 4x - 3$ and verify the relationship between the zeroes and the coefficients. [3]

C9. Find the zeroes of $x^2 - 2\sqrt{3}\,x - 9$ and verify the relationship between the zeroes and the coefficients. [3]

Value of an expression in α and β

★★★ 3 of 4 papers · 1–3 marks

C10. If α, β are the zeroes of $x^2 - 4x - 2$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is: MUST DO [1]

(a) 2 (b) $\frac{1}{2}$ (c) -2 (d) $-\frac{1}{2}$

C11. If α, β are the zeroes of $3x^2 - 6x - 1$, then $(\alpha - \beta)^2$ is: [1]

(a) $\frac{8}{3}$ (b) 4 (c) $\frac{16}{3}$ (d) 16

C12. If α, β are the zeroes of $x^2 - 5x + 3$, then $\alpha^2 + \beta^2$ is: [1]

(a) 25 (b) 31 (c) 22 (d) 19

C13. If α and β are the zeroes of $x^2 - 7x + 10$, find (i) $\alpha^2 + \beta^2$ (ii) $\alpha^2\beta + \alpha\beta^2$. MUST DO [2]

C14. If α and β are the zeroes of $3x^2 - 7x + 2$, find (i) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ (ii) $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$. MUST DO [3]

C15. If α and β are the zeroes of $2x^2 + 5x - 3$, find a quadratic polynomial whose zeroes are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$. [3]

C16. If α and β are the zeroes of $x^2 - x - 4$, find the value of $\frac{1}{\alpha} + \frac{1}{\beta} - \alpha\beta$. [2]

C17. If α and β are the zeroes of $x^2 - 8x + k$ and $\alpha^2 + \beta^2 = 40$, find k. [2]

Find an unknown coefficient

★★★ 3 of 4 papers · 1–2 marks

C18. If the sum of the zeroes of $3x^2 - k\sqrt{3}\,x + 4$ is $\sqrt{3}$, then k is: [1]

(a) $\sqrt{3}$ (b) 3 (c) $\frac{1}{3}$ (d) 9

C19. If α, β are the zeroes of $2x^2 + 8x + k$ and $\alpha + \beta + \alpha\beta = -\frac{5}{2}$, then k is: MUST DO [1]

(a) -3 (b) 13 (c) 3 (d) -13

C20. If the zeroes of $(k-2)x^2 + 5x + (2k+1)$ are reciprocals of each other, then k is: [1]

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

C21. For $ax^2 + bx + c$, if $a + b + c = 0$, then one zero is always: [1]

(a) 1 (b) -1 (c) $\frac{b}{a}$ (d) $-\frac{c}{a}$

C22. If one zero of $3x^2 - 8x + 2k + 1$ is seven times the other, find the zeroes and the value of k. [3]

C23. If 2 is a zero of $2x^2 + kx - 6$, find k and the other zero. MUST DO [2]

C24. If one zero of $x^2 + 3x + k$ is 2, find the value of k and the other zero. [2]

C25. Find a quadratic polynomial whose zeroes are each 3 more than the zeroes of $x^2 - 5x + 6$. [2]

Form a quadratic polynomial

★☆☆ Basic papers · 2–3 marks

C26. Find a quadratic polynomial, the sum and product of whose zeroes are -3 and 2 respectively. Hence find its zeroes. MUST DO [3]

C27. Find a quadratic polynomial whose zeroes are $2 + \sqrt{3}$ and $2 - \sqrt{3}$. [2]

C28. A quadratic polynomial whose sum of zeroes is 0 and one zero is 5 is: [1]

(a) $x^2 + 25$ (b) $x^2 - 5$ (c) $x^2 - 25$ (d) $x^2 - 10x + 25$

Signs of zeroes · spot a zero

★☆☆ 1 of 4 papers · 1 mark

C29. The zeroes of $4x^2 - 9x + 5$ are: [1]

(a) -1 and $-\frac{5}{4}$ (b) 1 and $\frac{5}{4}$ (c) 1 and $-\frac{5}{4}$ (d) -1 and $\frac{5}{4}$

C30. The zeroes of $x^2 + 7x + 10$ are: [1]

(a) both positive (b) both negative (c) of opposite signs (d) equal

C31. ASSERTION–REASON [1]

Assertion (A): The zeroes of $2x^2 + 3x - 5$ have opposite signs.

Reason (R): If a and c of $ax^2 + bx + c$ have opposite signs, the product of the zeroes is negative.

D

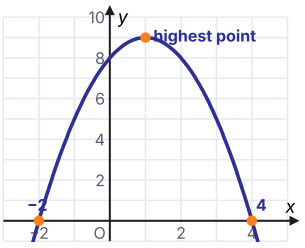
PART D · SECTION E STYLE

Case-Based Questions

Each case carries 4 marks (1 + 1 + 2), as in Section E of the board paper. Read the situation carefully before answering.

D1. Case Study · Garden Fountain [4]

A fountain in the school garden throws a jet of water. With the nozzle line as the x-axis, the jet follows the curve of $p(x) = -x^2 + 2x + 8$ (in metres), as shown. The water is at ground level where $p(x) = 0$.



(i) How many zeroes does $p(x)$ have? Write them from the graph. [1]

(ii) Find the sum and the product of the zeroes. [1]

(iii) Verify that the sum of the zeroes $= -\frac{b}{a}$ and the product $= \frac{c}{a}$. [2]

OR

(iii) The jet is highest midway between the zeroes. Find that value of x and the greatest height of the jet. [2]

D2. Case Study · Water Rocket [4]

The science club launches a water rocket from the roof of a building. Its height in metres after t seconds is $h(t) = -5t^2 + 20t + 25$. It lands on the ground when $h(t) = 0$.

(i) What type of polynomial is $h(t)$? What is the height of the roof? [1]

(ii) Write the sum and the product of the zeroes of $h(t)$ without finding them. [1]

(iii) Find the zeroes of $h(t)$. After how many seconds does the rocket land? [2]

OR

(iii) Find the height of the rocket after 2 seconds and after 4 seconds. What do you notice? [2]

D3. Case Study · Vegetable Plot [4]

A rectangular vegetable plot has length $(2x + 3)$ m and breadth $(x - 1)$ m. Its area is given by the polynomial $A(x) = (2x + 3)(x - 1) = 2x^2 + x - 3$.

(i) Find the zeroes of $A(x)$. [1]

(ii) Find the sum and the product of the zeroes of $A(x)$. [1]

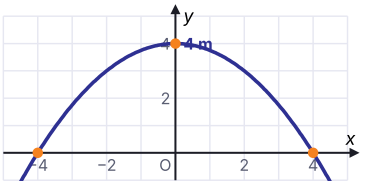
(iii) Find a quadratic polynomial whose zeroes are twice the zeroes of $A(x)$. [2]

OR

(iii) If α, β are the zeroes of $A(x)$, find $\alpha^2 + \beta^2$ using the relationship with the coefficients. [2]

D4. Case Study · Bridge Arch [4]

The arch under a footbridge has the shape of the graph of $p(x) = -\frac{1}{4}x^2 + 4$, where x is measured in metres along the path from the middle of the arch. The arch meets the path where $p(x) = 0$.



(i) Find the zeroes of $p(x)$. How wide is the arch at the path? [1]

(ii) Write the sum and product of the zeroes. Why is the sum zero? [1]

(iii) A new arch meets the path at $x = 0$ and $x = 8$ and has the same leading coefficient $-\frac{1}{4}$. Write its polynomial. [2]

OR

(iii) For what value of k does $q(x) = -\frac{1}{4}x^2 + k$ have zeroes ± 6? What is the height of that arch? [2]

PART E · FOR 95+

E Challenge Questions

Harder than the usual board question. Try these after Parts A–D: they stretch the same methods to the toughest 3- and 5-mark questions.

E1. If α, β are the zeroes of $x^2 - px + q$, find $\alpha^3 + \beta^3$ in terms of p and q. Hence find it for $x^2 - 3x + 1$. [3]

E2. If α, β are the zeroes of $2x^2 - 3x - 6$, find a quadratic polynomial whose zeroes are α^2 and β^2. [3]

E3. If α, β are the zeroes of $x^2 + px + 45$ and $(\alpha - \beta)^2 = 144$, find p. [3]

E4. If α, β are the zeroes of $x^2 - 6x + a$ and $3\alpha + 2\beta = 20$, find a. [3]

E5. If α, β are the zeroes of $x^2 - 2x - 15$, form a quadratic polynomial whose zeroes are $2\alpha + 1$ and $2\beta + 1$. [3]

E6. Show that $p(x) = x^2 + 4x + 7$ has no zero. What does this tell you about its graph? [2]

F

PART F · REAL BOARD QUESTIONS

Board PYQ Index

Real questions from recent Maths Standard board papers and the 2026–27 Sample Paper, by type. Open the official paper and solve the listed questions.

Frequency	Question type	Marks	Where asked (year: paper code, question number)	Practise here
★★★	**Expression in α, β**	1–3	**2026:** 30/1/1 Q21 · **2025:** 30/1/1 Q1 · **SQP 2026–27:** Q27	A13–A16, B12, C10–C17, D3, E1–E2
★★★	**Unknown coefficient from the zeroes**	1	**2025:** 30/1/1 Q1 · **2024:** 30/1/1 Q1, Q10 · **SQP 2026–27:** Q20	A13, B1, B4, B6, B11, C17–C25, E3–E4
★★★	**Zeroes from a graph**	1	**2026:** 30/1/1 Q4 · **2025:** 30/1/1 Q10 · **2024:** 30/1/1 Q20	A1–A3, A16, C1–C6, D1, E6
★★★	**Assertion–reason**	1	**2026:** 30/1/1 Q20 · **2024:** 30/1/1 Q20 · **SQP 2026–27:** Q20	B7, C4–C5, C31
★☆☆	**Find the zeroes (and verify)**	2	**2025:** 30/1/1 Q22	A4–A9, A15, B8–B10, C7–C9, D2
★☆☆	**Spot a zero from the coefficients**	1	**SQP 2026–27:** Q2	B3, B5, C6, C21, C29–C31

PAPERS CHECKED

- **2026:** 30/1/1 (Delhi, Set 1)
- **2025:** 30/1/1 (Delhi, Set 1)
- **2024:** 30/1/1 (Delhi, Set 1)
- **CBSE Sample Paper 2026–27** (Mathematics Standard)

Sets of one code family (30/1/1, 30/1/2, 30/1/3) share most questions, so each counts as one paper. Download the official papers from cbse.gov.in → Previous Year Question Papers, and solve the exact questions listed above.

PART G · YOUR RECORD

G My Mistakes

Write down each mistake from this chapter, including the chapter test.

Every wrong answer is a free lesson. Write it here, find the rule you missed, and redo the question after three days. Bring this page to class before the next test.

Date	Part & Q No.	What went wrong	Correct rule or method	Redone ✓