

Form a Quadratic Polynomial from the Sum & Product of Its Zeroes

NCERT / CBSE Class 10 Maths · Chapter 2 Polynomials · Section 2.3 · 2-page summary

Page 1 · Concept

For zeroes with sum **S** and product **P**: $p(x) = x^2 - Sx + P$ For zeroes α and β : $p(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

The three slots — and the sign that decides the marks

Slot	What goes in it	The trap
Coefficient of x^2	1, in the simplest answer	Not fixed — any $k \neq 0$ also works (see below)
Coefficient of x	–(sum) of the zeroes	Sum -3 gives $+3x$, not $-3x$
Constant term	+(product) , with its own sign	Product -6 stays -6 ; you do not flip it

Rhythm to say out loud: **sum sits with x, product sits alone** — and the sum always arrives behind a minus.

The method, and where NCERT puts it

1. Find the sum S. 2. Find the product P. 3. Write $x^2 - Sx + P$ with S and P in brackets. 4. Simplify the signs, then clear fractions if needed.

NCERT scope note. This is Class 10 Maths **Chapter 2, Section 2.3 – Example 4** is the sum = -3 , product = 2 question, and **Exercise 2.2 Q2** gives six more. The CBSE syllabus names the zeroes–coefficients relationship for **quadratic polynomials only**; the division algorithm for polynomials and the cubic relationship are not in the current course. Polynomials sits in **Algebra – 20 of the 80 theory marks**.

Why your answer and the answer key can both be right

Multiplying a polynomial by a non-zero constant does not move its zeroes, so **every $k(x^2 - Sx + P)$ has the same zeroes**. Give $k = 1$ unless the numbers are fractions.

Sum, product	Simplest answer ($k = 1$)	Whole-number form
$S = -3, P = 2$	$x^2 + 3x + 2$	already whole numbers
$S = 1/4, P = -1$	$x^2 - \frac{1}{4}x - 1$	$\times 4 \rightarrow 4x^2 - x - 4$
$S = 0, P = -3$	$x^2 - 3$	middle term vanishes

What the question is really asking for

Board phrasing	What to write first
“sum and product of whose zeroes are ...”	Straight into $x^2 - Sx + P$ — nothing to compute first
“whose zeroes are α and β ”	Compute $S = \alpha + \beta$ and $P = \alpha\beta$, then substitute
“with integral / whole-number coefficients”	Form it, then multiply by the LCM of the denominators
“one zero is twice the other ...”	Name the zeroes first (t and $2t$), find S and P, then substitute

Key takeaways

- Sum S, product P $\rightarrow x^2 - Sx + P$. The middle term is **minus** the sum; the constant is the product.
- A negative sum gives a **positive** middle term: $-(-3)x = +3x$.
- Given the zeroes instead, find S and P first — the formula never changes.
- The answer is **not unique**: any $k(x^2 - Sx + P)$ works. Use $k = 1$, or a k that clears fractions.
- Sum = 0 kills the middle term, leaving x^2 + product — e.g. zeroes $\sqrt{3}$ and $-\sqrt{3}$ give $x^2 - 3$.

Worked Board Questions

Forming a quadratic polynomial · NCERT Example 4 & Exercise 2.2 pattern

2 MARKS · FRACTIONS

The sum and product of the zeroes of a quadratic polynomial are $-1/2$ and -3 . Find the polynomial.

Step 1. $S = -1/2$, $P = -3$. **Step 2.** $p(x) = x^2 - (-1/2)x + (-3) = x^2 + 1/2x - 3$.

Step 3. Clear the half: $\times 2 \rightarrow 2x^2 + x - 6$.

Check: for $2x^2 + x - 6$, sum $= -b/a = -1/2$ ✓ and product $= c/a = -6/2 = -3$ ✓. Factorising gives $(2x - 3)(x + 2)$, so the zeroes are $3/2$ and -2 — which do add to $-1/2$.

3 MARKS · SURDS

Find a quadratic polynomial whose zeroes are $3 + \sqrt{5}$ and $3 - \sqrt{5}$.

Sum $= (3 + \sqrt{5}) + (3 - \sqrt{5}) = 6$ — the surds cancel. Product $= 3^2 - (\sqrt{5})^2 = 9 - 5 = 4$, using $(a + b)(a - b)$.

$p(x) = x^2 - 6x + 4$. **Check:** the roots of $x^2 - 6x + 4$ are $(6 \pm \sqrt{20})/2 = 3 \pm \sqrt{5}$ ✓

SPEED DRILL

Given	Sum, product	Polynomial
Zeroes 2 and -5	-3, -10	$x^2 + 3x - 10$
Zeroes $\sqrt{3}$ and $-\sqrt{3}$	0, -3	$x^2 - 3$
$S = 5$, $P = -6$	as given	$x^2 - 5x - 6$
Zeroes $3/4$ and $-2/3$	$1/12$, $-1/2$	$12x^2 - x - 6$

CONDITION QUESTION

The zeroes of a quadratic polynomial add to 9, and one zero is twice the other. Form the polynomial.

Let the zeroes be t and $2t$. Then $3t = 9$, so $t = 3$ and the zeroes are **3 and 6**. Sum $= 9$, product $= 18$, so $p(x) = x^2 - 9x + 18 = (x - 3)(x - 6)$ ✓ The lesson: name the zeroes before you reach for the formula.

WHERE THE MARKS ACTUALLY GO

- Write $x^2 - (S)x + (P)$ with the brackets **in place** — that line is the method mark, and it is where the double negative gets handled.
- State S and P separately before substituting; an examiner can award those even if the last line slips.
- Multiplying by k to clear fractions is not optional presentation — say “multiplying by 4” so the new polynomial is justified.
- Finish with the $-b/a$ and c/a check. It costs one line and catches every sign error.

SANITY CHECK IN 5 SECONDS

Before you write the final line, read the signs: **P negative** → the zeroes have **opposite signs**. **P positive with S positive** → both zeroes positive; **P positive with S negative** → both negative. If your factorisation disagrees with that, the slip is in a sign, not in the formula.

NOW TRY THIS ONE

Find a quadratic polynomial with whole-number coefficients whose zeroes are $-2/3$ and $3/4$.

(Sum $= 1/12$, product $= -1/2 \rightarrow x^2 - (1/12)x - 1/2, \times 12 \rightarrow 12x^2 - x - 6 = (4x - 3)(3x + 2)$.)

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