

Relationship Between Zeroes and Coefficients of a Polynomial

For $ax^2 + bx + c$ ($a \neq 0$) with zeroes α and β · $\alpha + \beta = -b/a$ · $\alpha\beta = c/a$

Where the two rules come from

If α and β are the zeroes, then $(x - \alpha)$ and $(x - \beta)$ are factors, so $ax^2 + bx + c = a(x - \alpha)(x - \beta) = ax^2 - a(\alpha + \beta)x + a\alpha\beta$. Comparing the x terms gives $b = -a(\alpha + \beta)$, so $\alpha + \beta = -b/a$. Comparing the constants gives $c = a\alpha\beta$, so $\alpha\beta = c/a$. Nothing here needs the zeroes to be whole numbers — the rules hold for fractions and surds too.

Memory line: sum flips the sign of b ; product just copies c . The sum carries a minus, the product does not — that one difference is where most of the lost marks live.

Why it is worth the trouble. The question "what is the sum of the zeroes of $3x^2 - 7x + 2$?" is a one-mark MCQ. Solving it takes a minute of factorising; reading $-b/a = 7/3$ off the coefficients takes five seconds and cannot go wrong on the arithmetic.

Reading a, b and c with their signs

Polynomial	a	b	c	Sum = $-b/a$	Product = c/a
$x^2 - 5x + 6$	1	-5	6	$-(-5)/1 = 5$	$6/1 = 6$
$2x^2 - 8x + 6$	2	-8	6	$-(-8)/2 = 4$	$6/2 = 3$
$x^2 - 3$	1	0	-3	$-0/1 = 0$	$-3/1 = -3$
$6x^2 - 7x - 3$	6	-7	-3	$7/6$	$-1/2$
$x^2 + 7x + 10$	1	7	10	$-7/1 = -7$	$10/1 = 10$

Two traps in one table. Row 3: a missing term means that coefficient is **0**, not absent. Row 4: when $a \neq 1$ you must divide by a — the coefficient of x^2 is always the denominator.

What NCERT and CBSE actually examine

Question	Answer
Where is it in NCERT?	Chapter 2 Polynomials , Section 2.3 (2.1 Introduction, 2.2 Geometrical Meaning, 2.3 this topic, 2.4 Summary)
Which exercise?	Exercise 2.2 — Q1 find the zeroes and verify, Q2 the reverse. Two questions, six parts each
The numbering trap	Section 2.2 is examined by Ex 2.1; Section 2.3 by Ex 2.2 . Section 2.1 is a bare introduction with no exercise
What was removed?	The division algorithm (old §2.4, old Ex 2.3 and 2.4) and the cubic form of this relationship

The CBSE clause, verbatim: "Zeros of a polynomial. Relationship between zeros and coefficients of **quadratic** polynomials." Polynomials sits in **Unit II Algebra, 20 of 80** — the largest unit — alongside Pair of Linear Equations, Quadratic Equations and Arithmetic Progressions. Unit marks: $6 \cdot 20 \cdot 6 \cdot 15 \cdot 12 \cdot 10 \cdot 11 = 80$. Chapter-wise percentage tables online are unofficial estimates.

Key takeaways

- For $ax^2 + bx + c$ with zeroes α , β : $\alpha + \beta = -b/a$ and $\alpha\beta = c/a$.
- The **sum carries a minus**; the product does not. That is the single most common lost mark.
- You get the sum and product **without solving** — read a , b and c straight off the polynomial.
- When $a \neq 1$, **divide by a** . A missing term means that coefficient is **0**.
- In a *verify* question, both sides are the answer: compute from the zeroes **and** from the coefficients, then say they match.
- NCERT **§2.3, Exercise 2.2**. CBSE examines **quadratic polynomials only**.

Two NCERT verifications, and the sign that decides the marks

NCERT EX 2.2 Q1(i) · 3 MARKS

Find the zeroes of $x^2 - 2x - 8$ and verify the relationship between the zeroes and the coefficients.

Step 1 – name the coefficients. $a = 1$, $b = -2$, $c = -8$.

Step 2 – factorise. Split the middle term: $x^2 - 4x + 2x - 8 = x(x - 4) + 2(x - 4) = (x - 4)(x + 2)$.

Step 3 – read off the zeroes. $x - 4 = 0$ or $x + 2 = 0$, so the zeroes are **4** and **-2**.

Step 4 – verify, both sides.

Quantity	From the zeroes	From the coefficients	
Sum	$4 + (-2) = 2$	$-b/a = -(-2)/1 = 2$	✓
Product	$4 \times (-2) = -8$	$c/a = -8/1 = -8$	✓

Hence the relationship is verified. Write that sentence. The table alone is the working; the statement is what closes the answer.

NCERT EX 2.2 Q1(iii) · WHEN $a \neq 1$

$6x^2 - 3 - 7x$. Write it in standard form first: **$6x^2 - 7x - 3$** , so $a = 6$, $b = -7$, $c = -3$.

Split the middle term using $6 \times (-3) = -18$ and $-9 + 2 = -7$: $6x^2 - 9x + 2x - 3 = 3x(2x - 3) + 1(2x - 3) = (2x - 3)(3x + 1)$.
Zeroes: **$3/2$** and **$-1/3$** .

Quantity	From the zeroes	From the coefficients	
Sum	$3/2 - 1/3 = 9/6 - 2/6 = 7/6$	$-b/a = 7/6$	✓
Product	$(3/2)(-1/3) = -1/2$	$c/a = -3/6 = -1/2$	✓

THE SIGN THAT COSTS THE MARK

For **$x^2 - 5x + 6$** the zeroes are 2 and 3, so the sum is 5.

What loses the mark: “ $b = 5$, so the sum is -5 .” The coefficient is **-5** , not 5 – the sign in front belongs to it. Then $-b/a = -(-5)/1 = +5$, which agrees with $2 + 3$. Copy each coefficient *with* its sign before you substitute.

The other one: using the cubic rules in a Class 10 answer. CBSE examines this relationship for **quadratic polynomials only** – in the board paper, $-b/a$ and c/a are the only two you need.

WHERE THE MARKS ACTUALLY GO

What you write	Why it earns the mark
$a = \dots$, $b = \dots$, $c = \dots$	Shows the signs were read correctly – everything after depends on it
The factorisation line	The method mark for the zeroes, kept even if arithmetic slips later
Both columns of the check	A <i>verify</i> question wants two computations; one column is half an answer
“Hence verified”	States the conclusion the question asked for, rather than leaving it implied

NOW TRY THESE TWO

1. Find the zeroes of **$4u^2 + 8u$** and verify the relationship. (NCERT Ex 2.2 Q1(iv). Answers: zeroes 0 and -2 ; sum $-2 = -8/4$; product $0 = 0/4$.)

2. Find a quadratic polynomial whose zeroes have sum **$1/4$** and product **-1** . (NCERT Ex 2.2 Q2(i). Answer: $x^2 - (1/4)x - 1$, usually written **$4x^2 - x - 4$** .)

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