

Linear Equations in Two Variables (Class 10)

What a pair of linear equations means – NCERT Chapter 3, Section 3.1

One equation in two variables has **infinitely many** solutions. Two together normally have **exactly one**.

Is it a linear equation in two variables?

General form $ax + by + c = 0$, where a, b, c are real numbers and **a and b are not both zero**. Every variable to the power 1 – no square, no product of variables, no variable underneath.

Equation	Linear in two variables?	Why
$2x + 3y - 12 = 0$	Yes	$a = 2, b = 3, c = -12$; both powers are 1
$x = 2y$	Yes	Rearranges to $x - 2y + 0 = 0$, so $c = 0$
$x^2 + y = 5$	No	x is squared – not degree 1
$xy + 3 = 0$	No	The variables are multiplied together
$2/x + y = 7$	No	A variable sits in a denominator

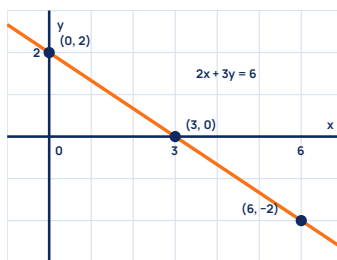
One equation, or a pair?

A **pair** is two linear equations in the **same** two variables, written together as $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$. The subscript says which equation the coefficient belongs to. Move everything to one side *before* reading a, b and c off – that is where the sign of c is won or lost.

The pair	Equation 1	Equation 2
$x - 2y = 0$ $3x + 4y - 20 = 0$	$a_1 = 1, b_1 = -2, c_1 = 0$	$a_2 = 3, b_2 = 4, c_2 = -20$
$x = 2y$ $12x + 20y = 88$	$a_1 = 1, b_1 = -2, c_1 = 0$	$a_2 = 12, b_2 = 20, c_2 = -88$

One equation, drawn correctly

Pick easy x -values, work out y , plot, then rule the line through the points. For $2x + 3y = 6$: $x = 0$ gives $y = 2$; $x = 3$ gives $y = 0$; $x = 6$ gives $y = -2$. **Every point in your own table must sit on the line you draw.** A marked point floating above or below the ruled line means the plotting slipped, not the algebra.



Three of the infinitely many solutions of a single linear equation – and the line that carries all of them.

Key Takeaways

- ▶ $ax + by + c = 0$ (a, b not both zero) is a linear equation in two variables; its graph is a straight line.
- ▶ On its own it has **infinitely many solutions** – one for every point on that line.
- ▶ A **pair** is two such equations in the same variables: $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$.
- ▶ A **solution of the pair** satisfies **both** equations – a point lying on both lines.
- ▶ NCERT numbering trap: graphical method is **Section 3.2 but Exercise 3.1**; substitution is Ex 3.2, elimination Ex 3.3.
- ▶ Chapter 3 sits in **Algebra – 20 of 80 marks**, the largest unit in the CBSE paper.

Form the pair, then test it properly

The two Section 3.1 skills that carry 1-mark and 2-mark board questions

WORKED EXAMPLE · 2 MARKS

5 pencils and 7 pens together cost **Rs 250**, while 7 pencils and 5 pens together cost **Rs 230**. Represent this situation algebraically.

Step 1 – name the unknowns. Let the cost of one pencil be **Rs x** and the cost of one pen be **Rs y** . Two unknowns, so expect two equations.

Step 2 – turn each fact into one equation. “5 pencils and 7 pens cost 250” gives **$5x + 7y = 250$** . “7 pencils and 5 pens cost 230” gives **$7x + 5y = 230$** .

Step 3 – write the pair in general form. **$5x + 7y - 250 = 0$** and **$7x + 5y - 230 = 0$** , so $a_1 = 5$, $b_1 = 7$, $c_1 = -250$ and $a_2 = 7$, $b_2 = 5$, $c_2 = -230$.

Check: the pair is the answer here – if the question says *represent*, full marks stop at the two equations. Solving them ($x = 15$, $y = 25$) is a different question, and $5(15) + 7(25) = 250$ with $7(15) + 5(25) = 230$ confirms the pair is the right one.

THE SOLUTION CHECK · 1 MARK

Which of these is a solution of the pair **$2x + y = 10$** and **$x - y = 2$** ? Substitute into **both** – that is the whole test.

(x, y)	$2x + y$	$x - y$	Solution of the pair?
(4, 2)	$8 + 2 = 10$ ✓	$4 - 2 = 2$ ✓	Yes – both true
(5, 0)	$10 + 0 = 10$ ✓	$5 - 0 = 5$ ✗	No – first only
(3, 1)	$6 + 1 = 7$ ✗	$3 - 1 = 2$ ✓	No – second only
(6, -2)	$12 - 2 = 10$ ✓	$6 + 2 = 8$ ✗	No – first only

Three of the four satisfy one equation each. **Only (4, 2) satisfies both**, so only (4, 2) is a solution of the pair – and it is the single point where the two lines cross.

WHERE THE MARKS GO

What students do	What it costs
Tick a pair after checking one equation	The whole mark – a solution must satisfy both
Read c straight off $2x + 3y = 12$	Sign error: it is $c = -12$, not 12
Swap a_1 , b_1 with a_2 , b_2	Every ratio comparison later in the chapter goes wrong
Stop at one equation for two unknowns	No unique answer exists – the second condition is the question

NOW TRY THIS ONE

Which of **(2, 3)**, **(4, 0)**, **(0, 6)** and **(1, 4)** is a solution of the pair **$3x + 2y = 12$** and **$x + y = 5$** ? Test every candidate in both equations before you answer.

Answer: (2, 3) – $3(2) + 2(3) = 12$ and $2 + 3 = 5$, both true. (4, 0) and (0, 6) satisfy only the first; (1, 4) satisfies only the second.

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- ▶ **Mistake Identification** names the exact slip – sign of c, one equation checked instead of two.
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