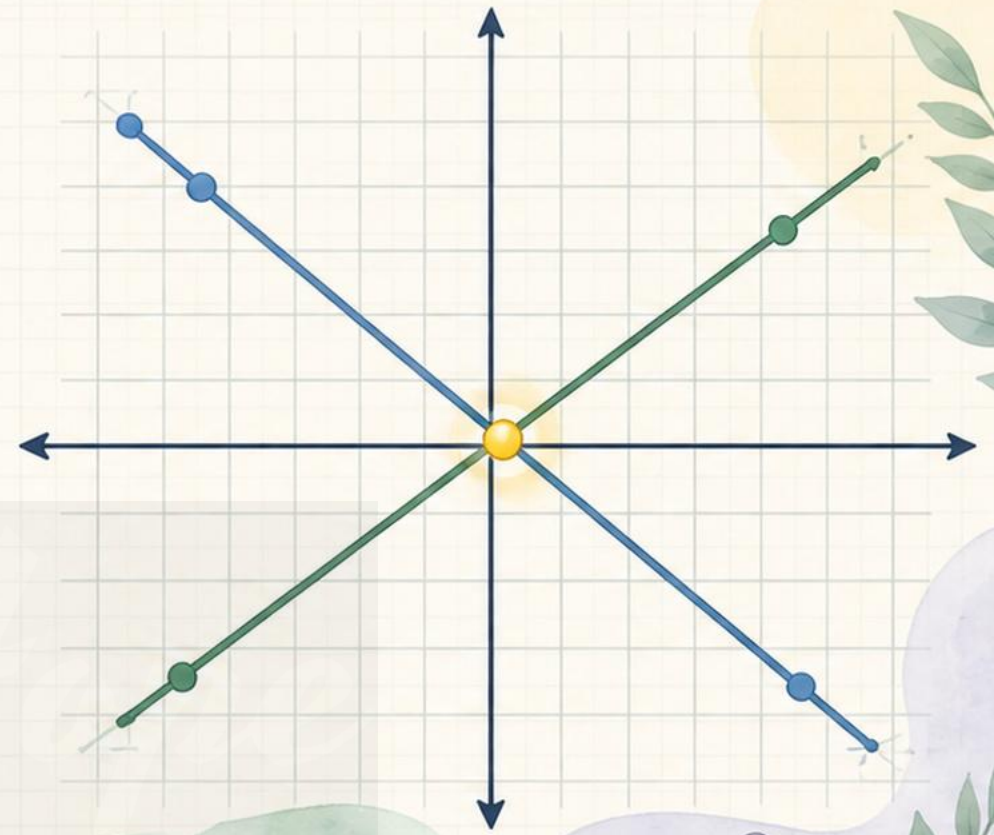


MATHEMATICS • CLASS 10

CHAPTER 3

Pair of Linear Equations in Two Variables

CHAPTER NOTES



PAIR OF LINEAR EQUATIONS

GENERAL FORM

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

where $a_1^2 + b_1^2 \neq 0$ and
 $a_2^2 + b_2^2 \neq 0$.

Each equation represents
a straight line in the
xy-plane.

SOLUTION

A solution is an ordered pair (x, y)
that satisfies both equations.

The common solution is the point
lying on both lines.

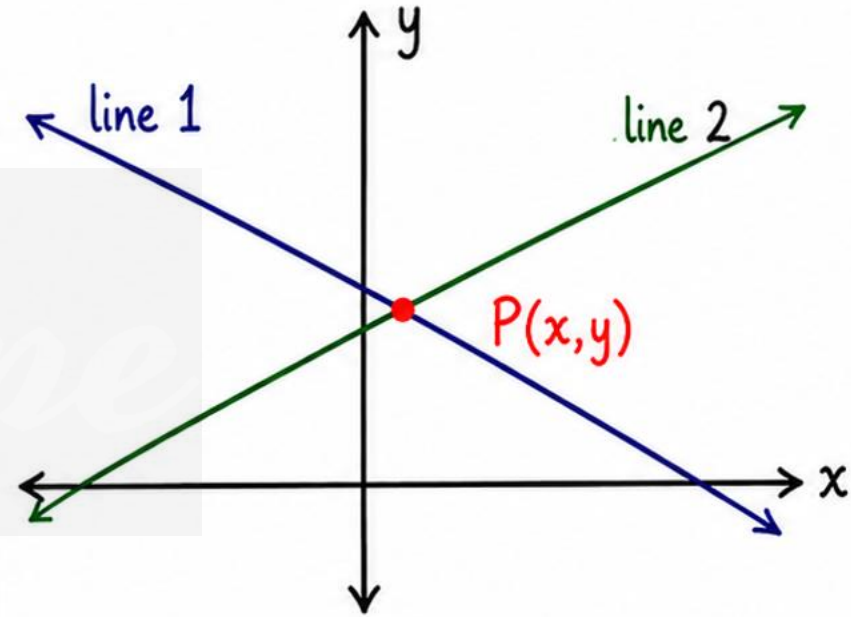
Check for $(2, 3)$:

$$x + y = 5 \rightarrow 2 + 3 = 5$$

$$2x - y = 1 \rightarrow 2(2) - 3 = 1$$

Therefore $(2, 3)$ satisfies both.

GRAPHICAL MEANING



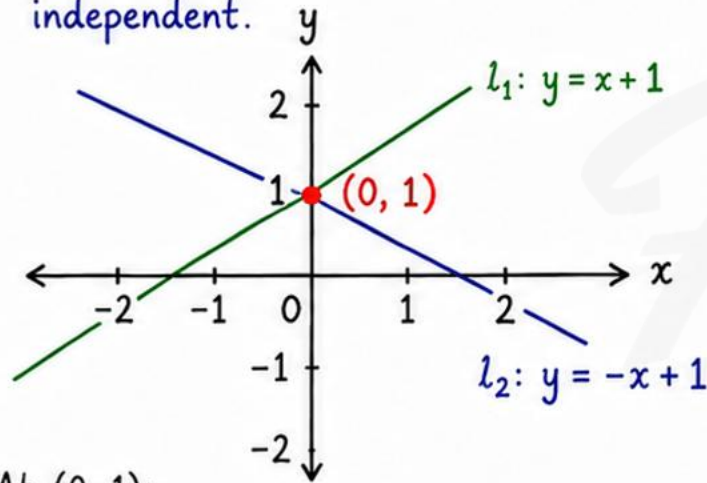
Their intersection gives the
common solution.

A pair may have one solution, no solution or infinitely many solutions.

THREE GRAPHICAL CASES

INTERSECTING LINES

- Two non-parallel lines intersect once.
- one common point $\rightarrow$ one solution
- System is consistent and independent.



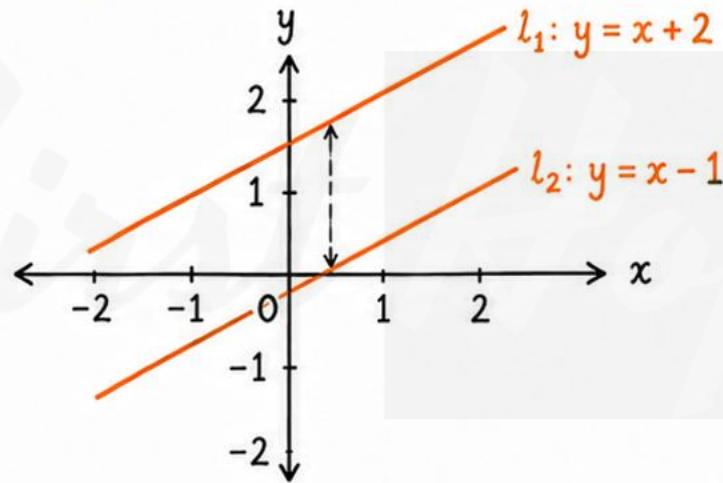
At $(0, 1)$:

$$\begin{aligned} \text{For } l_1: y &= x + 1 \\ 1 &= 0 + 1 \quad \checkmark \end{aligned}$$

$$\begin{aligned} \text{For } l_2: y &= -x + 1 \\ 1 &= -0 + 1 \quad \checkmark \end{aligned}$$

PARALLEL LINES

- Two distinct parallel lines.
- no common point $\rightarrow$ no solution
- System is inconsistent.



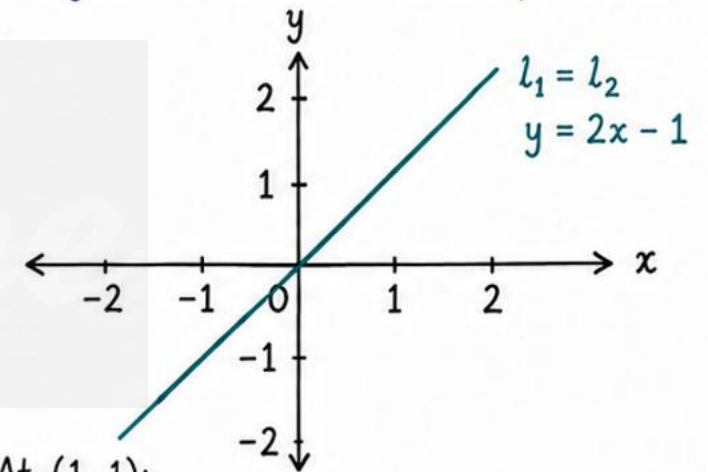
Slopes:

$$m_1 = 1, \quad m_2 = 1 \Rightarrow m_1 = m_2$$

$$y\text{-intercepts: } 2 \neq -1 \Rightarrow \text{lines are distinct}$$

COINCIDENT LINES

- Two equations lie on exactly the same line.
- every point on the line is common $\rightarrow$ infinitely many solutions
- System is consistent and dependent.



At $(1, 1)$:

$$\begin{aligned} \text{For } l_1: y &= 2x - 1 \\ 1 &= 2(1) - 1 \\ 1 &= 1 \quad \checkmark \end{aligned}$$

$$\begin{aligned} \text{For } l_2: y &= 2x - 1 \\ 1 &= 2(1) - 1 \\ 1 &= 1 \quad \checkmark \end{aligned}$$

intersection count: 1 $\rightarrow$ unique solution

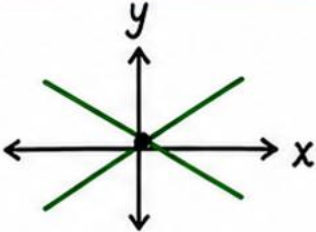
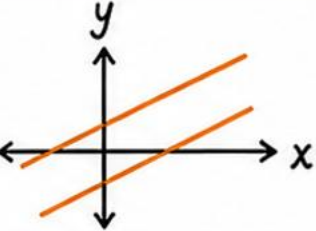
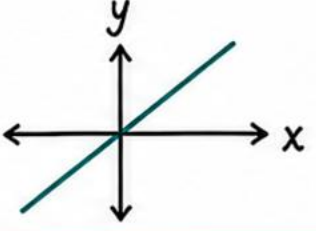
intersection count: 0 $\rightarrow$ no solution

intersection count: infinitely many $\rightarrow$ dependent solutions

CONDITIONS FOR CONSISTENCY

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Lines intersect.	Exactly one solution.	consistent and independent.	
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Lines are parallel and distinct.	No solution.	inconsistent.	
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Lines are coincident.	Infinitely many solutions.	consistent and dependent.	

EXAM CHECK:

First write both equations in standard form.

Compare $\frac{a_1}{a_2}$, $\frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$ with signs unchanged.

GRAPHICAL SOLUTION

EXAMPLE – Solve by Graph

$$x + y = 5$$

$$x - y = 1$$

PLOT THE FIRST LINE

For $x + y = 5$

x	0	5
y	5	0

Points to plot:

$(0, 5), (5, 0)$

Check in $x + y = 5$:

$$3 + 2 = 5$$

PLOT THE SECOND LINE

For $x - y = 1$

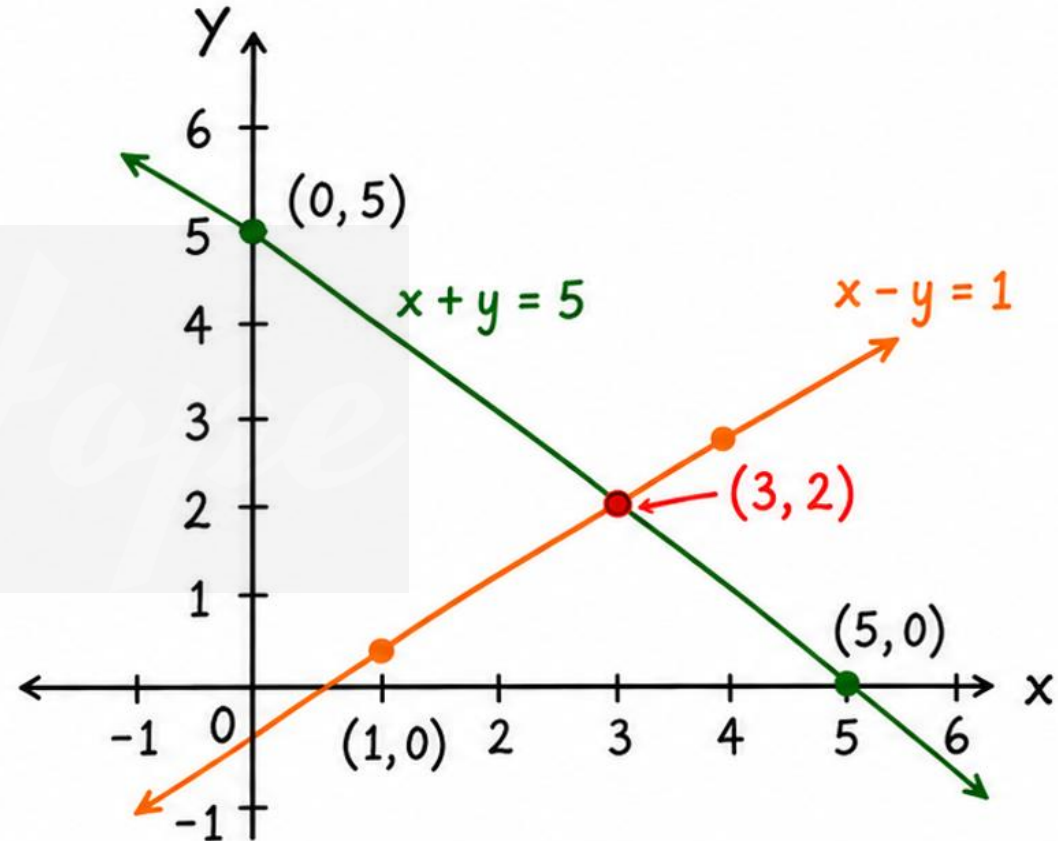
x	1	3
y	0	2

Points to plot:

$(1, 0), (3, 2)$

Check in $x - y = 1$:

$$3 - 2 = 1$$



Solution: $x = 3, y = 2$.

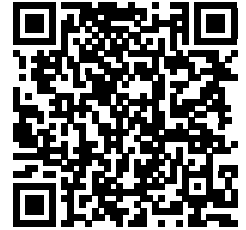


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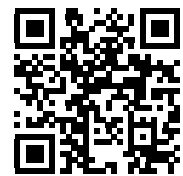


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