

# Pair of Linear Equations in Two Variables

## Algebraic Methods

### By Substitution

Solve :  $x + y = 14$  ... (i)  
 $x - y = 4$  ... (ii)

By substitution method

Sol. From (ii)  $x = 4 + y$  ... (iii)

Putting in (i),  
 $4 + y + y = 14$

$\Rightarrow 2y = 10 \Rightarrow y = 5$

Putting in (iii),  $x = 4 + 5 = 9$

Thus  $x = 9, y = 5$

### By Elimination

Solve :  $x + 3y = 8$  ... (i)  
 $= 8x - 3y = 10$  ... (ii)

Sol. Adding (i) and (ii)

$9x = 18$  or  $x = 2$

Again, (i)  $\times 8 -$  (ii)

$27y = 54$  or,  $y = 2$

Hence,  $x = 2, y = 2$

## Graphical Representation

## General Form

$a_1x + b_1y + c_1 = 0, a_2x + b_2y + c_2 = 0$   
 $a_1, b_1, a_2, b_2, c_1, c_2$  are Real numbers

## Graphical Solution

Each solution  $(x, y)$ , corresponds to a point on the line representing the equation and vice-versa

Pair of Lines  $2x + 3y - 8 = 0$   
 $4x + 6y - 16 = 0$

Compare the Ratios :  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = \frac{-8}{-16} = \frac{1}{2}$

Algebraic interpretation  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$   
 = Infinitely many solutions - Dependent

For  $2x + 3y - 8 = 0$

x	1	4
y	2	0

For  $4x + 6y - 16 = 0$

x	1	4
y	2	0

For  $2x + 3y - 8 = 0$

x	4	1
y	0	2

For  $3x - 2y - 6 = 0$

x	0	2
y	-3	0

Pair of Lines  $= 2x + 3y - 8 = 0$   
 $3x - 2y - 6 = 0$

Compare the Ratios  $= \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = \frac{-8}{-6} = \frac{4}{3}$

Algebraic Interpretation : Exactly one solution - consistent (unique)

Pair of Lines  $2x + 4y - 12 = 0$   
 $x + 2y - 4 = 0$

Compare the Ratios,  $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Algebraic Interpretation : No solution - Inconsistent

For  $2x + 4y - 12 = 0$

x	0	6
y	3	0

For  $x + 2y - 4 = 0$

x	0	4
y	2	0