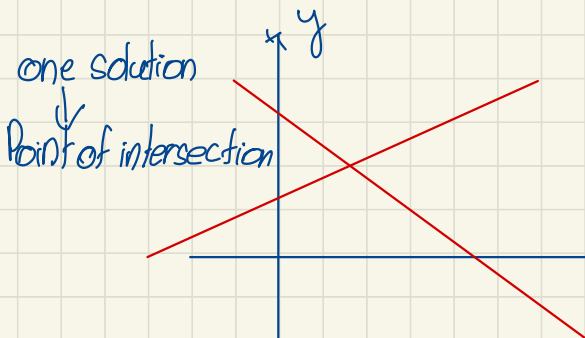


Simultaneous Equations

→ Linear & Linear

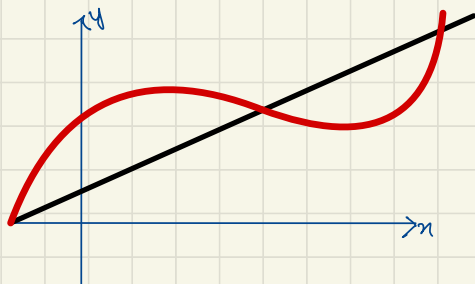


Parallel Lines have no solutions

Non Parallel Lines have one solution

There is a chance where two linear lines can make infinite solutions (shown at the end of the page)

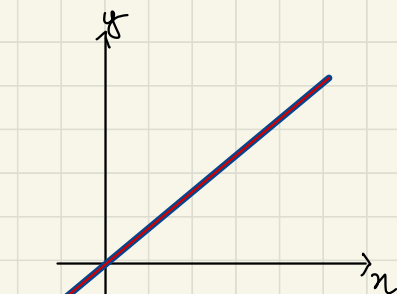
→ Linear & Non Linear



Two Solutions



Three Solutions



— = Line 1
— = Line 2

This is known as
co incident lines

Linear & Linear

- ① Elimination
- ② Substitution

1 →
$$\begin{array}{rcl} x + 2y = 5 & -3 & \text{--- ①} \\ 3x - 5y = -7 & & \text{--- ②} \end{array}$$

→
$$\begin{array}{r} -3x - 6y = -15 \\ + 3x - 5y = -7 \\ \hline -11y = -22 \\ \boxed{y = 2} \end{array}$$

Add

$$\boxed{(1, 2)}$$

$$\begin{array}{rcl} 3x - 5y = -7 & \text{--- ②} \\ 3x - 10 = -7 & \\ 3x = 3 & \\ \boxed{x = 1} & \end{array}$$

2 →

$$\begin{array}{rcl} x + 2y = 5 \\ 3x - 5y = -7 \end{array}$$

$$x = 5 - 2y \rightarrow x = 5 - 2(2)$$

$$3(5 - 2y) - 5y = -7$$

$$\boxed{x = 1}$$

$$15 - 6y - 5y = -7$$

$$\begin{array}{r} -11y = -22 \\ \boxed{y = 2} \end{array}$$

$$\boxed{(1, 2)}$$

Linear and Non Linear

eg1 $y = x^2$
 $y = x + 6$

$$y = x + 6$$

$$x + 6 = x^2$$

$$\begin{aligned} 0 &= x^2 - x - 6 \\ &= x^2 - 3x + 2x - 6 \\ &= x(x-3) + 2(x-3) \\ &= (x-3)(x+2) \end{aligned}$$

$$\begin{aligned} x &= 3 \\ x &= -2 \end{aligned}$$

$$\begin{aligned} y &= x + 6 \\ y &= 3 + 6 \\ y &= 9 \end{aligned}$$

$$\begin{aligned} y &= x + 6 \\ y &= -2 + 6 \\ y &= 4 \end{aligned}$$

eg2:
 $y^2 - 4x = 0$
 $2x + y = 4$

$$y = 4 - 2x$$

$$(4 - 2x)^2 - 4x = 0$$

$$16 - 16x + 4x^2 - 4x = 0$$

$$16 - 20x + 4x^2 = 0$$

$$4x^2 - 20x + 16 = 0$$

$$4(x^2 - 5x + 4) = 0$$

$$x^2 - 4x - x + 4 = 0$$

$$x(x-4) - 1(x-4) = 0$$

$$(x-4)(x-1) = 0$$

$$x = 4 \quad x = 1$$

$$y = 4 - 2(4)$$

$$y = 4 - 8$$

$$y = -4$$

$$y = 4 - 2$$

$$y = 2$$

$$(4, -4), (1, 2)$$

eg3 $\Rightarrow 3s^2 + 2t^2 = 11$

$$3s + 2t = 1$$

$$s = \frac{1-2t}{3}$$

$$\begin{aligned} S &= \frac{1-4}{3} \\ &= -1 \end{aligned}$$

$$\begin{aligned} S &= 1 + \frac{16}{5} \\ &= \frac{21}{5} \end{aligned}$$

$$S = \frac{7}{5}$$

$$(2, -1), \left(\frac{7}{5}, \frac{8}{5}\right)$$

$$3\left(\frac{1-2t}{3}\right)^2 + 2t^2 = 11$$

$$3\left(\frac{1-4t+4t^2}{9}\right) + 2t^2 = 11$$

$$1 - 4t + 4t^2 + 6t^2 = 33$$

$$10t^2 - 4t + 1 = 33$$

$$10t^2 - 4t - 32 = 0$$

$$2(5t^2 - 2t - 16) = 0$$

$$5t^2 - 2t - 16 = 0$$

$$t = 2 \text{ or } t = -\frac{8}{5}$$

$$\text{Q51} \Rightarrow \begin{aligned} x+y &= 2 \\ 2x^2+xy+1 &= 0 \end{aligned}$$

$$y = 2-x \longrightarrow \begin{aligned} y &= 2-1 \\ \boxed{y} &= 3 \end{aligned}$$

$$2x^2 + x(2-x) + 1 = 0$$

$$2x^2 + 2x - x^2 + 1 = 0$$

$$x^2 + 2x + 1 = 0$$

$$x^2 + x + x + 1 = 0$$

$$x(x+1) + 1(x+1) = 0$$

$$(x+1)(x+1) = 0$$

$$\boxed{x = -1}$$

$$\begin{aligned} \text{Q2)} \quad x-5y &= 8 \\ \hookrightarrow x &= 8+5y \\ x &= 8-5 & x &= 8+10 & 64 + 80y + 25y^2 + 9y^2 + 24 + 15y &= 20 + 8y + 5y^2 \\ x &= 3 & x &= -2 & 34y^2 + 45y + 88 &= 30 + 8y + 5y^2 \\ & & & & 29y^2 + 87y + 58 &= 0 \\ & & & & 29y^2 + 29y + 58y + 58 &= 0 \\ & & & & 29y(y+1) + 58(y+1) &= 0 \\ & & & & y &= -1 & y &= -2 \end{aligned}$$

$$\boxed{(3, -1), (-2, -2)}$$