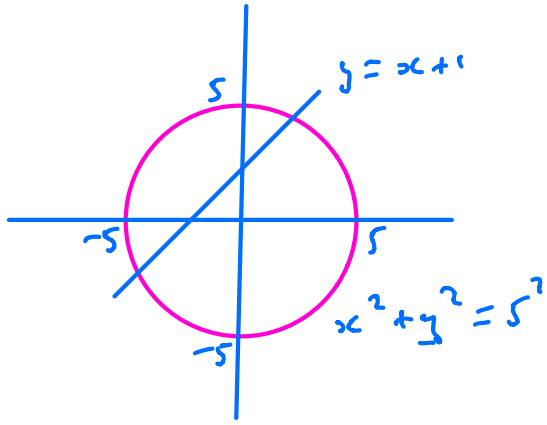
Non-Linear Simultaneous Equations

Ex

$$y = x + 1 \quad (1)$$

$$x^2 + y^2 = 5^2 \quad (2)$$



Sub for y in (2)

$$x^2 + (x+1)^2 = 25$$

$$x^2 + x^2 + 2x + 1 = 25$$

$$2x^2 + 2x - 24 = 0$$

$$x^2 + x - 12 = 0$$

$$(x+4)(x-3) = 0$$

Either $x = -4$ or $x = +3$

$\Rightarrow y = -4+1$ $\quad$ $y = +3+1$

$y = -3$ $\quad$ $y = 4$

Points of intersection

$(-4, -3)$ and $(3, 4)$

or solution to eqns

$$\begin{cases} x = -4 \\ y = -3 \end{cases} \qquad \begin{cases} x = 3 \\ y = 4 \end{cases}$$

Ex2

$$y = x^2 + 3x + 4 \quad (1)$$

$$y = 10x - 6 \quad (2)$$

Sub for y in (1)

$$10x - 6 = x^2 + 3x + 4$$

$$0 = x^2 + 3x + 4 - 10x + 6$$

$$0 = x^2 - 7x + 10$$

$$0 = (x - 2)(x - 5)$$

$$\Rightarrow \quad x = 2 \quad \text{or} \quad x = 5$$

$y = 10(2) - 6$ $\qquad$ $y = 10(5) - 6$

$y = 14$ $\qquad$ $y = 44$

$$\begin{cases} x = 2 \\ y = 14 \end{cases} \qquad \begin{cases} x = 5 \\ y = 44 \end{cases}$$