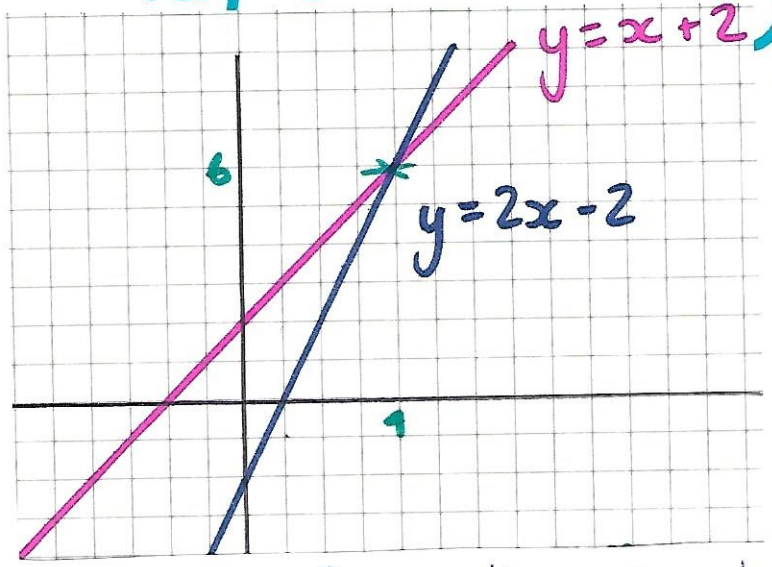
SIMULTANEOUS EQUATIONS

This is when we have 2 equations with 2 different variables but with the same solution for both.

They can be solved Graphically



The 2 Equations
$y = x + 2$
$y = 2x - 2$
meet at coordinate $(4, 6)$
So the solution is $x = 4$
$y = 6$

Without a Graph they can be solved with either

SUBSTITUTION METHOD

Where we substitute the value of the one unknown into the second equation

① $y = x + 1$
② $y + 3x = 21$

substitute $y = x + 1$ into 2nd equation

$(x + 1) + 3x = 21$

Now simplify & solve

$4x + 1 = 21$
$4x = 20 \Rightarrow \underline{x = 5}$

Now substitute $x = 5$ back into ①
$y = 5 + 1$ ∴ $\underline{y = 6}$

$y = 2x - 3$
$2y + 3x =$

If $y = 2x - 3$
$2y = 4x - 6$
subs into ①

$4x - 6 + 3x = 15$

Now simplify & solve

$7x - 6 = 15$
$7x = 21 \Rightarrow \underline{x = 3}$

now substitute $x = 3$ back into ①

$y = (2 \times 3) - 3$
$y = 6 - 3$
$\underline{y = 3}$

ELIMINATION METHOD

By adding or subtracting one equation from the other we eliminate one unknown

① $2x + y = 7$
② $x - y = 2$

add ① to ② to eliminate y

$3x = 9$ ← Now solve
$\underline{x = 3}$

Finally substitute back into ① to find y

$6 + y = 7$ & solve
∴ $\underline{y = 1}$

① $5x + 2y = 8$
② $2x + y = 3$ ×2
③ $4x + 2y = 6$

Multiply the 2nd equation by 2 to get 2y

Now take ③ from ② to eliminate y

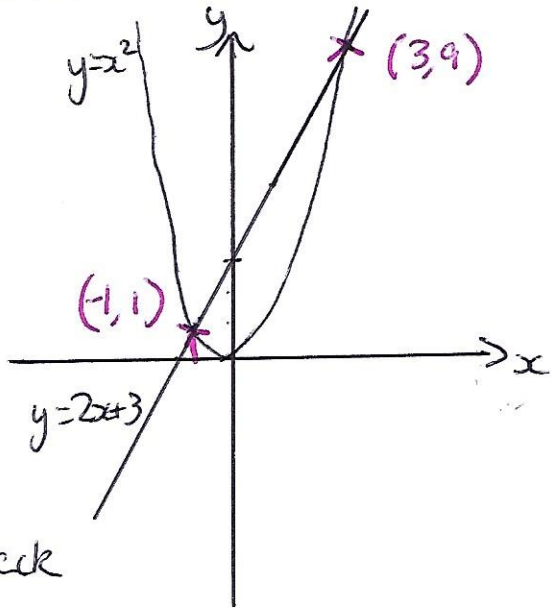
$\underline{x = 2}$

Finally substitute $x = 2$ back into ② to find y

$(2 \times 2) + y = 3$
$4 + y = 3$
$\underline{y = -1}$

Simultaneous Equations

One linear & one non-linear



ie $y = 2x+3$ (1)
$y = x^2$ (2)

- Substitute (2) into (1)

$x^2 = 2x+3$ — now rearrange to get to $=0$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$ factorise & solve

$x = 3$ or $x = -1$

- Now substitute your 2 values of x back into equation (1) to get 2 values of y

$x=3$ $y = 6+3 = 9$ $x=-1$ $y = -2+3 = 1$

So $x=3$ & $y=9$ OR $x=-1$ & $y=1$

When an equation of a circle is involved

equation of a circle $x^2 + y^2 = r^2$ where r = radius

ie $x + 2y = 10$ (1)
$x^2 + y^2 = 25$ (2)

- In equation (1) make x the subject

$x = 10 - 2y$

- Now square it $x^2 = (10-2y)^2 \Rightarrow 100 - 40y + 4y^2$
- Substitute this into equation (2)

$100 - 40y + 4y^2 + y^2 = 25$ ← simplify & make $=0$

$5y^2 - 40y + 75 = 0$

$\div 5$ $y^2 - 8y + 15 = 0$

$(y-3)(y-5) = 0$

So $y = 3$ or $y = 5$

Now substitute back into Eq (1) to get values for x

when $y=3$ $x=4$ $y=5$ $x=0$