A* A B C D

Simultaneous equations 2

If there is an x^2 or y^2 term in a pair of simultaneous equations, you need to solve them using SUBSTITUTION.

$y = x^2 - 2x - 7$ (1)

$x - y = -3$ (2)

Rearrange the linear equation to make one letter the subject.

$y = x + 3$ (3)

Substitute (3) into (1):

$x + 3 = x^2 - 2x - 7$

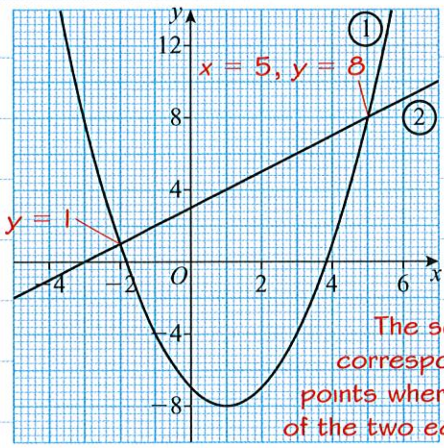
$0 = x^2 - 3x - 10$

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

$x = 5$ or $x = -2$

Each solution for x has a corresponding value of y. Substitute into (3) to find the two solutions.

Solutions are $x = 5$, $y = 8$ and $x = -2$, $y = 1$.



The solutions correspond to the points where the graphs of the two equations cross.

Worked example

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Solve the simultaneous equations

$x - 2y = 1$ (1)

$x^2 + y^2 = 13$ (2)

$x = 1 + 2y$ (3)

Substitute (3) into (2):

$(1 + 2y)^2 + y^2 = 13$

$1 + 4y + 4y^2 + y^2 = 13$

$5y^2 + 4y - 12 = 0$

$(5y - 6)(y + 2) = 0$

$y = \frac{6}{5}$ or $y = -2$

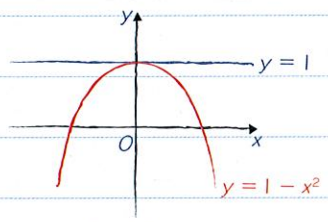
$x = 1 + 2\left(\frac{6}{5}\right) = \frac{17}{5}$ $\quad x = 1 + 2(-2) = -3$

Solutions: $x = \frac{17}{5}$, $y = \frac{6}{5}$ and $x = -3$, $y = -2$.

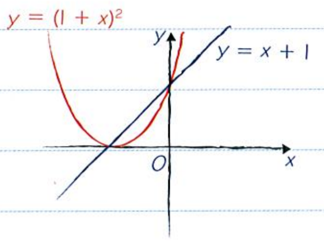
You can substitute for x or y. It is easier to substitute for x because there will be no fractions.
Use brackets to make sure that the whole expression is squared.
Rearrange the quadratic equation for y into the form $ay^2 + by + c = 0$.
Factorise the left-hand side to find two solutions for y.

How many solutions?

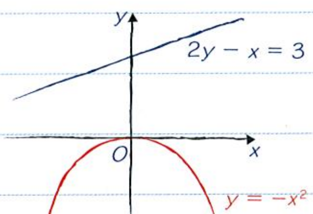
When one equation is linear and the other is quadratic there can be one solution, two solutions or no solutions.



1 solution



2 solutions



0 solutions

Now try this

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edexcel

1. Solve the simultaneous equations
$x^2 + y^2 = 29$
$y - x = 3$ **(7 marks)**

2. Solve the simultaneous equations
$y + 1 = x^2$
$x = y - 1$ **(6 marks)**

grade A*