Simultaneous Equations

Graphical solution

Draw a graph of each equation.
Where the lines cross each other is the solution.
Draw a table or plot 2 points for each line.
Pick where lines cross x and y axes. i.e. when x = 0 and y = 0

<u>Example:</u>

Find the solution of the set of equations

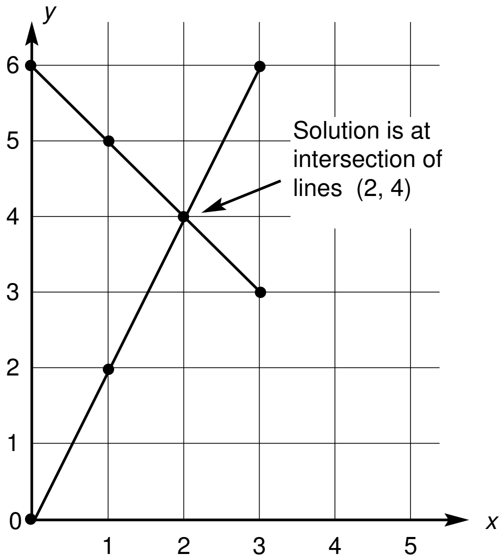
$y = 2x$
$y = 6 - x$

Table for y = 2x

x	0	1	2	3
y	0	2	4	6

Table for y = 6 - x

x	0	1	2	3
y	6	5	4	3



The solution of the equations is at the intersection of the two lines.

The point (2, 4) indicates the solution.

The solution is $x = 2$, $y = 4$

Simultaneous Equations

Solving Simultaneous equations by elimination

This is an algebraic method of solution.
Make sure that the variable are lined up under each other.

Example 1:

Solve the equations:

$$3x + 2y = 8 \quad \ldots (1)$$
$$5x - 3y = 7 \quad \ldots (2)$$

We eliminate one of the variables - in this case we will eliminate y.

Multiply (1) x 3 $\quad 9x + 6y = 24$

Multiply (2) x 2 $\quad 10x - 6y = 14$

Adding $\quad 19x = 38$

$x = 2$

Substitute in (1) $\quad 3(2) + 2y = 8$

$6 + 2y = 8$

$2y = 2$

$y = 1$

Check in (2)

	LHS	RHS
	5(2) - 3(1)	7
	7	

Solution is <u>x = 2</u> and <u>y = 1</u>

Summary

The aim is to multiply one or both equations by a positive or negative number so that when you add or subtract the two equations, one of the variables is eliminated.

It does not matter which variable you eliminate. Choose the easiest.

Substitute back into either of the original equations to find the other variable.

Check by substituting in the remaining original equation, to make sure your solutions satisfy the equation.

Give solution as x = _______ and y = ________ *(or whatever the variables are)*

Interpret the solution if the equation is a means of solving a problem.

Simultaneous Equations

Solving problems using Simultaneous Equations

This is an algebraic method of solution.

Example 1:

David buys 3 burgers and two portions of fries; he pays £6.85
Amy buys 2 burgers and 3 portions of fries; she pays £5.90

a) What is the cost of a burger ?
b) What is the cost of a portion of fries ?

Hint: Work in pence - not pounds.

Let the cost of a burger be x pence
Let the cost of a portion of fries be y pence

	$3x + 2y$	=	685	. . . (1)
	$2x + 3y$	=	590	. . . (2)
multiply (1) x -2	$-6x - 4y$	=	-1370	
multiply (2) x 3	$6x + 9y$	=	1770	
adding	$5y$	=	400	
	y	=	80	
substitute for y in (1)	$3x + 160$	=	685	
	$3x$	=	525	
	x	=	175	

So **burger costs £1.75** and a **portion of fries costs 80p**

Example 2:

Angus hires a boat for 5 days and used 80 litres of diesel. The total cost was £181.
Robbie hires the boat for 4 days and used 60 litres of diesel. His bill was £142.
Let the daily cost of the boat be £ d per day and the cost of a litre of diesel be £ p.

Write down two equations in d and p which satisfy these two conditions.

	$5d + 80p$	=	181	. . . (1)
	$4d + 60p$	=	142	. . . (2)
multiply (1) x 4	$20d + 320p$	=	724	
multiply (2) x -5	$-20d - 300p$	=	-710	
adding	$20p$	=	14	So $p = 14 \div 20 = 0.7$
substitute in (1)	$5d + 80x\ (0.7)$	=	181	
	$5d$	=	181 - 64	So d = 25

Cost of boat is £25 per day. Diesel costs 80 pence per litre.