Guidance for tutors

The table below outlines useful information for tutors as well as some suggested approaches and resources.

Outcome	AG1	**Student can consistently:**	Draw linear graphs and use them to solve equations.
How the topic is examined	▯ Examined through test paper questions. ▯ Questions are equally likely to appear on calculator or non-calculator papers. ▯ These questions involve drawing graphs of linear functions. ▯ For the majority of questions students will be given an equation of a graph to draw and then a grid on which to plot the points. Very occasionally students will have to draw their own axes. ▯ Over time these questions have become less structured. Whereas previously students have been given a table of values to complete, there is a move towards students creating their own table of tables.		
Prior knowledge	▯ Students should be confident with: ○ Negative numbers ○ Substitution (AEx5) ▯ In addition questions involving this topic can have links to: ○ Straight line graphs.		
Suggested tuition approaches	▯ Any straight line graph can be written in the form $=+$ (e.g. $=3-1$). ▯ Students need to understand what this means (e.g. $=3-1$ means multiply each value by 3 and then subtract 1. This will give the value. Although this seems quite basic, students do struggle to understand this and so it is worthwhile spending time understanding what an equation means. ▯ The majority of graphs that students will be asked to draw are presented in this form. Occasionally equations are presented slightly differently (e.g. $2-3=6$) and students may have to rearrange first or find points that fit the equation ▯ In order to draw a straight line there are several methods that students might come across. The table method below is the most common method used and students need to be aware of it as often questions can ask for a table to be completed before drawing the graph. If the question doesn't stipulate to use a table then students can use any of these methods.		

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Using a table

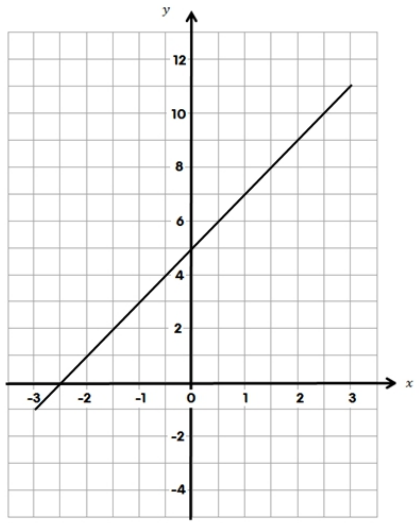
The most common method for drawing graphs is to firstly make a table of and values. This may already have been done for you.

$= 2 + 5$

	-3	-2	-1	0	1	2	3
	-1	1	3	5	7	9	11

This table could be presented vertically too.

Students then plot the points on a grid.



Finding points

Some students prefer to simply find sets of co-ordinates that satisfy a given equation

$= 2 + 5$

For example when $= 2$, $= 9$

etc…

This is a less organized version of presenting results in a table.

Although you only need two points to draw a straight line. It is useful to find three points and use one of them as a check.

This method is more useful for equations of the form

$$2 - 3 = 4$$

For example if x = 5 then y = 2 (so (5, 2) is a point on the line. Students find it easier to do this rather than make a table of values for such a function.

Expanding a bracket

Some students use knowledge of the

general straight line $= + b$

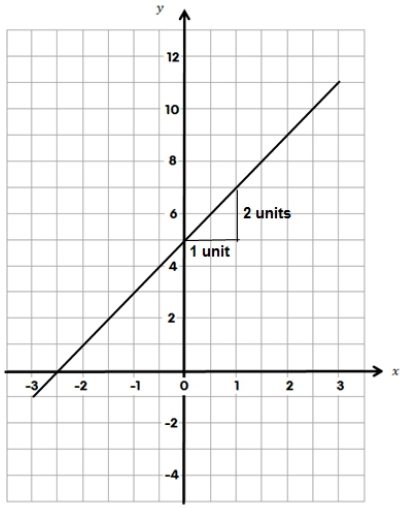
draw this.

We know that is the gradient and is the point where it crosses the - axis.

$= 2 + 5$

This means that the graph crosses the -axis at 5 and the gradient of the line is 2.

A gradient of 2 means that for every 1 unit of the -axis the graph increases by 2 on the -axis.



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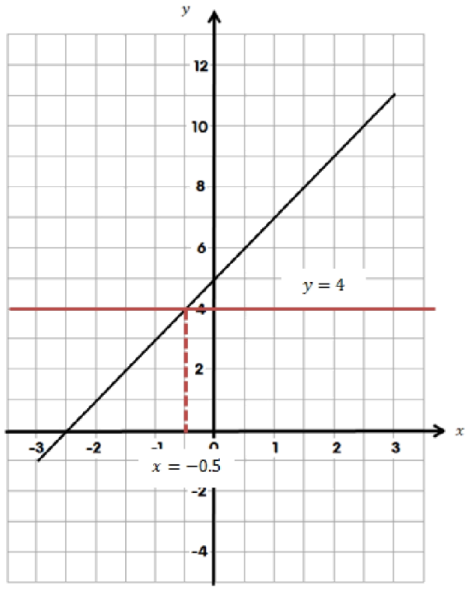
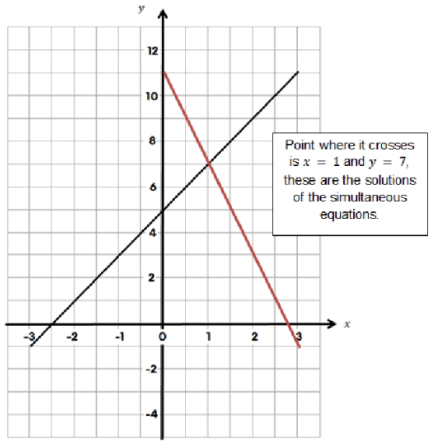
- Students may be asked to use a graph to solve an equation.

Using the graph to solve an equation where it equals a number	Solving a pair of simultaneous equations using a graph
If students are given a graph (e.g. $= 2 + 5$) and then asked to solve an equation where the graph equals a number (e.g. Use your graph to solve $2 + 5 = 4$) 1. Draw the straight (horizontal line) $= 4$ 2. The co-ordinate of the point where the line drawn meets the graph is the solution to the equation. 	If students are asked to solve the following pair of simultaneous equations using graphs $= 2 + 5$ $= 11 - 4$ 1. Draw each graph on the grid given (use one of the methods above) 2. The point where the two points cross is the x and y value of the solution to the equation The equation may be presented in a different way eg. $2 + 5 = 11 - 4$ 

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Common errors and misconceptions	Students get the wrong values when substituting into the equation. This particularly happens with negative values. Encourage students to substitute positive values in first and see if they can spot a pattern. Often when a student plots the points they have they don't end up with a straight line. They must go back and look at the values – particularly ones that don't seem to fit the general pattern of the line. If they check and still cannot see why they are wrong, encourage them to put a straight line in regardless and ignore the points that seem out of place. When a question is less structured, students don't always take a strategic approach and can try to draw straight onto the graph without first thinking. Encourage them to use one of the methods described above. When students are asked to solve an equation using a graphical method, they should use the graph and not solve it algebraically. They could of course solve it algebraically to check their answer.
Suggested resources	Questions ○ http://www.cimt.org.uk/projects/mepres/allgcse/bkc13.pdf (pp 9 -17) ○ https://corbettmaths.files.wordpress.com/2013/02/drawing-linear-graphs-pdf.pdf Video Tutorials ○ http://corbettmaths.com/2012/12/23/drawing-graphs-using-xy-tables/ ○ http://corbettmaths.com/2013/04/20/drawing-graphs-using-gradient-and-intercept/ Past GCSE Questions ○ https://keshgcsemaths.files.wordpress.com/2013/11/66_straight-line.pdf