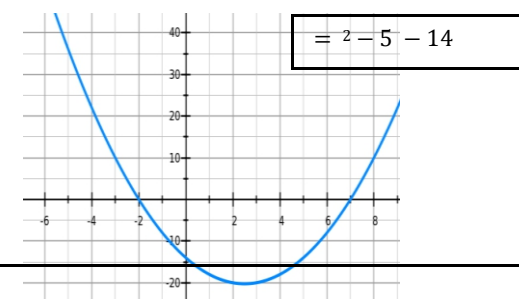


Guidance for tutors

Outcome	AG5	Student can consistently:	Draw quadratic graphs and use them to solve equations.
How the topic is examined	<ul style="list-style-type: none"> Examinated through test paper questions. Questions are equally likely to appear on calculator or non-calculator papers. <small>These questions involve drawing graphs of quadratic (-1) functions.</small> 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. It is likely for these questions that students will be given a partially completed table of values. Supplementary questions can ask students to solve an equation using a graph. 		
Prior knowledge	<ul style="list-style-type: none"> Students should be confident with: <ul style="list-style-type: none"> Expanding brackets (AEx1) Simplifying expressions (AEx2) Negative numbers Substitution (AEx5) In addition questions involving this topic can have links to: <ul style="list-style-type: none"> Solving quadratic equations (AEq6) (AEq7) Transformation of graphs (AG10) 		
Suggested tuition approaches	<ul style="list-style-type: none"> Students could be asked to draw any quadratic equation of the form $y = x^2 + bx + c$ A partially completed table will usually be provided for students to complete before drawing the graph. Students should then plot the resulting points. Quadratic graphs take the following shape. If you are asked to solve the equation $x^2 - 5x - 14 = 0$ you would look at where the graph crosses the x-axis. The points $x = 7$ and $x = -2$ are the solutions of the equation. <p>Students can get the same answers if they factorised (AEq6)</p>		



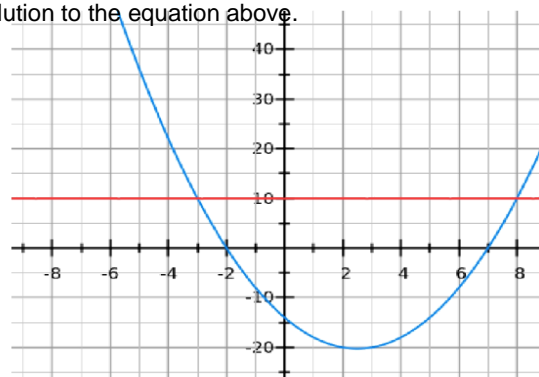
Guidance for tutors

□ Graphs can be used to solve other equations, for example:

Solve the equation $x^2 - 5x - 14 = 10$

When a quadratic equation equals a number other than 0, draw the line $y = 10$.

The co-ordinates of the points where the graphs cross gives the solution to the equation above.



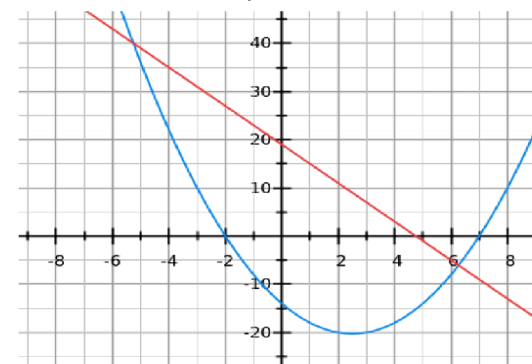
The two solutions are $x = 8$ and $x = -8$

You can check these points by substituting into the equation and checking the answer is 10 for each value.

Solve the equation $x^2 - 5x - 14 = 19 - 4x$

To solve this equation you would draw the graph $y = 19 - 4x$ on the same as the original quadratic.

The co-ordinates of the points where the graphs cross gives the solution to the equation above.



The two solutions appear to be approximately $x = 6.3$ and $x = -5.3$

You can check these points by substituting into the equation and checking the answer is equivalent for both sides.

Guidance for tutors

	<ul style="list-style-type: none"> <input type="checkbox"/> When drawing the graphs, points should be connected with a nice smooth curve. <input type="checkbox"/> The curve should look rounded rather than pointed.
Common errors and misconceptions	<ul style="list-style-type: none"> <input type="checkbox"/> Students get the wrong values when substituting into the equation. This particularly happens with negative values. Remind students that when they square a negative value the answer is positive. <input type="checkbox"/> Some students try to use pattern spotting to complete the values. This should be done with caution as they don't follow a linear pattern like linear graphs. The pattern is with the second difference. <input type="checkbox"/> Substituting into quadratic expressions can lead to a few mistakes. E.g. find 5^2 when $x = 2$. A common wrong answer is 100 as students multiply by 5 first and then square their answer. Instead it is only the x that is squared, so students should square 2 and then multiply by 5. <input type="checkbox"/> If using a calculator you should put negative numbers in brackets as this often can lead to wrong answer if they don't. <small>For example when typing into a calculator they should use brackets around negative numbers (e.g. -10^2).</small> calculator would give the answer -9 if a student just typed in -3^2 <input type="checkbox"/> Often when a student plots the points they have they don't end up with a graph that looks like the ones above and it has points that don't make it appear smooth. If this is the case encourage students to go back and check their working. <input type="checkbox"/> Students sometimes connect points with straight lines. Students need to connect points with a nice smooth curve.
Suggested resources	<ul style="list-style-type: none"> <input type="checkbox"/> Questions <ul style="list-style-type: none"> <input type="checkbox"/> http://www.cimt.org.uk/projects/mepres/allgcse/bkc13.pdf (pp 17 - 25) <input type="checkbox"/> http://www.cimt.org.uk/projects/mepres/allgcse/pr13-sa.pdf (pp 48 - 54) <input type="checkbox"/> https://corbettmaths.files.wordpress.com/2013/02/drawing-quadratics-pdf.pdf <input type="checkbox"/> Past GCSE Questions

Guidance for tutors

- 
 - https://keshgcsemaths.files.wordpress.com/2013/11/68_drawing-quadratic-graphs.pdf
- Video tutorial
 - <http://corbettmaths.com/2013/06/23/drawing-quadratics/>