

Outcome	AEx10	Student can consistently:	Complete the square for an algebraic expression
How the topic is examined	<ul style="list-style-type: none"> <li>• Examined through test paper questions.</li> <li>• Questions are equally likely to appear on calculator or non-calculator papers.</li> <li>• It is unlikely to ask students to 'complete the square'. Instead it will ask students to write a given quadratic expression in the form <math>(x + a)^2 + b</math>. A supplementary question usually then asks to state the values of a and b.</li> <li>• In the previous GCSE, questions on this topic were quite rare, but it is likely that these questions will get more emphasis on the new GCSE.</li> </ul>		
Prior knowledge	<p>Students should be confident with:</p> <ul style="list-style-type: none"> <li>○ Expanding brackets (AEx1)</li> <li>○ Simplifying expressions (AEx2)</li> <li>○ Factorising simple expressions (AEx4)</li> <li>○ Factorising quadratic expressions (AEx7)</li> <li>○ Multiplying and dividing fractions</li> </ul> <p>In addition questions involving this topic can have links to:</p> <ul style="list-style-type: none"> <li>○ Solving algebraic fraction equations.</li> </ul>		
Suggested tuition approaches	<ul style="list-style-type: none"> <li>• Students should be made aware that completing the square is one of the most useful methods when working with quadratic expressions.</li> <li>• Completing the square for a quadratic function has multiple uses: <ul style="list-style-type: none"> <li>• It allows you to go and solve equations.</li> <li>• You can use it to prove the quadratic formula (AEq7)</li> <li>• You can use it to sketch a quadratic graph and determine the line of symmetry and co-ordinates of the turning point.</li> <li>• You can use it to rearrange more complicated formulae.</li> </ul> </li> <li>• Students might be interested to know why it is called completing the square. The following link gives a nice visual explanation. <a href="https://en.wikipedia.org/wiki/Completing_the_square">https://en.wikipedia.org/wiki/Completing_the_square</a></li> </ul>		

- The steps involved in completing the square are outlined below.

<p><b><u>Step 1</u></b></p> <p>Halve the middle term (x term) – the coefficient of this becomes the 'a' in the bracket.</p>	<p>Write <math>x^2 - 8x + 3</math> in the form <math>(x + a)^2 + b</math></p> <p>Halve the coefficient of the <math>x</math> term and this is the value of a</p> $(x - 4)^2$
<p><b><u>Step 2:</u></b></p> <p>Now square this value and subtract this value.</p>	<p>If we square -4, you get 16 (note you will always get a positive answer here)</p> <p>We now subtract 16 from our expression</p> $(x - 4)^2 - 16$
<p><b><u>Step 3</u></b></p> <p>Bring down the constant term from the original expression.</p>	<p>The constant term in the original expression was +3</p> $(x - 4)^2 - 16 + 3$
<p><b><u>Step 4</u></b></p> <p>Simplify your expression.</p>	$(x - 4)^2 - 13$ <p>You may be asked to state the values of a and b. If you compare them to the form you want <math>a = -4</math> and <math>b = -13</math></p>

- You can check your answer by expanding out your answer and check that it equals what you were given to start with.
- Students can then write down the values of a and b.
- Note that you could be asked to write the expression in the form  $(x - a)^2 + b$  or  $(x + a)^2 - b$  or  $(x - a)^2 - b$ , these are all the same. It is just the signs of the values of a and b that could change.

<b>Common errors and misconceptions</b>	<ul style="list-style-type: none"> <li>Students often forget to bring down the constant term from the original expression.</li> <li>Students can get the sign associated with a and b wrong when asked to state them. Be careful to check the signs of a and b in the required form. For example if our example asked to write the given expression in the form <math>(x - a)^2 - b</math> then <math>a = 4</math> and <math>b = 13</math>.</li> </ul>
<b>Suggested resources</b>	<ul style="list-style-type: none"> <li>Questions <ul style="list-style-type: none"> <li><a href="http://www.cimt.org.uk/projects/mepres/allgcse/pr10-es.pdf">http://www.cimt.org.uk/projects/mepres/allgcse/pr10-es.pdf</a> (pp 75 - 77)</li> <li><a href="https://corbettmaths.files.wordpress.com/2013/02/completing-the-square-exercise-10-pdf.pdf">https://corbettmaths.files.wordpress.com/2013/02/completing-the-square-exercise-10-pdf.pdf</a></li> </ul> </li> <li>Past GCSE Questions <ul style="list-style-type: none"> <li><a href="https://corbettmaths.files.wordpress.com/2013/02/completing-the-square-pdf1.pdf">https://corbettmaths.files.wordpress.com/2013/02/completing-the-square-pdf1.pdf</a></li> </ul> </li> <li>Video tutorial <ul style="list-style-type: none"> <li><a href="http://corbettmaths.com/2013/12/29/completing-the-square-video-10/">http://corbettmaths.com/2013/12/29/completing-the-square-video-10/</a></li> </ul> </li> </ul>