<table>
<tr><td>Outcome</td><td>AEx11</td><td>Student can consistently:</td><td>Expand three or more linear expressions</td></tr>
<tr><td>How the topic is examined</td><td colspan="3">

Examined through test paper questions.
Questions are equally likely to appear on calculator or non-calculator papers.
This is a new topic to the GCSE this year and it is hard to predict how this topic will be examined or even how likely something like this is going to come up. The question is likely to say ‘Expand and simplify’
This topic provides a nice stepping stone to the binomial expansion.

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<tr><td>Prior knowledge</td><td colspan="3">

Students should be confident with:

Expanding brackets (AEx1)
Simplifying expressions (AEx2)

In addition questions involving this topic can have links to:

Binomial expansion.

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<tr><td>Suggested tuition approaches</td><td colspan="3">

Students may already be confident in expanding two sets of brackets (AEx1) and simplifying the resulting expression.
Double brackets

Students multiply each term in the first bracket by each term in the second bracket.
To do this there are a variety of methods that students use to ensure they do not miss any terms.

<table>
<tr><th>FOIL</th><th>Smiley face</th><th>Gird method</th></tr>
<tr><td>FOIL stands for First, Outside, Inside, Last.

Multiply first terms first
Multiply outside terms
Multiply inside terms
Multiply last terms
</td><td>This is essentially the FOIL method, but has arrows on the expression so that it ends up looking like a smiley face.</td><td>Many students are used to grid multiplication and so this has been extended to algebraic terms. This method is best if there are more than two terms in each bracket.</td></tr>
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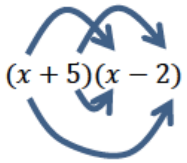
	$(x+5)(x-2)$ F : $x \times x = x^2$ O : x x -2 = -2x I : $5 \times x = 5x$ L: 5 x -2 = -10  $= x^2 - 2x + 5x - 10$ |	x | +5 | | x | x^2 | $+5x$ | | -2 | $-2x$ | -10 |

- In these questions students will be given three or more brackets to expand. It is unlikely that students would be given more than three brackets to expand as the activity is time consuming and is inefficient.
- Expand two pairs of brackets is the basis for expanding more. If a student is asked to expand (x + 5)(x + 3)(x − 7), here are the steps they should follow:
  - Expand the first two pairs of brackets (x + 5)(x + 3) and simplify your answer $x^2 + 8x + 15$
  - Now multiply this result by the final bracket from the original question ($x^2 + 8x + 15$)(x − 7)
  - Remember students need to multiply each term in the first bracket by each term in the second bracket. This time it is a little more complicated because you have three terms in the first bracket. Methods 1 and 2 in the table above won't work for this, so you can either use method 3 or simply take a systematic approach and list the terms. Ensure you simplify the final answer.

$$x^3 - 7x^2 + 8x^2 - 56x + 15x - 105 = x^3 + x^2 - 41x - 105$$

- Students should be aware that these questions could be presented as a power function (e.g. Expand and simplify $(2x - 1)^3$. In this case students should think about this as three linear expressions side by side (2x − 1)(2x − 1)(2x − 1)

Common errors and misconceptions

- The biggest error that students make on these questions is that they lose track of what they have done or make basic errors when multiplying out. Encourage students to take their time and take a systematic approach to expanding.
- Students add or subtract instead of multiplying, particularly when getting the last term.
  - (x + 5)(x − 3) = a common mistake for the last term would be to write + 2 (i.e. they have done 5 – 3)
- For expressions like $(x - 3)^3$ or $(3x - 5)^4$ students don't realise this is a multiple bracket expansion.
- When expanding three or more brackets, students try and do it all at once and this leads to errors. Encourage students to do two pairs of brackets at a time, work through it slowly and then simplify their answer after each expansion.
- Students make errors when simplifying (see AEx2).

- Questions
  - https://corbettmaths.files.wordpress.com/2013/02/expanding-three-brackets-exercise-15-pdf.pdf
- Past GCSE Questions
  - https://corbettmaths.files.wordpress.com/2013/02/expanding-three-brackets-pdf.pdf
- Video tutorial
  - http://corbettmaths.com/2013/12/27/expanding-three-brackets-video-15/