Guidance for tutors

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

Outcome	AEq1	**Student can consistently:**	Solve linear equations, involving ones with brackets.
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 finding the value of the unknown. • It is possible that students might have to use information or a diagram given to form an equation to solve.		

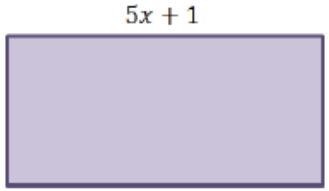
Prior knowledge	• Students should be confident with:
	  o Negative numbers
	  o Expanding brackets (AEx1)
	  o Simplifying expressions (AEx2)
	• In addition questions involving this topic can have links to:
	  o Area and perimeter
	  o Angles		

Suggested tuition approaches

- Students should understand that solving equations means that they are looking to find the unknown (which is likely to be a letter).
- There are different methods that students use to do this
  - Inverse functions (see AEx8 for notes on this topic)
  - Balancing
  - Tricks (e.g. change side, change sign)
- For students who are aiming for a top grade and thinking about studying maths beyond GCSE they need to avoid using tricks and try and use one of the other methods, preferably the balancing method.
- When solving equations, students should look to take a systematic approach. They should show all their working out, showing clearly what they are doing at each step (shown in brackets below)
- Encourage students to keep the equals signs lined up to make the solution clear.
- The table below shows the most common examples of problems that come up.

Simple equation	Unknown on both sides	Expanding a bracket
$3x - 5 = 10$	$7x + 10 = 2x - 8$	$2(3p - 2) = 7 - 5p$
$(+5)$	$(-2x)$	Expand
$3x = 10 + 5$	$5x + 10 = -8$	$6p - 4 = 7 - 5p$
$3x = 15$	(-10)	$(+5p)$
$(\div 3)$	$5x = -8 - 10$	$11p - 4 = 7$
$x = \frac{15}{3}$	$5x = -18$	$(+4)$
$x = 5$	$(\div 5)$	$11p = 7 + 4$
	$x = \frac{-18}{5}$	$11p = 11$
	$x = -3.6$	$(\div 11)$
		$p = \frac{11}{11}$
		$p = 1$

- Students can leave their solutions as fractions if they find it easier, although any solutions that work out to be a whole number should be evaluated.
- GCSE problems are increasingly asking students to form their own equation first before solving. The majority of problems tend be associated with area, perimeter and angle properties. Here are a couple of examples of the type that might come up. The starting point with problems like this is to work out the fact you are using.



Find the value of x

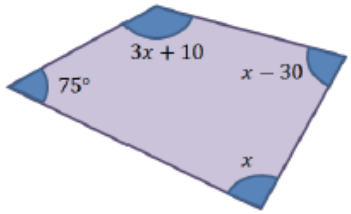
The fact we are using here is that in a rectangle these two sides are equal.

$5x + 1 = 3x + 9$

$(-3x)$ $\quad 2x + 1 = 9$

(-1) $\quad 2x = 8$

$(\div 2)$ $\quad x = 4$



Find the value of x

The fact we are using here is that angles in a quadrilateral add up to 360°

$5x + 55 = 360$

(-55) $\quad 5x = 305$

$(\div 5)$ $\quad x = 61$

Common errors and misconceptions

- Students tend to make a range of mistakes when solving equations
  - They don't balance correctly (e.g. they add on instead of subtracting etc…). They need to think about doing the opposite. A lot of these mistakes happen when students become complacent; they need to take their time.
  - They struggle with the number work without a calculator. Encourage students to leave their final answer as a fraction if it does not cancel equally. They will always be given full marks for this.
  - They struggle when solutions include negatives.
- Students struggle to form equations for the more problem solving style questions, where they have to form their own equation. To help this, students need to work through lots of different problems.
- Students don't show working and their presentation leaves a lot to be desired. To avoid this always stress the importance of presentation and showing the steps in their working.

Suggested resources	

	• Questions
	  o http://www.cimt.org.uk/projects/mepres/allgcse/bkb10.pdf (pp 191-197)
	  o https://www.tes.co.uk/teaching-resource/solving-equations-worksheets-6117293 (free account required)
	  o https://www.tes.co.uk/teaching-resource/algebra-problem-solving-questions--probs-1-to-10-7000280
	• Video Tutorials
	  o https://www.khanacademy.org/math/algebra-basics/core-algebra-linear-equations-inequalities/core-algebra-solving-basic-equations/v/one-step-equations
	• Past GCSE Questions
	  o https://keshgcsemaths.files.wordpress.com/2013/11/59_algebra_solving.pdf