Outcome	AEq10	Student can consistently:	Solve a pair of simultaneous equations where one expression is linear and one is quadratic.
How the topic is examined			

How the topic is examined	- Examined through test paper questions. - Questions are equally likely to appear on calculator or non-calculator papers. - Students are asked to "Solve" or "Solve the pair of equations." An algebraic approach is expected to be taken. - In these questions students will be given a linear equation and a quadratic equation (including equations like $x^2 + y^2 + 3xy = 15$)
Prior knowledge	- Students should be confident with: - Simplifying expressions (AEx2) - Substituting into expressions (AEx5) - Solving basic equations (AEq1) - Solving quadratic equations (AEq6, Eq7, Eq9) - Solving simultaneous equations (AEq8) - In addition questions involving this topic can have links to: - Solving quadratic equations using graphs.
Suggested tuition approaches	- When solving a pair of simultaneous equations students need to understand that they are trying to find both unknowns (usually x and y). The values of these unknowns should satisfy both equations and not just one of them. - Students must use an algebraic method to solve simultaneous equations. Sometimes students try to use a trial and error method to find the solutions. - There are two methods that are generally used to solve a pair of simultaneous equations of this type. - Substitution - Equating the equations - Both are acceptable algebraic methods and will lead to the correct answers. Indeed it is easy to argue that the equating method is substitution.

Substitution	Equating
Solve $2x + y = 5$ $x^2 + y^2 = 25$	Solve $y = x^2 + x - 5$ $y = 5x$

- Substitution method:
  - You can see in this example you have both an x^2 and y^2 term, indeed you might also get an xy term too. The method of equating the equations would not work in that instance.
  - Rearrange the linear equation so that either x = or y =
  - Substitute this rearranged equation into the equation with the quadratic term.
  - Expand, Simplify and rearrange to you have an equation equal to 0
  - Solve this equation (there are usually two values to find)
  - Find the corresponding value(s) of the other unknown using the linear equation.

- Equating method:
  - You can see in this example both equations start (or can be rearranged to start $y =$) and there are no y^2 terms or xy terms.
  - If not done so already rearrange both equations so y =
  - Put these two equations equal to each other.
  - Simplify and rearrange so that you have an equation equal to 0
  - Solve this equation (there are usually two values to find)
  - Find the corresponding value(s) of the other unknown using the linear equation.

- Answers should always be checked whether or not they are correct by substituting the two sets of values into the quadratic equation and see if they work out. If they don't students need to go back and check their working out.
- These equations in GCSE exams should lead to two pairs of solutions or one repeated pair (where the numbers are the same)

Common error and misconceptions	- Students use the wrong method - These problems are worth a significant number of marks in an exam, therefore they involve lots of working out and there is great room for error. Students should take their time and work through the question methodically. - The most common areas where students make mistakes with algebra are: - Rearranging the equation so that it equals 0 - Expanding expressions like $(2x + 1)^2$, remember this needs to be thought of as $(2x + 1)(2x + 1)$ - Solving the quadratic equation (See notes in AEx6, 7 and 9) - Working with negatives. - Sometimes students work out two correct values for one of the letters and then forget to work out the corresponding values for the other letter.
Suggested resources	- Questions - https://corbettmaths.files.wordpress.com/2013/02/simultaneous-equations-non-linear-pdf.pdf - Past GCSE Questions - https://keshgcsemaths.files.wordpress.com/2013/11/101_simultaneous-equations-with-a-quadratic.pdf - Video tutorial - http://corbettmaths.com/2013/05/07/simultaneous-equations-linear-and-quadratic/