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| **UNIT 9: Algebra: Solving quadratic equations and inequalities, solving simultaneous equations algebraically** |

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**SPECIFICATION REFERENCES**

N1 order positive and negative integers, decimals and fractions; use the symbols =, ≠, <, >, ≤, ≥

N8 calculate exactly with … **surds**; … **simplify surd expressions involving squares   
(e.g. √12 = √(4 × 3) = √4 × √3 = 2√3)**

A4 simplify and manipulate algebraic expressions (including those involving surds …) by: … **factorising quadratic expressions of the form *ax*2 + *bx* + *c***

A5 understand and use standard mathematical formulae; rearrange formulae to change the subject

A9 … find the equation of the line through two given points, or through one point with a given gradient

A11 identify and interpret roots … of quadratic functions algebraically …

A18 solve quadratic equations **(including those that require rearrangement)** algebraically by factorising, **by completing the square and by using the quadratic formula**; …

A19 solve two simultaneous equations in two variables (linear/linear **or linear/quadratic**) algebraically; find approximate solutions using a graph

A21 … derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution.

A22 solve linear inequalities in one **or two** variable**(s)**, **and quadratic inequalities in one variable**; represent the solution set on a number line, **using set notation and on a graph**

**PRIOR KNOWLEDGE**

Students should understand the ≥ and ≤ symbols.

Students can substitute into, solve and rearrange linear equations.

Students should be able to factorise simple quadratic expressions.

Students should be able to recognise the equation of a circle.

**KEYWORDS**

Quadratic, solution, root, linear, solve, simultaneous, inequality, completing the square, factorise, rearrange, surd, function, solve, circle, sets, union, intersection

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| **9a. Solving quadratics and simultaneous equations**  (N8, A4, A5, A9, A11, A18, A19, A21) | **Teaching time**  6-8 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Factorise quadratic expressions in the form *ax*2 + *bx* + *c*;
* Set up and solve quadratic equations;
* Solve quadratic equations by factorisation and completing the square;
* Solve quadratic equations that need rearranging;
* Solve quadratic equations by using the quadratic formula;
* Find the exact solutions of two simultaneous equations in two unknowns;
* Use elimination or substitution to solve simultaneous equations;
* Solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns:
* linear / linear, including where both need multiplying;
* linear / quadratic;
* linear / *x*2 + *y*2 = *r*2;
* Set up and solve a pair of linear simultaneous equations in two variables, including to represent a situation;
* Interpret the solution in the context of the problem;

**POSSIBLE SUCCESS CRITERIA**

Solve 3*x*2 + 4 = 100.

Know that the quadratic formula can be used to solve all quadratic equations, and often provides a more efficient method than factorising or completing the square.

Have an understanding of solutions that can be written in surd form.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Problems that require students to set up and solve a pair of simultaneous equations in a   
real-life context, such as 2 adult tickets and 1 child ticket cost £28, and 1 adult ticket and 3 child tickets cost £34. How much does 1 adult ticket cost?

**COMMON MISCONCEPTIONS**

Using the formula involving negatives can result in incorrect answers.

If students are using calculators for the quadratic formula, they can come to rely on them and miss the fact that some solutions can be left in surd form.

**NOTES**

Remind students to use brackets for negative numbers when using a calculator, and remind them of the importance of knowing when to leave answers in surd form.

Link to unit 2, where quadratics were solved algebraically (when *a* = 1).

The quadratic formula must now be known; it will not be given in the exam paper.

Reinforce the fact that some problems may produce one inappropriate solution which can be ignored.

Clear presentation of working out is essential.

Link with graphical representations.