Title: Quadratics

Key Knowledge/Prior Learning KS2/3 and Retrieval and Suggested Starters

- simplifying expressions involving sums, products and powers, including the laws of indices
- Solve linear equations in one unknown algebraically <u>including those with the unknown on both sides of the equation</u>
- Find approximate solutions using a graph
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KS4 National Curriculum – what students will be practicing

- Simplify and manipulate algebraic expressions (<u>including those involving surds</u>) by:
  - <u>expanding products of two binomials</u>
  - <u>factorising quadratic expressions of the form `x^2 + bx + c` including the difference of two squares</u>
  - <u>expanding products of two **or more** binomials</u>
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- <u>Solve quadratic equations **(including those that require rearrangement)** algebraically by factorising</u>, **by completing the square and by using the quadratic formula**
- <u>Find approximate solutions using a graph</u>
- Recognise, sketch and interpret graphs of linear and quadratic functions
- <u>Identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically</u> **and turning points by completing the square**

Specific Ambitious Knowledge

Key Vocabulary/Literacy Opportunities

- Coefficient
- Quadratic
- Roots
- Sketch
- Turning points
- Complete the square
- Difference of two squares

Key Formulae/Knowledge

A root is a **solution** to a **quadratic equation** when it is set **equal to zero**. This means roots are the points at which a quadratic $ax^2 + bx + c$ crosses the x axis.

A turning point is the place on a curve where it **changes direction**. At the turning point, the gradient is 0.

For example, look at the following graph, which shows the equation $y = x^2 - 4x + 3$:
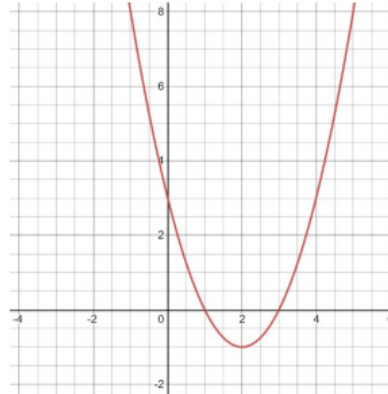
Using the graph, we can locate the turning point at $(2, -1)$, as this is where the curve changes direction.

Solving quadratic equations using the quadratic formula (Higher only)

The quadratic formula can also be used to solve quadratic equations. The quadratic formula is

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

And gives solutions to quadratic equations in the form

$$ax^2 + bx + c = 0.$$

Maths in Context (Historical, Real Life and Student Thinking Points)

The Persian mathematician **Muhammad Al-Khwarizmi** (محمد بن موسى الخوارزمي, 780 – 850) lived during the golden age of the Muslim Abbasid regime in Baghdad. He worked at the "House of Wisdom", which contained the first large collection of academic books since the destruction of the Library of Alexandria.

Al-Khwarizmi has been called the "Father of algebra" – in fact, the word *algebra* comes from the Arabic title of his most important book: "The Compendious Book on Calculation by Completion and Balancing". In it, he showed how to solve linear and quadratic equations, and for many centuries, it was the main mathematics textbook at European universities.

Al-Khwarizmi also worked in astronomy and geography, and the word "algorithm" is named after him.

Projects/Enrichment/Investigations
Difference of Two Squares   **Factorising with Multilink**   **Square Number Surprises**