

Year 10 Maths Learning Outcomes

Unit 1: Investigating Properties of Shapes

- Appreciate that the ratio of corresponding sides in similar triangles is constant.
- Choose an appropriate trigonometric ratio that can be used in a given situation.
- Understand that sine, cosine and tangent are functions of an angle.
- Establish the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90° .
- Establish the exact value of $\tan\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ$ and 60° .
- Use a calculator to find the sine, cosine and tangent of an angle.
- Know the trigonometric ratios, $\sin\theta = \text{opp/hyp}$, $\cos\theta = \text{adj/hyp}$, $\tan\theta = \text{opp/adj}$.
- Set up and solve a trigonometric equation to find a missing side in a right-angled triangle.
- Set up and solve a trigonometric equation when the unknown is in the denominator of a fraction.
- Set up and solve a trigonometric equation to find a missing angle in a right-angled triangle.
- Use trigonometry to solve problems involving bearings.
- Use trigonometry to solve problems involving an angle of depression or an angle of elevation.

Extended Learning:

- Multistep trigonometry questions.
- 3D trigonometry problems.

Unit 2: Calculating

- Estimate squares and cubes of numbers up to 100.
- Estimate powers of numbers up to 10.
- Estimate square roots of numbers up to 150 and cube roots of numbers up to 20.
- Know and use the fact that $a^{-n} = 1/a^n$.
- Know and use the fact that $a^{1/n} = \sqrt[n]{a}$.
- Calculate exactly with surds.
- Choose the required minimum and maximum values when solving a problem involving upper and lower bounds.
- Calculate the upper and lower bounds in a given situation.

Extended Learning:

- Simplifying surds.
- Adding/Subtracting surds.
- Expanding brackets involving surds.
- Rationalise the denominator.

Unit 3: Solving Equations and Inequalities 1

- State the (simple) inequality represented by a shaded region on a graph.
- Construct and shade a graph to show a linear inequality of the form $y > ax + b$, $y < ax + b$, $y \geq ax + b$ or $y \leq ax + b$.
- Construct and shade a graph to show a linear inequality in two variables stated implicitly.
- Construct and shade a graph to represent a set of linear inequalities in two variables.
- Find the set of integer coordinates that are solutions to a set of inequalities in two variables.
- Use set notation to represent the solution set to an inequality.

Extended Learning:

- Solve other pairs of simultaneous equations graphs (not both linear).

Unit 4: Mathematical Movement 1

- Use the centre and scale factor to carry out an enlargement of a 2D shape with a fractional scale factor.
- Find the scale factor of an enlargement with fractional scale factor.
- Find the centre of an enlargement with fractional scale factor.
- Solve problems involving similarity.
- Perform a sequence of transformations on a 2D shape.
- Find and describe a single transformation given two congruent 2D shapes.

Extended Learning:

- Combinations of transformations (Grade 5 or Grade 6 if negative enlargement is included).

Unit 5: Algebraic Proficiency (Tinkering)

- Add and subtract algebraic fractions.
- Multiply and divide algebraic fractions.
- Simplify an algebraic fraction.
- Expand the product of three binomials.
- Expand the product of two binomials involving surds.
- Factorise an expression involving the difference of two squares.
- Factorise a quadratic expression of the form $ax^2 + bx + c$ (a is prime).
- Factorise a quadratic expression of the form $ax^2 + bx + c$ (a is composite).
- Identify when factorisation of the numerator and/or denominator is needed to simplify an algebraic fraction.
- Simplify an algebraic fraction that involves factorisation.
- Change the subject of a formula when more than two steps are required.
- Change the subject of a formula when the required subject appears twice.

Extended Learning:

- Apply BIDMAS to a sum involving algebraic fractions.
- Solving equations involving algebraic fractions.

Unit 6: Proportional Reasoning

- Interpret graphs and equations that describe direct proportion.
- Interpret graphs and equations that describe inverse proportion.
- Solve problems involving the combining of ratios.
- Solve complex problems combining understanding of fractions, percentages and/or ratio.
- Solve more complex problems involving density.
- Solve more complex problems involving pressure.
- Solve more complex problems involving speed.

Extended Learning:

- Ensure that students have seen questions involving tables of values and roots up to and including cube roots.

Unit 7: Pattern Sniffing & Solving Equations Inequalities II & III

Pattern Sniffing

- Find the n th term of a sequence of the form $ax^2 + b$.
- Find the n th term of a sequence of the form $ax^2 + bx + c$.
- Recognise and describe a simple geometric progression (of the form rn).
- Find the next three terms, or a given term, in a geometric progression.

Solving Equations II

- State the (simple) inequality represented by a shaded region on a graph.
- Construct and shade a graph to show a linear inequality of the form $y > ax + b$, $y < ax + b$, $y \geq ax + b$ or $y \leq ax + b$.
- Construct and shade a graph to show a linear inequality in two variables stated implicitly.
- Construct and shade a graph to represent a set of linear inequalities in two variables.
- Find the set of integer coordinates that are solutions to a set of inequalities in two variables.
- Use set notation to represent the solution set to an inequality.

Solving Equations III

- Solve a quadratic equation of the form $x^2 + bx + c = 0$ by factorising.
- Solve a quadratic equation by rearranging and factorising.
- Make connections between graphs and quadratic equations of the form $ax^2 + bx + c = 0$.
- Make connections between graphs and quadratic equations of the form $ax^2 + bx + c = dx + e$.
- Find approximate solutions to quadratic equations using a graph.
- Deduce roots of quadratic functions algebraically.
- Solve problems that involve solving a quadratic equation in context.

Extended Learning:

- n th term of quadratic patterns.
- Find the next 3 terms of a geometric progression.
- Find a given term in a simple geometric progression.

Unit 8: Calculating Space

- Use Pythagoras' theorem to find lengths in a pyramid or cone.
- Find the surface area of spheres, cones and pyramids.
- Find the volume of spheres, cones and pyramids.
- Identify how to find the volume or surface area of a composite solid.
- Solve practical problems involving the surface area of solids.
- Solve practical problems involving the volume of solids.
- Understand the implications of enlargement on area.
- Understand the implications of enlargement on volume.
- Move freely between scale factors for length, area and volume.
- Solve practical problems involving length, area and volume in similar figures.

Extended Learning:

- Volumes of compound shapes (including spheres/cones).
- Volume of frustums.

Unit 9: Conjecturing

- Create a chain of logical steps to create a proof in a geometrical situation.
- Know that 'the angle in a semicircle is a right angle'.
- Know that 'the angle at the centre is double the angle at the circumference'.
- Know that 'angles in the same segment are equal'.
- Know that 'opposite angles in a cyclic quadrilateral sum to 180° '.
- Know that 'two tangents from an external point are equal in length'.
- Know that 'a radius is perpendicular to a tangent at that point'.
- Know that 'a radius that bisects a chord is perpendicular to that chord'.
- Know the alternate segment theorem.
- Use a combination of known and derived facts to solve a geometrical problem.
- Identify when a circle theorem can be used to help solve a geometrical problem.
- Justify solutions to geometrical problems.

Extended Learning:

- Use circle theorems to prove geometrical situations.

Unit 10: Algebraic proficiency (Visualising 1 & Visualising 2)

Visualising 1

- Recognise, plot and interpret exponential graphs.
- Plot graphs of non-standard functions.
- Use graphs of non-standard functions to solve simple kinematic problems.
- Recognise that the gradient of a curve is not constant.
- Know that the gradient of a curve is the gradient of the tangent at that point.
- Calculate the gradient at a point on a curve.
- Interpret the gradient at a point on a curve as the instantaneous rate of change.
- Interpret the gradient of a chord as an average rate of change.
- Solve problems involving the gradients of graphs in context.

- Calculate an estimate for the area under a graph, including the area under a speed-time graph as distance.
- Solve problems involving the area under graphs in context.
- Identify and interpret roots, intercepts and turning points of quadratic functions graphically.

Visualising 2

- Know that perpendicular lines have gradients with a product of -1.
- Identify perpendicular lines using algebraic methods.
- Identify the equation of a circle from its graph.
- Use the equation of a circle to draw its graph.
- Find the equation of a tangent to circle at a given point.
- Solve algebraic problems involving tangents to a circle.

Extended Learning:

- Calculate gradients of curves for tangents at a point.

Unit 11: Exploring Fractions, Decimals and Percentages

- Convert a fraction to a recurring decimal.
- Convert a recurring decimal of the form $0.\dot{x}$, $0.\dot{x}y$, $0.\dot{x}yz$ to a fraction.
- Convert a recurring decimal of the form $0.0\dot{x}$, $0.0\dot{x}y$, to a fraction.
- Recognise when a situation involves compound interest.
- Calculate the result of a repeated percentage change, including compound interest.
- Solve problems involving growth and decay.

Extended Learning:

- Use exponential graphs to figure out decay problems.

Unit 12: Understanding Risk and Analysing Statistics

Understanding Risk

- Apply the product rule for counting.
- Understand set notation used with Venn diagrams: \cup , \cap , \emptyset , ξ
- Use a Venn diagram to calculate theoretical probabilities.
- Use a two-way table to sort information in a probability problem.
- Use a two-way table to calculate theoretical probabilities.
- Calculate conditional probabilities using different representations.

Statistics

- Understand limitations of sampling and use a sample to infer properties of a population.
- Construct and use a cumulative frequency graph.
- Construct and compare box plots.
- Stratified sampling.

Extended Learning for Unit 15: (Analysing Statistics)

Unit 13: Mathematical Movement 2

- Know and use different notations for vectors, including diagrammatic representation.
- Add and subtract vectors.
- Multiply a vector by a scalar.
- Solve simple geometrical problems involving vectors.

Extended Learning for Unit 13: Mathematical Movement 2

- Prove two vectors are parallel.
- Show that two vectors make a straight line.
- Simultaneous equations using vectors.

Year 11 Maths Learning Outcomes

Unit 1: Investigating Properties of Shapes

- Solve 3D Pythagoras problems.
- Solve 3D trigonometry problems (SOHCAHTOA).
- Use and apply the Sine Rule.
- Use and apply the Cosine Rule.
- Use and apply $0.5ab\sin C$.

Extended learning:

- Solve problems involving Sine Rule/Cosine Rule with bearings.

Unit 2: Calculating

- Simplify surds.
- Add/subtract/multiply/divide surds.
- Expand brackets with surds.
- Rationalise the denominator.

Extended learning:

- Problem solving involving surds e.g. Pythagoras involving surds.

Unit 3: Solving Equations and Inequalities

- Complete the square for a given quadratic expression.
- Identify turning points using completed the square form.
- Solve quadratics using quadratic formulae.
- Solve iteration problems.

Extended learning:

- Links made to completing the square and transformation of quadratics.
- Proof of the quadratic formula using completing the square.

Unit 4: Mathematical Movement

- Enlargement with a negative scale factor (including negative fractions).
- Combinations of transformations (translations/reflections/enlargements/rotations).

Unit 5: Algebraic Proficiency

- Use function notation for finding the value of a function.
- Derive composite functions.
- Find the inverse for a given function.

Extended learning:

- Links to function notation for transformations of graphs.

Unit 6: Mathematical Movement

- Algebraic proof.
- Counter proof.
- Geometric proof (Congruent triangles/Circle theorems).
- Recurring decimal proof.

Unit 7: Pattern Sniffing

- Nth term linear sequences (patterns).
- Nth term quadratic sequences.
- Fibonacci style sequences.
- Arithmetic/Geometric sequences.

Unit 8: Solving Equations and Inequalities 2

- Solving quadratics.
- Turning points/roots and intercepts of quadratics.
- Solve quadratic inequalities.
- Solve Linear and Non-linear pair of simultaneous equations.
- Solve Linear and Non-linear pair of simultaneous equations graphically.

Extended learning:

- Solve simultaneous equations involving only circles and quadratics.

Unit 9: Algebraic Proficiency (Visualising)

- Plot graphs for trigonometric functions.
- Find angles of any size using trigonometric graphs.
- Know the effects on the original graph by transforming the graph with $y = f(x)$: $f(x) + a$, $f(x + a)$, $y = f(-x)$ and $y = -f(x)$
- Know the effects on a coordinate by transforming the graph with $y = f(x)$: $f(x) + a$, $f(x + a)$, $y = f(-x)$ and $y = -f(x)$
- Apply transformation of graphs on trigonometric graphs.

Extended learning:

- Combinations of transformations e.g. reflection then a translation.

Unit 10: Analysing Statistics

- Construct histograms.
- Interpret histograms.
- Solve problems involving histograms.

Extended learning:

- Comparing two histograms.
- Converting histograms into other forms of data representation e.g. pie charts, grouped frequency tables.

Unit 11: Algebraic Proficiency (Visualising) 2

- Complete the square for a quadratic function.
- Deduce the turning point of a quadratic function by completing the square.
- Deduce the roots of a quadratic function by factorising.
- Discriminant of a quadratic.
- Deduce the roots of a quadratic function using the completed square form.
- Gradient of a tangent to a curve at a given point.
- Area under a curve.

Unit 12: Mathematical Movement (Vectors)

- Prove two vectors are parallel.
- Show that two vectors make a straight line.
- Make deductions about situations involving vectors expressed using ratios.