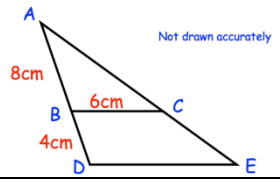
Curriculum Map: Year 10 Mathematics (Higher tier pathway)

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Content Declarative knowledge 'I Know'	**Indices and Standard Form** • Index notation • Estimating powers and roots • Laws of indices • Writing numbers in standard form • Calculations with numbers in standard form **Algebraic Manipulation** • Simplifying expressions • Expanding brackets • Factorising expressions • Completing the square • Substitution **Proofs and Formulae** • Formulate algebraic expressions • Change the subject of a formula • Algebraic terminology and proofs	**Algebraic Solutions of Equations** • Solving linear equation with one unknown • Solving quadratic equations **Data Collection and Sampling** • Populations and samples • Averages and range • Construct charts for categorical data (frequency tables, bar charts, pie charts and pictograms) • Construct charts for ungrouped numerical data (vertical line charts) **Compound Units** • Convert between different units of measurement • Convert compound units (speed, density, pressure, rates of change and pricing) **Solving Linear Inequalities** • Solve inequalities with one unknown • Represent inequalities on a number line	**Surds** • Simplify expressions (including expanding brackets) with surds • Rationalise the denominator **Congruent and Similar Shapes** • Identify congruent triangles • Identify similar triangles • Compare lengths, areas and volumes using scale factors **Pythagoras' Theorem** • Find missing sides in right angled triangles • Apply Pythagoras' theorem in a 3D context **Trigonometry** • Find missing sides and angles in right angled triangles • Use trigonometry to solve problems • Exact trigonometric values	**Organising, Presenting and Analysing Data** • Time series graphs • Cumulative frequency • Box plots **Bivariate Data** • Scatter diagrams • Correlation • Lines of best fit **Fractions and Decimals** • Simplifying fractions and equivalent fractions • Fraction arithmetic • Algebraic fractions • Decimal arithmetic • Converting recurring decimals to fractions **Accuracy and Bounds** • Upper and lower bounds • Error intervals • Problem solving with upper and lower bounds	**Simultaneous Equations** • Linear simultaneous equations • Quadratic simultaneous equations • Forming and solving simultaneous equations **Graphical Solutions to Equations** • Solve linear equations graphically • Approximate roots of a curve with a straight line **Percentage Change** • Compound and simple interest • Exponential growth and decay **Bearings and Scale Drawings** • Measure and draw bearings • Calculate bearings • Construct and interpret scale drawings	**Circles, Spheres and Pyramids** • Area and circumference of circles • Sector area and arc length • Volume of cylinders, spheres and pyramids • Surface area of cylinders, spheres and pyramids **Probability** • Relative frequency • Sample spaces • Enumeration • Venn diagrams • Probability trees **Constructions and Loci** • Perpendicular and angle bisector • Perpendicular from a point to a line • Identify the loci of a set of points

Skills Procedural Knowledge 'I know how to'	**Indices and Standard Form** • Write numbers using index notation. • Use negative indices to represent reciprocals. • Use fractional indices to represent roots and combinations of powers and roots. • Estimate powers and roots. • Apply the rules of indices. • Interpret and order numbers expressed in standard form. • Convert numbers to and from standard form. • Use a calculator to perform calculations with numbers in standard form. • Without a calculator, add, subtract, multiply and divide numbers in standard form. **Algebraic Manipulation** • Simplify algebraic expressions by expanding a simple bracket. • Expand products of two binomials. • Expand products of more than two binomials. • Factorise by taking out common factors. • Factorise quadratic expressions where the coefficient of x^2 is not 1.	**Algebraic Solutions of Equations** • Solve linear equations in one unknown. • Solve linear equations with the unknown on both sides (including with brackets and fractions). • Set up and solve linear equations in mathematical and non-mathematical contexts. • Solve quadratic equations through factorising. • Solve quadratic equations through completing the square. • Solve quadratic equations using the quadratic formula. **Data Collection and Sampling** • Define the population in a sample and understand the difference between a population and a sample. • Understand what is meant by simple random sampling and stratified sampling. • Interpret and construct frequency tables, bar charts, pie charts and pictograms for categorical data. • Interpret and construct vertical line charts for	**Surds** • Use surds in exact calculations without a calculator. • Simplify expressions involving surds. • Expand brackets involving surds. • Rationalise the denominator. **Congruent and Similar Shapes** • Prove that two triangles are congruent using the cases SSS, ASA, SAS and RHS. • Apply knowledge of congruent triangles in calculations and simple proofs. • Identify and prove that two triangles are similar. • Compare lengths, areas and volumes using ratio notation and scale factors. • Apply the principles of similarity to calculate unknown lengths in similar figures. **Pythagoras' Theorem** • Know and apply Pythagoras' theorem ($a^2 + b^2 = c^2$) to find lengths in right angled triangles.	**Organising, Presenting and Analysing Data** • Design tables to classify data. • Interpret and construct line graphs for time series data and identify trends such as seasonal variations). • Construct cumulative frequency diagrams, and use them to estimate the median, upper quartile and lower quartile. • Construct and interpret box plots. **Bivariate Data** • Plot and interpret scatter diagrams for bivariate data. • Recognise and interpret correlation within the context of the variables. • Draw a line of best fit by eye and use it to make predictions. • Interpolate and extrapolate from data. • Identify an outlier on a scatter diagram. **Fractions and Decimals** • Recognise and use equivalence between fractions and mixed numbers. • Add, subtract, multiply and divide simple fractions	**Simultaneous Equations** • Manipulate and solve two linear simultaneous equations in two variables algebraically. • Set up and solve simultaneous equations in mathematical and non-mathematical contexts. • Manipulate and solve two simultaneous equations in two variables algebraically, including examples in which one equation is a quadratic or examples which result in a quadratic). **Graphical Solutions to Equations** • Use a graph to find the approximate solution of a linear equation. • Use graphs to find approximate roots of quadratic equations and the approximate solution of two linear simultaneous equations. • Know that the coordinates of the points of intersection of a curve and a straight line are the solutions to the simultaneous equations for that line and curve.	**Circles, Spheres and Pyramids** • Find the circumference and area of a circle. • Find the arc length of a sector. • Find the area of a sector. • Given the arc length/area of a sector, find the radius/diameter of the circle. • Calculate the surface area and volume of cylinders, spheres, pyramids and cones. **Probability** • Use the 0 – 1 probability scale as a measure of likelihood of random events. • Analyse and calculate the relative frequency of outcomes. • Use relative frequency as an estimate of probability. • Use tables and grids to list the outcomes of single events and to calculate theoretical probabilities. • Use systematic listing strategies. • Use a two-circle Venn diagram to enumerate sets and use this to calculate related probabilities. • Use simple set notation to describe simple sets of numbers or objects.

	• Complete the square for a quadratic expression. • Substitute positive or negative numbers into simple and complex formulae, including those involving powers, roots and algebraic fractions. **Proofs and Formulae** • Recognise the distinction between an equation and an identity. • Use algebra to construct mathematical arguments. • Change the subject of formulae, where the subject only appears once. • Change the subject of formulae where the subject appears twice or where a power of reciprocal of the subject appears.	ungrouped, discrete numerical data. • Interpret multiple and composite bar charts. • Calculate the mean, mode, median and range from ungrouped data. • Calculate estimates of mean, mode and range from grouped data. **Compound Units** • Use and convert standard units of measurement for length area, volume/capacity, mass, time and money. • Know and apply speed = distance ÷ time. • Know and apply density = mass ÷ volume. • Use and convert compound units in algebraic contexts. **Solving Linear Inequalities** • Solve linear inequalities in one variable. • Using the correct notation, represent solutions to inequalities on a number line. • Solve linear inequalities in two variables, representing the solution set on a graph.	• Apply Pythagoras' theorem in more complex figures, including 3D shapes. **Trigonometry** • Know and apply trigonometric ratios to find angles and lengths in right angled triangles. • Know exact values of sin θ, cos θ and tan θ where θ = 0°, 30°, 45°, 60°, 90°. • Apply trigonometry for right-angled triangles within more complex shapes, including 3D figures.	including mixed numbers and negative fractions. • Calculate a fraction of a quantity including with fractions greater than 1. • Simplify and manipulate algebraic fractions. • Express a simple fraction as a terminating decimal or vice versa. • Use division to convert a simple fraction to a decimal. • Convert a recurring decimal to an exact fraction. • Add, subtract and multiply decimals including decimals that are negative. • Without using a calculator, divide a decimal by a whole number or by another decimal. **Accuracy and Bounds** • Use inequality notation to write down an error interval for a number or measurement rounded or truncated to a given degree of accuracy. • Calculate the upper and lower bounds of calculations. • Understand the difference between bounds of discrete and continuous data.	**Percentage Change** • Calculate and simple interest, for instance in financial contexts. • For compound interest and depreciation over a given interval, use multipliers to solve problems step-by-step. • Express exponential growth or decay as a formula. • Solve and interpret answers in growth and decay problems. **Bearings and Scale Drawings** • Understand how to measure and construct bearings. • Understand how to work out bearings either from a given diagram or from a worded problem. • Use trigonometry and bearings to solve problems. • Use the scale of a map and work with bearings. • Construct and interpret scale drawings.	• Use tree diagrams to enumerate sets and to record probabilities of successive events. • Use the addition law for mutually exclusive events. **Constructions and Loci** • Use construction to find the midpoint of a line segment. • Construct the perpendicular bisector of a line segment. • Construct the bisector of an angle. • Construct the perpendicular from a point to a line. • Construct the perpendicular to a line at a point. • Apply constructions involving ruler and compasses to identify the loci of points. Include real world problems.

Strategies Conditional Knowledge 'I know when to'	**Indices and Standard Form** • Apply the correct rules of indices. • When and how to use fractional and negative indices. • Know what methods to follow when adding, subtracting, multiplying and dividing with numbers in standard form. • When answering problem solving and worded questions involving standard form, know when to apply the appropriate rule of arithmetic. **Algebraic Manipulation** • Understand the difference between expanding double brackets and expanding single brackets. • Understand how to fully factorise an expression. • Understand when an expression will be factorised into two brackets rather than one. **Proofs and Formulae** • Understand how to rearrange formulae and when taking a factor of the subject is necessary.	**Algebraic Solutions of Equations** • Construct a chain of reasoning to justify the solution to an equation. • Solve area, volume and kinematics problems given in word form or in diagrammatic contexts. • Know when it is appropriate to solve quadratic equations through factorisation, completing the square or using the quadratic formula. **Data Collection and Sampling** • From a sample, infer properties of populations and distributions. • Recognise graphical misrepresentation, for instance through incorrect scales and labels. **Compound Units** • Know when different units are appropriate dependent on the context of the question.	**Surds** • Know when it is appropriate to leave answers in exact form. • For a complex surd calculation, construct chains of reasoning to show how to achieve a given result. • Make and use connections between exact calculations and surds within different parts of mathematics. **Congruent and Similar Shapes** • Know when to explain with reasoning whether shapes are congruent of similar. • Use similar shapes to translate non-mathematical contexts into problems that can be solved. **Pythagoras' Theorem** • Know whether to add or subtract the squares of the sides. • From the three sides of a triangle, make a deduction about whether a triangle has a right angle. • Make and use connections between similar and congruent triangles, units of	**Organising, Presenting and Analysing Data** • Design appropriate tables to analyse data. • Show clear chains of reasoning to present statistical arguments. • Know when the interquartile range is used and why it can be more appropriate and representative than other forms of spread. **Bivariate Data** • Make deductions and inferences and draw conclusions, taking care to recognise the limitations of those findings. • Extrapolate and interpolate data using a line of best fit and be aware of the limitations of these techniques. • Interpret results in the context of a given problem. **Fractions and Decimals** • Use fractions and decimals in a series of mathematical processes. • Know when it is more appropriate to leave answers in either fraction or decimal form.	**Simultaneous Equations** • Know when to set up and solve simultaneous equations in two variables. • Know when and how to manipulate one or both equations in order to solve a problem. • Construct clear chains of reasoning to solve simultaneous equations and interpret the answers, with justification. **Graphical Solutions to Equations** • Know when to construct equations set in words or diagrams and plot graphically to determine solutions. **Percentage Change** • Express as a total percentage change the effect of growth and decay. • Apply either simple or compound interest to a problem. **Bearings and Scale Drawings** • Know when to draw a diagram to help solve a problem involving bearings.	**Circles, Spheres and Pyramids** • Present arguments and proofs to solve problems giving answers in terms of pi. • Make deductions and inferences and draw conclusions regarding re-shaping solids assuming no loss of volume. • Given the volume or surface area, work backwards to find an unknown radius/diameter/height. **Probability** • Know when to use different terminology and mathematical vocabulary when working through probability problems. • Apply Venn diagrams and tree diagrams to solve probability problems in a variety of mathematical and non-mathematical contexts. **Constructions and Loci** • Justify loci using clear mathematical reasoning. • Know when to solve problems using constructions, and which construction is the most appropriate to use.

		Solving Linear Inequalities • Know when to solve inequalities involving mensuration and angle problems.	measurement, error intervals and bounds, estimation and rounding. **Trigonometry** • Identify when to use the correct trigonometric ratio. • From the three sides of a triangle, make deductions about whether the triangle includes all acute angles or one right angle or one obtuse angle. • Know when it is most appropriate to apply either trigonometry or Pythagoras' theorem.	**Accuracy and Bounds** • Dependent on whether the data is discrete or continuous, know when your answer must be an integer. • Dependent on the context of the question, know when to use either the upper or lower bound.	• Make connections between different parts of mathematics, for instance when using ratios and converting units.	
Key Questions	**Indices and Standard Form** 1) Evaluate $64^{\frac{2}{3}}$ 2) Simplify $3a^2 \times 2a^{\frac{1}{2}}$ 3) Write 0.000809 in standard form. 4) Leaving your answer in standard form, work out $(3.6 \times 10^3) \div (9 \times 10^{-3})$. 5) The diameter of the Moon is 3.5×10^3 km. The diameter of the Sun is 1.4×10^6 km. Calculate the ratio of the diameter of the Moon to the diameter of the Sun. Give your answer in the form 1: n.	**Algebraic Solutions of Equations** 1) Solve $7(5 - x) = -4(x - 1)$ 2) Solve $3x^2 - 8x - 3 = 0$ 3) Either by using the quadratic formula or by completing the square, solve $x^2 + 4x - 5 = 7$. **Data Collection and Sampling** Parker wants to take a random sample of people who live in his street. Explain what is meant by a random sample and describe a sampling	**Surds** 1) Simplify $\sqrt{72}$ 2) Expand and simplify $(2 + \sqrt{6})(3 - \sqrt{6})$ 3) Rationalise the denominator of $\frac{1+\sqrt{5}}{\sqrt{5}-6}$ **Congruent and Similar Shapes** 1) Find missing length DE  	**Organising, Presenting and Analysing Data** a) Construct a cumulative frequency diagram for …. b) Estimate values for the upper quartile, median and lower quartile from your diagram. c) Use this information to construct a box plot. **Bivariate Data** a) Plot a scatter graph for …. b) Identify the outlier from your scatter graph. c) Draw a line of best fit onto your scatter graph.	**Simultaneous Equations** 1) Solve the following simultaneous equation: $4x + 3y = 20$ $3x + 5y = 24$ 2) Solve the following simultaneous equations: $3x = 2y + 6$ $x^2 + y^2 = 20$ 3) Two numbers have a sum of 20 and a difference of 8. By forming and solving two equations, find the values of the two numbers.	**Circles, Spheres and Pyramids** 1) The area of a circle is 34.8cm^2. Find the circumference of the circle. 2) A cube, of side length 6cm, has the same volume as a sphere. Find the radius of the sphere. **Probability** 1) Laura observed 20 cars and found that 3 of them were blue. Based on this evidence, if Laura were to observe another 100 cars, how many would she expect not to be blue?

Algebraic Manipulation

1) Expand and simplify
$4x - (3 - 2x)$.

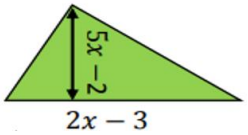
2) Expand and simplify
$(x + 3)(x - 2)(x + 4)$.

3) Factorise $6x^2 + x - 2$.

4) Write $x^2 - 3x + 5$ in completed square form.

5) Substitute $x = 3$ and $y = -4$ into the expression
$3y^2 - 4x - 3$

6) Write an expression for the area of the following shape:



Proofs and Formulae

Prove that the square of an odd number is always odd.

method which Parker could use.

Compound Units

1) A car is travelling at 30 mph for 20 minutes. How far does the car travel in this time?

2) Convert 10 cm^3 into mm^3.

3) Convert 15 mph into m/s.

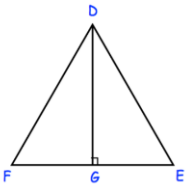
4) Material A has a density of 5.8 g/cm^3. Material B has a density of 4.1 g/cm^3. 377g of Material A and 1.64 kg of Material B form Material C. Work out the density of Material C.

Solving Linear Inequalities

1) Solve the inequality $5x - 6 < -7$ and represent your solution on a number line.

2) Solve the inequality $14 < 3x + 5 \leq 29$ and represent your solution on a number line.

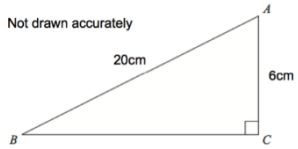
2) DEF is an equilateral triangle.



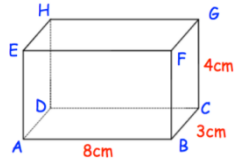
G lies of EF.
DG is perpendicular to FE.
Prove DFG is congruent to DEG.

Pythagoras' Theorem

1) Find length BC.

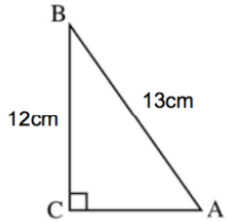


2) Find length AG.



Trigonometry

1) Find angle BAC.



d) Estimate ….. from your line of best fit. Does this seem reliable?

Fractions and Decimals

1) Express as a single fraction

$$\frac{1}{x+1} + \frac{4}{x-2}$$

2) Convert the recurring decimal $0.345\dot{}$ into a fraction in its simplest form.

Accuracy and Bounds

1) A length has been recorded as 4.5cm correct to the nearest mm. Represent this in an error interval.

2) A car is travelling at 50 mph (correct to the nearest 10 mph) for 3 hours (correct to the nearest hour). What is the shortest distance the car could have travelled?

Graphical Solutions to Equations

1) By plotting $y = 3x + 4$ and $y = 4x - 2$, find the solution to simultaneous equations.

2) By plotting the curve $y = x^2 + 6x - 4$ and the line $y = 4x - 2$, find the solutions to the simultaneous equations.

Percentage Change

1) A car depreciates in value by 3.2% each year for 6 years. The car is valued at £4000 at the end of the 6th year. How much did it cost originally?

2) A shop has a sale. In the sale all items are reduced by 15%. In the last week of the sale all items are reduced by a further 10%. What is the overall percentage reduction?

Bearings and Scale Drawings

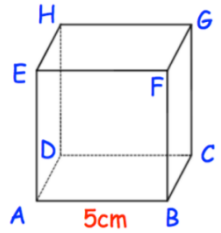
1) The bearing of a ship from a lighthouse is 055°. Work out the bearing of the lighthouse from the ship.

2) At a restaurant there are 3 options for starter, 3 for a main course and 4 for dessert. Sam would like a 2-course meal. How many possible meal combinations does he have?

3) Paul asked the 30 students in his class whether they liked tea and coffee. 10 said they liked tea, 15 said they liked coffee and 12 said they liked neither.
What is the probability a student chosen at random from the class likes both tea and coffee?

Constructions and Loci

For the rectangle ABCD shown on your worksheet, find the region which is
a) less than 3cm from B,
b) closer to B than C,
and
c) closer to AB than to BC.

			2) A cube is shown below. Find angle CAG.  		2) From town B, town A is 6 km due north and town C is 4.5 km due east. Calculate the bearing of A from C.	
Assessment topics	Mini assessment for each topic studied	Mini assessments End of term tests	Mini assessment for each topic studied	Mini assessments End of term tests	Mini assessment for each topic studied	Mini assessments End of term tests
Cross curricular links/ Character Education	**Indices and Standard Form** In Science, standard form is used when working with particularly large numbers (e.g. for mass and distance in astrophysics) and small numbers (for mass and lengths in biology). **Algebraic Manipulation** In Science, algebraic manipulation is used to rearrange key formulae.	**Algebraic Solutions of Equations** In Computing, algebra is used to form equations that create graphics. **Data Collection and Sampling** Sampling and data collection methods are reviewed regularly in Psychology. **Compound Units** Compound units are used frequently in Physics.	**Pythagoras' Theorem and Trigonometry** In Design Technology, Pythagoras' theorem and trigonometry are used to calculate distances and angles of elevation/depression.	**Organising, Presenting and Analysing Data** The ability to organise, present and analyse data is used in multiple subjects. This includes looking at statistics in Geography, collecting data in Biology and analysing data in Business and Economics. **Fractions and Decimals** In Design Technology, fractions are used when working with materials and also when scaling up/down recipes.	**Percentage Change** In Geography, percentage calculations are used to make comparisons, for instance when looking at rainfall or comparing changes in population sizes. In Business and Economics, profit, loss, growth and decay are all represented as percentages. **Bearings and Scale Drawings** In Design Technology you need to be able to work with scale drawings. In Geography, you need to be able to work with scale on maps.	**Circles, Spheres and Pyramids** In Design Technology, working with area and volume will help when designing different objects and products.