



Mathematics Year 10	Working towards expected outcomes	Working at expected outcomes	Working beyond expected outcomes
Autumn Term	<p>Students working towards expected outcomes in Y10 can:</p> <ul style="list-style-type: none">Expand up to three bracketsFactorise quadratics of the form $x^2 + bx + c$ and recognise basic cases of DOTS e.g $x^2 - 9$Simplify simple surds (e.g. $\sqrt{50}$)Use Pythagoras' theorem in 2D problemsApply SOHCAHTOA in basic right-angled trianglesCombine basic trigonometry and Pythagoras to use in simple compound diagrams.Recall and sketch the three trigonometric graphs.Recall some exact trigonometric values.	<p>Students working at expected in Y10 can:</p> <ul style="list-style-type: none">Add and subtract multiple sets of brackets accurately.Complete the square for quadraticsSolve quadratics using all three methods (factorising, completing the square, formula)Use their quadratic skills to form expressions and equations for typical 'show that' questions.Rationalise denominators including those with 2 terms in the denominator.Use surds in context (e.g. finding an area where lengths are in surd form).Apply trigonometry in 2D and 3D problems and use exact trig valuesUnderstand basic trig graphs and solve simple trig equations, including those requiring some rearranging. Eg. $2 \cos x = 1.2$	<p>Students working beyond expected in Y10 can: In addition to the skills listed under 'Working At' for this topic, students working beyond expected outcomes can:</p> <ul style="list-style-type: none">Factorise more complex quadratics including those that can be factorized by taking out a group of terms.Complete the square for ax^2 style quadraticsTackle more demanding "Show that" questions involving quadraticsManipulate surds fluently and accurately in a variety of question styles including application.Use known trig values in non-calculator questions.Solve multi-step 3D trig problems involving bearings and angles between planesSolve trigonometric equations where the principal value might not fall into the required range. Eg. $\sin x = -\frac{1}{2}$ for $0 < x < 360$



- Round or truncate numbers to a given number of decimal places or significant figures
- Identify upper and lower bounds for rounded or truncated values
- Use bounds to maximise or minimise simple calculations
- Sketch basic quadratic graphs, indicating the co-ordinates of axes intersections.
- Understand and solve simple linear inequalities (Y9) e.g. $x + 2 < 5$
- Represent linear inequalities on a number line
- List outcomes in sample spaces and use basic probability rules Eg. Probability scale 0-1
- Interpret basic Venn diagrams and use them to find probabilities including basic set notation (Y8)

- Use bounds in calculations involving multiple operations. Eg. Maximise a where $a = b \times c - d$
- Sketch quadratic graphs, identifying turning points and intercepts
- Solve quadratic inequalities using a graph
- Represent solutions of inequalities graphically or on number lines
- Construct and interpret Venn diagrams involving two or three sets
- Work with probabilities from Venn diagrams including understanding most set notation (Y8)
- Calculate probabilities using tree diagrams for independent events
- Identify and calculate probabilities for mutually exclusive and independent events using the AND/OR rules met in Y9.
- Extend Y9 probability skills to cope with 'non-replacement' questions.

- Use bounds in a variety of contexts including those where a value must be given 'to a suitable degree of accuracy'
- Combine solutions from two or more inequalities to produce a single solution set (linear & quadratic)
- Apply quadratic modelling skills from the earlier unit to incorporate inequalities, understanding the difference between 'greater than'/'at least'; 'less than'/'no more than'.
- Fluent use and understanding of set notation to interpret Venn diagrams and identify a range of probabilities.
- Use probability trees for conditional/dependent events such as taking an item from Bag A and placing it into Bag B.



Spring Term

Students working **towards** expected outcomes in Y10 can:

- Recall and use basic angle facts covered in Y7 (including parallel lines) and angles in polygons covered in Y8.
- Begin to use some circle theorems on simple diagrams.
- Convert between standard form and ordinary numbers
- Perform calculations with standard form using a calculator
- Solve basic ratio and percentage problems including: sharing a ratio; where one side of the ratio is known; when the difference between parts is known; combining ratios (Y7) and sub ratios (Y8)
- Find counter-examples to disprove simple statements. Eg. “All prime numbers are odd.”
- Be able to represent odd and even numbers algebraically.

Students working **at** expected in Y10 can:

- Apply a mixture of angle rules including parallel lines, polygons, and missing angles confidently to a variety of problems.
- Apply all circle theorems to solve typical problems and some applications.
- Apply the laws of indices to solve standard form problems without a calculator
- Use algebraic notation for odd, even and consecutive numbers to construct a range of proofs.
- Represent and use 2-digit numbers algebraically.
- Create equations from ratios including equivalent ratios and situations where a ratio has changed.
- Solve compound percentage problems including reverse percentages, unknown time periods, and unknown percentage rate.

Students working **beyond** expected in Y10 can:
In addition to the skills listed under ‘Working At’ for this topic, students working beyond expected outcomes can:

- Solve angle problems that combine multiple rules and involve reasoning
- Link other geometric facts to the circle theorems (eg. Establishing that AC is a diameter by proving AC is the hypotenuse of a right-angled triangle ABC).
- Extend non-calculator skills to tackle standard form questions involving roots. Eg. $\sqrt{6.4 \times 10^{11}}$
- Construct algebraic proofs where further argument is required. Eg. Prove that the product of two consecutive numbers is always even.
- Solve a variety of percentage and ratio problems with confidence, giving appropriate interpretation of answers where required.



- Rearrange simple formulae with one or two steps
- Evaluate indices where powers are positive, whole numbers and some where the power may be fractional or negative.
- Use laws of indices with positive whole numbers and some fractional or negative powers.
- Recall and use the sine and cosine rules and the area of a non-right-angled triangle in routine problems.

- Rearrange more complex formulae including those requiring cross-multiplication, brackets or roots (Y9)
- Rearrange a variety of formulae where the subject appears on both sides (Y10)
- Fluently evaluate a mixture of indices problems involving laws and negative or fractional powers.
- Use and apply all laws of indices including negative and fractional powers to evaluate or solve basic equations.
- Change the bases of indices to solve basic equations. Eg. $4^x = 64^2$ find the value of x .
- Use the sine, cosine and area of a triangle to work in compound diagrams where multiple steps are required.
- Work 'backwards' (where the area of a triangle might be known) in order to find a missing side or angle.
- Answer some questions where bearings are involved by drawing appropriate diagrams.

- Form further expressions from indices, including those where indices are algebraic. Eg. $100^a \times 1000^b$ can be written in the form 10^w . Show that $w = 2a + 3b$
- Confidently rearrange a wide variety of formulae including those where multiple fractions might be involved. Eg. $1/a + 1/b = 1/c$ make 'a' the subject.
- Fluently change bases on a collection of terms where fractional or negative indices might be used.
- Solve a variety of trigonometric problems where diagrams may need to be drawn from context (including bearings).
- Use exact trigonometric values to solve problems without a calculator, including where values might need to be compared to other known values Eg. Knowing $\sin(30) = \sin(150)$
- Understand the ambiguous case and are able to recognise where this is present.

**Summer Term**

Students working **towards** expected outcomes in Y10 can:

- Simplify basic algebraic fractions with a single term on the denominator. Eg. $\frac{2x}{2}$ and $\frac{3x^2-6x}{3x}$
- Simplify some algebraic fractions where factorisation in the numerator and denominator is required before cancelling common factors. Eg. $\frac{x^2+7x+12}{x^2-9}$
- Use their fraction skills to apply the four operations to basic questions involving algebraic fractions. Eg. $\frac{2}{x+4} + \frac{3}{x-5}$
- Recognise and describe relationships that are directly or inversely proportional and solve simple problems by 'common sense'. Eg. 8 coffees cost £24, how much do 5 coffees cost?
- Recall the form $y = mx + c$ and identify the gradient and y-intercept from this
- Use (and recall some) co-ordinate geometry rules to answer basic questions such as the midpoint, length or gradient between two points.

Students working **at** expected in Y10 can:

- Simplify and manipulate a wide range of algebraic fractions involving all factorizing types met in the autumn term.
- Solve equations involving algebraic fractions including where algebraic manipulation is required to combine or cross-cancel fractions before solving.
- Recall and use all co-ordinate geometry formulae to solve a range of problems including finding the equation of lines or areas.
- Identify the equation of a circle and describe its features.
- Find the equation of tangents to a circle centred at the origin, sometimes performing further co-ordinate geometry such as finding where the tangent crosses the x-axis.
- Set up and solve direct and inverse proportion problems algebraically.
- Identify the graphs of basic direct and inverse proportional relationships.

Students working **beyond** expected in Y10 can:
In addition to the skills listed under 'Working At' for this topic, students working beyond expected outcomes can:

- Solve challenging algebraic fraction problems (including equations) with multiple steps
- Apply their proportional skills to model problems in context.
- Link co-ordinate geometry to shape properties to solve more complex problems.
- Cope with algebraic proportion questions where more than two variables might have a proportional relationship. Eg. T is inversely proportional to w . w is directly proportional to the cube root of d . When $w = 6, T = 20$. When $w = 1, d = 8$. Find the value of d when $T = 48$.
- Find tangents to circles not necessarily centred at the origin (plus further co-ordinate geometry problems).
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- Calculate the area and perimeter of basic shapes including compound shapes and circles.
- Calculate volume and surface area of prisms and cylinders.
- Use the formulae for sector area and arc length on most sectors.
- Find averages (mean, median, mode) and range from listed data or a non-grouped frequency table.
- Recognise and draw key charts such as stem and leaf, scatter graphs and box plots.
- Make some comparative statements between two sets of data using key statistics such as the mean or range.
- Plot a cumulative frequency curve and use it to make some estimations.
- Read time-series graphs and be able to comment on general trends.

- Solve a variety of surface area and volume problems including those where a formula might need to be adapted (eg. For a hemisphere).
- Confidently use the formulae for sector area and arc length on all sectors and use them 'backwards' to find missing radii or angles.
- Apply volume skills to solve problems involving rate of flow.
- Find averages and range from all previously met statistical representations, including mean from grouped frequency tables.
- Construct and interpret cumulative frequency graphs, box plots, scatter graphs and time series graphs.
- Answer a variety of questions related to cumulative frequency graphs including finding percentages and the interquartile range.
- Compare distributions showing an understanding of which average or spread is most appropriate for the given data

- Answer a variety of 2D and 3D shape problems.
- Model situations using their geometric properties (eg. A sector to model the area covered by a swinging pendulum) and apply appropriate formulae.
- Work with rates of flow questions requiring compound unit conversions or containers comprising challenging compound shapes.
- Make accurate inferences from a range of statistical diagrams using appropriate statistical summaries.
- Identify errors in statistical diagrams and comment on the validity of predictions or analysis of data.
- Formulate and solve problems requiring multiple statistical and geometric interpretations
- Understand the advantages and draw-backs of certain statistical representations. Eg. Grouped versus raw data.