

## Yr 10 Learning Objectives - Higher Tier (One Year Course)

<b>GCSE MATHEMATICS (Academic Year 2008/09)</b>
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✓ Tick once you are fully confident with a learning objective.

<b>Module 1: Whole Numbers &amp; Decimal Numbers</b>		<b>Grade</b>
Multiply and divide decimal numbers by whole numbers and decimal numbers (up to 2 dp), eg $266.22 \div 0.34$		E
Know that, eg $13.5 \div 0.5 = 135 \div 5$		E
Check their calculations by rounding, eg $29 \times 31 \approx 30 \times 30$		E
Approximate decimals to a given number of decimal places or significant figures		D

<b>Module 2: Fractions &amp; Percentages</b>		<b>Grade</b>
Write a fraction in its simplest form and recognise equivalent fractions		E
Compare the sizes of fractions using a common denominator		E
Write an improper fraction as a mixed number, and vice versa		E
Convert a fraction to a decimal, or a decimal to a fraction		E
Add and subtract fractions by using a common denominator		D
Add and subtract mixed numbers		D
Find the reciprocal of whole numbers, fractions, and decimals		D
Convert a fraction to a recurring decimal (and vice versa)		D
Use fractions in contextualised problems		D
Multiply and divide a fraction by an integer, by a unit fraction and by a general fraction (expressing the answer in its simplest form)		C
Write a percentage as a decimal; or as a fraction in its simplest terms		E
Write one number as a percentage of another number		D
Calculate the percentage of a given amount		D
Use a multiplier to increase by a given percent, eg $1.1 \times 64$ increases 64 by 10%		D
Find a percentage increase/decrease of an amount		C
Find a reverse percentage, eg find the original cost of an item given the cost after a 10% deduction		C
Calculate simple and compound interest for two, or more, periods of time		B

<b>Module 3: Algebra &amp; Solving Linear Equations</b>		<b>Grade</b>
Simplify algebraic expressions in one or more like terms by addition and subtraction		E
Multiply and divide using algebra and numbers		E
Multiply and divide powers of the same variable		D
Understand and use the index rules to simplify algebraic expressions		D
Use brackets to expand and simplify simple algebraic expressions		D
Solve linear equations with one, or more, operations (including fractional coefficients)		D
Solve linear equations involving a single pair of brackets		D
Expand or factorise algebraic expressions involving one pair of brackets		C
Expand and simplify expressions involving two pairs of brackets		C
Factorise quadratic expressions (including the difference of two squares)		B

<b>Module 3 Extension: Solving Quadratic Equations</b>		<b>Grade</b>
Solve quadratic equations by factorising (including values of a not equal to 1)		B/A
Use the quadratic formula to solve quadratic equations giving the answers to 1 dp		A*
Use the quadratic formula to solve quadratic equations leaving the answer in surd form		A*

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Module 4: Angles & Geometry	Grade
Distinguish between acute, obtuse, reflex and right angles	E
Use angle properties on a line and at a point to calculate unknown angles	E
Use angle properties of triangles and quadrilaterals to calculate unknown angles	E
Mark parallel lines in a diagram	E
Use parallel lines to identify alternate and corresponding angles	D
Calculate interior and exterior angles in a polygon	D
Understand and use bearings	D
Identify and list the properties of quadrilaterals (including kites)	D
Name all quadrilaterals that have a pair of opposite sides that are equal	D
Calculate and use the sums of the interior angles of convex polygons of sides 3, 4, 5, 6, 8 and 10	D
Know, or work out, the relationship between the number of sides of a polygon and the sum of its interior angles	D
Know that the sum of the exterior angles of any polygon is $360^\circ$	D
Find the size of each exterior/interior angle of a regular polygon	D
Find missing angles using properties of corresponding angles and alternate angles, giving reasons	C
Find the three missing angles in a parallelogram when one of them is given	C

Module 5: Collecting & Representing Data	Grade
Design a suitable question for a questionnaire	E
Understand the difference between: primary and secondary data; discrete and continuous data	D
Design suitable data capture sheets for surveys and experiments	D
Understand about bias in sampling	D
Choose and justify an appropriate sampling scheme, including random and systematic sampling	D
Represent data as: Pie charts (for categorical data) Bar charts and histograms (equal class intervals) Frequency diagrams for grouped discrete data Frequency polygons	D
Choose an appropriate way to display discrete, continuous and categorical data	D
Compare distributions shown in charts and graphs	C
Understand the difference between a bar chart and a histogram	C

Module 6: Drawing & Constructing 2-D & 3-D Shapes	Grade
Range of standard constructions including:	
The angles $60^\circ$ , $30^\circ$ and $45^\circ$	E
Count the vertices, faces and edges of 3-D shapes	E
Draw nets of solids and recognise solids from their nets	E
Recognise and name examples of solids, including prisms, in the real world	E
An equilateral triangle with a given side	D
The midpoint and perpendicular bisector of a line segment	D
The perpendicular from a point on a line	D
The bisector of an angle	D
A regular hexagon inside a circle, etc	D
A path equidistant from two points or two line segments	D
A region bounded by a circle and an intersecting line	D
Draw and interpret plans and elevations	D
Draw planes of symmetry in 3-D shapes	C

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<b>Module 7: Number Patterns, Sequences, Factors &amp; Multiples</b>		<b>Grade</b>
Find the missing numbers in a number pattern or sequence		E
Use a calculator to produce a sequence of numbers		E
Understand odd and even numbers, and prime numbers		E
Find the $n$ th term of a number sequence as an algebraic expression		D
Find: squares; cubes; square roots; cube roots of numbers, with and without a calculator (including the use of trial and improvement)		D
Find the HCF and the LCM of numbers		D
Write a number as a product of its prime factors, eg $108 = 2^2 \times 3^3$		D
Explain why a number is, or is not, a member of a given sequence		C

<b>Module 8: Perimeter &amp; Area of Rectangles &amp; Triangles</b>		<b>Grade</b>
Find the perimeter and area of shapes made up from triangles and rectangles		E
Convert between units of area		D
Use Pythagoras' theorem to find unknown lengths, eg the height of an isosceles triangle given the lengths of all three sides		C
Find when numbers are given to a specific degree of accuracy, the upper and lower bounds of perimeters and areas		C

<b>Module 9: Circle Theorems</b>		<b>Grade</b>
Understand, prove and use circle theorems		B/A
Use circle theorems to find unknown angles and explain their method — quoting the appropriate theorem(s)		B/A

<b>Module 10: Coordinates, Linear Functions &amp; Inequalities</b>		<b>Grade</b>
Plot and read coordinates on a coordinate grid (in all four quadrants)		E
Understand that one coordinate identifies a point on a line, two coordinates identify a point in a plane and three coordinates identify a point in space, and use the terms '1-D', '2-D' and '3-D'		D
Find the coordinates of the fourth vertex of a parallelogram		D
Identify the coordinates of the vertex of a cuboid on a 3-D grid		D
Writing down the coordinates of the midpoint of the line connecting two points		D
Calculate the length of the line segment joining two points in the plane (all four quadrants)		D
Plot points for linear functions on a coordinate grid and draw the corresponding straight lines		D
Substitute values of $x$ into linear functions to find corresponding values of $y$		E
Interpret $m$ and $c$ as gradient and $y$ -intercept in linear functions		D
Understand that the graphs of linear functions are parallel if they have the same value of $m$		D
Understand linear functions in practical problems, eg distance-time graphs		D
Know that the line perpendicular to $y = mx + c$ has gradient $-1/m$		B
Rearrange and solve linear inequalities in one variable and show the solution set on a number line, or to write down all the integer solutions		C
Draw the graphs of linear inequalities in two variables and interpret the solution sets given by regions in the coordinate plane, or to identify all the integer coordinates with crosses		B

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<b>Module 11: Time Series, Scatter Graphs &amp; Correlation</b>		<b>Grade</b>
Represent data as a time series		D
Identify trends in data over time		D
Draw and produce a scatter graph		D
Calculate a moving average		C
Appreciate that correlation is a measure of the strength of association between two variables		C
Distinguish between positive, negative and zero correlation using a line of best fit		C
Appreciate that zero correlation does not necessarily imply 'no correlation' but merely 'no linear relationship'		C
Draw a line of best fit by eye and understand what it represents		C
Use a line of best fit to interpolate/extrapolate		C

<b>Module 12: Ratio, Scale &amp; Similar Triangles</b>		<b>Grade</b>
Solve word problems involving ratios, eg find the cost of 8 pencils given that 6 cost 78p		E
Appreciate that, eg the ratio 1:2 represents $\frac{1}{3}$ and $\frac{2}{3}$ of a quantity		E
Divide quantities in a given ratio, eg divide £20 in the ratio 2:3		D
Work out the real distance from a map, eg find the real distance represented by 4 cm on a map with scale 1:25000		E
Work out the distance on a map for a given real distance and scale		E
Know the relationship between linear, area and volume scale factors of similar shapes		D
Use integer and non-integer scale factors to find the length of a missing side in each of two similar shapes, given the lengths of a pair of corresponding sides		C
Prove formally geometric properties of triangles, eg that the base angles of an isosceles triangle are equal		A
Prove formally that two triangles are congruent		A

<b>Module 13: Index Notation, Surds &amp; Standard Form</b>		<b>Grade</b>
Use index rules to simplify and calculate numerical expressions involving powers		D/C
Rationalise the denominator of fractions, and, eg write $(\sqrt{18} + 10) \div \sqrt{2}$ in the form $p + q\sqrt{2}$		A
Understand the standard form convention		D
Convert numbers to, and from, standard form		D
Round numbers given in standard form to a given number of significant figures		C
Calculate with numbers given in standard form with, and without, a calculator		B

<b>Module 14: Formulae &amp; Circles</b>		<b>Grade</b>
Use letters or words to state the relationship between different quantities		E
Substitute positive and negative numbers into simple algebraic formulae		D
Find the solution to a problem by writing an equation and solving it		D
Substitute positive and negative numbers into algebraic formulae involving powers		C
Change the subject of a formula, eg convert the formula for converting Celsius into Fahrenheit into a formula that converts Fahrenheit into Celsius		C
Use and recall formulae to calculate perimeters and areas of circles, and parts of circles		D
Generate a formula from given information, eg find the formula for the perimeter of a rectangle given its area A and the length of one side		C
Find the perimeter and area of shapes made up from triangles, rectangles and parts of circles		C

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<b>Module 15: Transformations</b>		<b>Grade</b>
	Understand rotation as a (anticlockwise) turn about a given origin	E
	Understand translation as a combination of a horizontal and vertical shift including signs for directions	D
	Reflect shapes in a given mirror line; parallel to the coordinate axes and then $y = x$ or $y = -x$	D
	Understand that shapes produced by translation, rotation and reflection are congruent to its image	D
	Enlarge shapes by a given scale factor from a given point; using positive and negative scale factors greater and less than one	C

<b>Module 16: Direct &amp; Inverse Proportion &amp; Compound Measures</b>		<b>Grade</b>
	Interpret direct and inverse proportions as algebraic functions, eg $y \propto x^2$ as $y = kx^2$	A
	Use given information to find the value of the constant of proportionality	A
	Use algebraic functions for direct and inverse proportionality, with their value of k, to find unknown values	A
	Recognise and sketch the graphs for direct and inverse proportions ( $y \propto x, y \propto x^2, y \propto x^3, y \propto \frac{1}{x}, y \propto \frac{1}{x^2}$ )	A
	Convert between metric units of speed, eg km/h to m/s	D
	Convert between metric units of density, eg kg/m to g/cm	D
	Calculate speed when, eg fractions of an hour must be entered as fractions or as decimals	D
	Use the relationship between distance, speed and time to solve problems	C
	Know that density is found by mass $\div$ volume	C
	Use the relationship between density, mass and volume to solve problems, eg find the mass of an object with a given volume and density	C

<b>Module 17: Information from Large Sets of Data</b>		<b>Grade</b>
	Recall how to find the mean, mode and median for small data sets	E
	Calculate the mean of data given in a frequency distribution	D
	Understand and use the sigma notation for the mean of ungrouped, and grouped, data	D
	Find the median and quartiles for large sets of ungrouped data	D
	Recall how to use and interpret a stem and leaf diagram	D
	Use the mid interval value to find an estimate for the mean of data given in a grouped frequency distribution	C
	Draw a cumulative frequency table for grouped data (using the upper class boundary)	C
	Draw a cumulative frequency curve for grouped data	C
	Use a cumulative frequency diagram to solve problems, eg how many greater than a particular value	C
	Use a cumulative frequency diagram to find estimates for the median and quartiles of a distribution	B
	Draw a box plot to summarise information given in cumulative frequency diagrams	B
	Compare cumulative frequency diagrams and box plots to make inferences about distributions	B

<b>Module 18: Simultaneous Equations</b>		<b>Grade</b>
	Solve algebraically two simultaneous equations	C
	Interpret the solution of two simultaneous equations as the point of intersection the corresponding lines	C

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<b>Module 19: Quadratic Functions &amp; Simplifying Rational Expressions</b>		<b>Grade</b>
Plot the graphs of quadratic functions for positive and negative values of $x$		C
Find graphically the solutions of quadratic equations by considering the intercept on the $x$ -axis		B
Solve quadratic equations by factorising (including values of $a$ not equal to 1)		B/A
Use the quadratic formula to solve quadratic equations giving the answers to 1 dp		A*
Use the quadratic formula to solve quadratic equations leaving the answer in surd form		A*
Complete the square of a quadratic function (using this to write down the maximum/minimum of the function)		A*

<b>Module 20: Trial &amp; Improvement</b>		<b>Grade</b>
Solve cubic functions by successive substitution of values of $x$		D

<b>Module 21: Probability</b>		<b>Grade</b>
List all the outcomes from mutually exclusive events, eg from two coins, and sample space diagrams		E
Know that if the probability of an event occurring is $p$ then the probability of it not occurring is $1 - p$		E
Write down the probability associated with equally likely events, eg the probability of drawing an ace from a pack of cards		D
Find the missing probability from a list or table		D
Find estimates of probabilities by considering relative frequency in experimental results (including two-way tables)		D
Know that the more an experiment is repeated the better the estimate of probability		D
Know that the probability of A or B is $P(A) + P(B)$		B
Know that the probability of A and B is $P(A) \times P(B)$		B
Draw and use tree diagrams to solve probability problems (including examples of non-replacement)		B

<b>Module 22: Trigonometry</b>		<b>Grade</b>
Calculate the length of a diagonal of a rectangle given the lengths of the sides of the rectangle		C
Use trigonometric ratios (sin, cos and tan) to calculate angles in right-angled triangles		B
Use the trigonometric ratios to calculate unknown lengths in right-angled triangles		B
Calculate the diagonal through a cuboid, or across the face of a cuboid		A
Find the angle between the diagonal through a cuboid and the base of the cuboid		A
Find the angle between a sloping edge of a pyramid and the base of the pyramid		A
Identify when to use the sine or cosine rule and adapt the relevant formula to the given triangle		A

<b>Module 23: Non-Right Angled Triangles</b>		<b>Grade</b>
Find the unknown lengths, or angles, in non right-angle triangles using the sine and cosine rules		A
Find the area of triangles given two lengths and an included angle		A

<b>Module 24: Histograms</b>		<b>Grade</b>
Complete a histogram from a frequency table		A
Complete a frequency table from a histogram		A
Use a histogram to work out the frequency in part of a class interval		A

<b>Module 25: Further Functions</b>		<b>Grade</b>
Plot and recognise cubic, reciprocal, exponential and circular functions		B/A
Use the graphs of these functions to find approximate solutions to equations, eg given $x$ find $y$ (and vice versa)		B/A
Match equations with their graphs		B/A
Sketch graphs of given functions		B/A
Find the values of $p$ and $q$ in the function $y = p + q^x$ given the graph of $y = p + q^x$		A*

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<b>Module 26: Further Simultaneous Equations</b>		<b>Grade</b>
Draw a circle of radius $r$ centred at the origin		B
Find graphically the approximate solutions of linear and circular simultaneous equations		A
Find graphically the approximate solutions of linear and quadratic simultaneous equations		A
Find the exact solutions of linear and quadratic simultaneous equations		A
Find the exact solutions of linear and circular simultaneous equations		A*

<b>Module 27: Surface Area &amp; Volume of 3-D Shapes</b>		<b>Grade</b>
Find volumes of shapes by counting cubes		E
Convert between units of volume		D
Solve a range of problems involving surface area and volume, eg given the volume and length of a cylinder find the radius		B
Use formulae to calculate the surface areas and volumes of cuboids, right-prisms and cylinders		B
Find the surface area and the volume of more complex shapes, eg find the volume of an equilateral triangular prism		A
Solve more complex problems, eg given the surface area of a sphere find the volume		A*
Understand formulae for perimeters, areas and volumes by their dimensions, for example know that $4\pi r^2$ cannot represent the volume of a sphere		A*

<b>Module 28: Vectors</b>		<b>Grade</b>
Understand that $2\mathbf{a}$ is parallel to $\mathbf{a}$ and twice its length		A
Understand that $\mathbf{a}$ is parallel to $-\mathbf{a}$ and in the opposite direction		A
Use and interpret vectors as displacements in the plane (with an associated direction)		A
Use standard vector notation to combine vectors by addition, eg $\mathbf{AB} + \mathbf{BC} = \mathbf{AC}$ and $\mathbf{a} + \mathbf{b} = \mathbf{c}$		A
Represent vectors, and combinations of vectors, in the plane		A*
Solve geometrical problems in 2-D, eg show that joining the midpoints of the sides of any quadrilateral forms a parallelogram		A*

<b>Module 29: Transformation of Graphs</b>		<b>Grade</b>
Represent translations in the $x$ and $y$ direction, reflections in the $x$ -axis and the $y$ -axis, and stretches parallel to the $x$ -axis and the $y$ -axis		B/A
Sketch the graph of $y = f(x + 2)$ , $y = f(x) + 2$ , $y = 2f(x)$ , $y = f(2x)$ given the shape of the graph $y = f(x)$		A
Sketch the graph of $y = 3 \sin 2x$ , given the graph of $y = \sin x$		A*
Find the coordinates of the minimum of $y = f(x + 3)$ , $y = f(x) + 3$ given the coordinates of the minimum of $f(x) = x^2 - 2x$		A*