10.1. Linear Graphs and Sequences

	Foundation	Higher
Core	For Foundation groups, please teach a lesson on function machines before anything else Understand that lots of this unit recaps Y8 graphs. First lesson: 'rules make patterns': Compare and contrast $y = 3x + 2; y = 3x + 5; 3n$ This covers: • Draw, label and scale axes; • Find the coordinates of points identified by geometrical information in 2D (all four quadrants); • Plot and draw graphs from the equation using a table of values & **compare to sequences** • Recognise that equations of the form *y = mx + c* correspond to straight-line graphs & **compare to sequences** Then move on to understanding gradient and y-intercept: • Identify and interpret gradient and y-intercept from an equation • Identify parallel lines from their equations & **compare to sequences** • Find the equation of a straight line from a graph; (with both interpretations of gradient - $\frac{\Delta y}{\Delta x}$ is new!) • Sketch a graph using the gradient and y-intercept; Another skill that needs covering: • Find the coordinates of the midpoint of a line segment; (length of a line segment is in the Pythagoras unit)	• Find the equation of the line through two given points. • Identify and interpret gradient from an equation *ax + by = c*; • Generate equations of lines parallel and perpendicular to the given line; • Select and use the fact that when *y = mx + c* is the equation of a straight line, then the gradient of a line parallel to it will have a gradient of *m* and a line perpendicular to this line will have a gradient of $-\frac{1}{m}$. x
Challenge	• Plot and draw graphs of straight lines in the form *ax + by = c*; • Find approximate solutions to a linear equation from a graph; • Find the equation of the line through one point with a given gradient;	• Graphs problems where a diagram is not provided

What's new?
Gradient as $\frac{\Delta y}{\Delta x}$

10.2. Functions (H)

	Foundation	Higher,
Core	• Continue with 10.1 Linear Graphs and Sequences if needed	• Use function notation; • Find f(x) + g(x) and f(x) – g(x), 2f(x), f(3x) etc algebraically; • Find the inverse of a linear function; • Know that $f^{-1}(x)$ refers to the inverse function;
Challenge	RECAP 9.7. Equations and Formulae 9.17. Sequences (not nth term of a quadratic)	• For two functions f(x) and g(x), find gf(x).

What's new?
Function Notation

10.3. Graph Zoo

	Foundation	Higher
	• Draw graphs of linear, reciprocal, exponential, quadratic and cubic functions given an equation, using a table of values. • Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape	• State the value of x for which a reciprocal equation is not defined; • Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape • Interpret graphs of simple cubic functions, including finding solutions to cubic equations; • Draw circles, centre the origin, equation $x^2 + y^2 = r^2$

What's new?
Cubic and Circle Functions

10.4 Rotations and Reflections

	Foundation	Higher
Core	• Identify congruent shapes by eye; • Perform and fully describe rotations, including on a coordinate grid and where the centre may be given as a coordinate • Plot and draw graphs of $y = a$, $x = a$, $y = x$ and $y = -x$; • Recognise straight-line graphs parallel to the axes; • Perform and fully describe reflections, including on a coordinate grid and where the equation of the line of the reflection may be required	• Invariant Points

What's new?
Full and accurate descriptions of transformations, using exam-grade language

10.5. One-Variable Data

Order of teaching:

1. Recap MMM&R (including from frequency and grouped frequency tables);
2. Problem Solving (e.g. reverse mean);
3. Move from dataset to representation (and back);
4. Move from one representation to another
5. Comparing datasets by finding averages and range (from a variety of representations)

	Foundation	Higher
Core	• Use correct notation for time, 12- and 24-hour clock and work out time taken for a journey from a timetable; • Recognise types of data • Understand how sources of data may be biased and explain why a sample may not be representative of a whole population; • Understand sample and population. Representations: • Pictogram • Tally Chart • (Grouped) Frequency Table • Bar Chart • Pie Chart • Frequency Polygon • (Back-to-back) Stem and Leaf	• Identify possible sources of bias and plan to minimise it; • Write questions to eliminate bias, and understand how the timing and location of a survey can ensure a sample is representative • Understand how different sample sizes may affect the reliability of conclusions drawn;
Challenge	• Recognise the advantages and disadvantages between measures of average.	

10.6. Fractions & Worded Number Problems

The purpose of this unit is twofold:

1. To recap and develop Y7 Fractions skills (see below)
2. To practise GCSE style worded questions, particularly those that involve fractions and ratio; calc and non-calc.

	Foundation	Higher
Core	• Use diagrams to find equivalent fractions or compare fractions; • Express a given number as a fraction of another • Write a fraction in its simplest form and find equivalent fractions; • Compare fractions, use inequality signs, compare unit fractions; • Find fractions of quantities • Convert between mixed numbers and improper fractions; • 4 operations with fractions and integers • Find the reciprocal of an integer or fraction; • Understand and use unit fractions as multiplicative inverses;	• The ability to infer properties of populations or distributions from a sample (**Peterson Capture recapture**)
Challenge	• 4 operations with mixed number fractions • Simplify fraction multiplications by cancelling first; • Find the reciprocal of a decimal • Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined).	

What's new?
Long, worded problems

10.7. Intro to Vectors

	Foundation	Higher
Core	• Understand and use column notation in relation to vectors; • Calculate using column vectors including scalar multiples. • Perform and fully describe translations (using column vectors) • Perform and fully describe enlargements, with and without a centre of enlargement, and with integer and simple fractional scale factors. (advice here is to use vector notation when enlarging shapes)	• Perform and fully describe enlargements with negative scale factors
Challenge	• Perform and fully describe enlargements with fractional scale factors	• Find areas after enlargement and compare with before enlargement, to deduce multiplicative relationship (area scale factor); given the areas of two shapes, one an enlargement of the other, find the scale factor of the enlargement (whole number values only);

What's new?
Vector Notation

10.8. Further quadratics

	Foundation	Higher
Core	• **Recap 9.18.** • Generate points and plot graphs of simple quadratic functions, then more general quadratic functions; • Identify the line of symmetry of a quadratic graph; • Find approximate solutions ('roots') to quadratic equations using a graph;	• **Recap 9.18.** • Factorise quadratic expressions in the form $ax^2 + bx + c$; • (Set up and) solve quadratic equations; by completing the square and using the formula; • Be able to identify from a graph if a quadratic equation has any real roots; • Expand the product of more than two linear expressions; • Sketch a graph of a quadratic function, by factorising or by using the formula, identifying roots and y-intercept, turning point;
Challenge	• This unit can be extended by including quadratics where a ≠ 1. • Interpret graphs of quadratic functions from real-life problems; • Identify and interpret roots, intercepts and turning points of quadratic graphs.	• *Interpret graphs of simple cubic functions, including finding solutions to cubic equations;* • *Sketch graphs of simple cubic functions, given as three linear expressions;*

10.9. Scatter Graphs

	Foundation	Higher
Core	• Draw scatter graphs; • Interpret points on a scatter graph; • Identify outliers and ignore them on scatter graphs; • Draw the line of best fit on a scatter diagram by eye, and understand what it represents; • Distinguish between positive, negative and no correlation using lines of best fit; • Use a line of best fit to predict values of a variable given values of the other variable; • Interpret scatter graphs in terms of the relationship between two variables; • Understand that correlation does not imply causality; • State how reliable their predictions are, i.e. not reliable if extrapolated.	• Explain an isolated point on a scatter graph; • Appreciate that correlation is a measure of the strength of the association between two variables and that zero correlation does not necessarily imply 'no relationship' but merely 'no linear correlation';
		• find the equation of a line of best fit (scatter graphs) to model the relationship between quantities;

What's new?
All

10.10. Compound Measures

	Foundation	Higher

Core	• Understand and use compound measures:
	  • density;
	  • pressure;
	  • Speed (mph as well as metric):
	• convert between metric speed measures;
	• read values in km/h and mph from a speedometer;
	
	• Draw distance–time graphs and velocity–time graphs;
	• Work out time intervals for graph scales;
	• Interpret distance–time graphs, and calculate: the speed of individual sections, total distance and total time;
		• convert between density measures
		• convert between pressure measures;

Challenge	• Interpret gradient as the rate of change in distance–time and speed–time graphs • use kinematics formulae from the formulae sheet to calculate speed, acceleration (with variables defined in the question); • change d/t in m/s to a formula in km/h, i.e. d/t × (60 × 60)/1000 – with support;	

Notes

More Real life Graphs content in Unit 20

When you cover kinematic graphs, leave area under a graph and gradient of a curve until Unit 20

Note that students no longer need to know imperial metric conversions – they are provided in the exam.

What's new?

Density and Pressure

10.11. Simultaneous Equations

	Foundation	Higher

Core	**RECAP: 9.6**
	• Add and subtract algebraic expressions
	• Write simultaneous equations to represent a situation;
	• Solve simultaneous equations (linear/linear) algebraically and graphically;
	• Interpret solutions in the context of the problem;
		• Solve simultaneous equations graphically:
		  • linear / $x^2 + y^2 = r^2$;
		  • find approximate solutions to simultaneous equations formed from one linear function and one quadratic function using a graphical approach;

Challenge		• Solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns: • linear / quadratic;

10.12. Properties of Polygons

	Foundation	Higher
Core	• Recall the properties and definitions of special types of quadrilaterals, including symmetry properties; • Identify quadrilaterals from everyday usage; • Given some information about a shape on coordinate axes, complete the shape; recognise and name pentagons, hexagons, heptagons, octagons and decagons; • Understand 'regular' and 'irregular' as applied to polygons; • Use the sum of the interior angles of an *n*-sided polygon; • Use the sum of the exterior angles of any polygon is 360°; • Use the sum of the interior angle and the exterior angle is 180°; • Identify shapes which are congruent (by eye); • Explain why some polygons fit together and others do not;	• Explain why the angle sum of a quadrilateral is 360°; • Use the sum of angles in a triangle to deduce the angle sum in any polygon • Find the number of sides of a regular polygon from angle information • Calculate the angles of regular polygons and use these to solve problems; • Use angle facts to demonstrate how shapes would 'fit together', and work out interior angles of shapes in a pattern.

What's new?
Angles in Polygons

10.13. Further Surds (H)

	Foundation	Higher
Core	**RECAP** **9.2. Factors and Multiples** **9.3. Accuracy**	**Recap & Extend 9.6.** Understand surd notation Simplify a surd simplify and manipulate algebraic expressions with surds by: - collecting like terms - multiplying a single term over a bracket New Learning - Rationalise the denominator where there is one term
Challenge		• Rationalise the denominator

What's new?
RTD

10.14. Calculating with Standard Form

	Foundation	Higher
Core	**Recap 9.1. Decimals and Powers of 10** **Recap 9.5. Indices**	Extend Foundation Content
Challenge	• Add, subtract, multiply and divide numbers in standard form (without a calculator) • Interpret a calculator display using standard form and know how to enter numbers in standard form.	

What's new?
Calculations with SF

10.15. Bearings & Scale Diagrams

	Foundation	Higher
Core	**Recap Bearings & Co-Interior Angles from Year 9 Unit 11** • Use and interpret maps and scale drawings; • Estimate lengths using a scale diagram; • Make an accurate scale drawing from a diagram; • Mark on a diagram the position of point *B* given its bearing from point *A*; • Given the bearing of a point *A* from point *B*, work out the bearing of *B* from *A* (*"back bearings"*) • Use accurate drawing to solve bearings problems; • Solve locus problems including bearings.	
Challenge	Bearings with Pythagoras / Right-angled Trigonometry	(to be extended in year 11 with non-right angled Trig)

What's new?
Back Bearings

10.16. Growth and Decay

	Foundation	Higher
Core	• Calculate percentage profit or loss; • Make calculations involving repeated percentage change, not using the formula; • Find the original amount given the final amount after a percentage increase or decrease; • Represent repeated proportional change using a multiplier raised to a power, use this to solve problems involving compound interest and depreciation; • Set up, solve and interpret the answers in growth and decay problems;	• Work out the multiplier for repeated proportional change as a single decimal number; • Recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k and integer values of x;

What's new?
Repeat % Change Formula

10.17. More Probability (Trees and Venns)

	Foundation	Higher
Core	**Recap and extend Year 9 Unit 13** • Find a missing probability from a list or table including algebraic terms; • Estimate the probability of an event happening using relative frequency; • Estimate the number of times an event will occur, given the (experimental or theoretical) probability and the number of trials • Use and draw sample space diagrams; • Work out probabilities from Venn diagrams; • Compare experimental data and theoretical probabilities; • Compare relative frequencies from samples of different sizes; • Design, complete and use two-way tables for discrete and grouped data • Use tree diagrams to calculate the probability of two independent events;	• Understand conditional probabilities and decide if two events are independent; • Understand selection with or without replacement; • Use a two-way table to calculate conditional probability; • Calculate the probability of independent and dependent combined events;
Challenge	• Use tree diagrams to calculate the probability of two dependent events • Use union and intersection notation;	Use a tree diagram to calculate conditional probability; Use a Venn diagram to calculate conditional probability;

What's new?
Union and Intersection notation; Conditional Probability

10.18. Volume Recap (F) / Volume (H)

	Foundation	Higher
Core	• Recall and use the formula for the volume of a cuboid; • Find the volume of a prism, including a triangular prism, cube and cuboid; • Estimate volumes by rounding measurements to 1 significant figure;	• Use the formula for volume of pyramid; • Use the formulae for volume of spheres and cones; • Find the volumes of compound solids constructed from cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinders; • Solve problems involving more complex shapes and solids, including frustums of cones; • Form equations involving more complex shapes and solve these equations.
Challenge	• Find the volume of a cylinder; • Convert between metric measures of volume and capacity e.g. 1ml = 1cm^3.	

Notes/Links
Formula is given for cones and spheres. Not pyramids or cylinders.
What's new?
Volume of Pyramid, sphere, cone