Year 11

Week	Strand	Topic	
1	S1, S3, S4	Statistics 14b – Cumulative frequency and histograms	
2		Statistics 14b – Cumulative frequency and histograms	
3		Statistics 14b – Cumulative frequency and histograms	
4	A8, A12, A13, G21	Geometry 13a - Graphs of trig functions	
5		Geometry 13a - Graphs of trig functions	
6	N8, A4, A5, A6, A7, A18	Algebra 17 – Algebraic fractions, surds and proof	
7		Algebra 17 – Algebraic fractions, surds and proof	
8		**REVIEW/ASSESS/DIRT WEEK 1**	
9	N8, A4, A5, A6, A7, A18	Algebra 17 – Algebraic fractions, surds and proof	
10	G9, G10	Geometry 16a – Circle theorems	
11		Geometry 16a – Circle theorems	
12	N16, G11, G20, G22, G23	Geometry 13b – Further trigonometry	
13		Geometry 13b – Further trigonometry	
14		**REVIEW/ASSESS/DIRT WEEK 2**	
15	R7, R10, R13, R16	Algebra and Ratio 19b – Direct and inverse proportion	
16		Algebra and Ratio 19b – Direct and inverse proportion	
17		**REVIEW/ASSESS/DIRT WEEK 3**	
18	A16	Geometry 16b – Circle geometry	
19		Geometry 16b – Circle geometry	
20	G25	Geometry 18 – Vectors and geometric proof	
21		Geometry 18 – Vectors and geometric proof	
22		**REVIEW/ASSESS/DIRT WEEK 4**	
23	R14, R15, A7, A12, A13, A14, A15	Algebra 19a – Graphs including gradients and area under	
24		Algebra 19a – Graphs including gradients and area under	
25		**REVIEW/REVISE LEARNING**	
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BOLD – Higher only UNDERLINED – higher and foundation tier High

Statistics 14b

OBJECTIVES
By the end of the sub-unit, students should be able to:
• Use statistics found in all graphs/charts in this unit to describe a population;
• **Know the appropriate uses of cumulative frequency diagrams;**
• **Construct and interpret cumulative frequency tables;**
• **Construct and interpret cumulative frequency graphs/diagrams and from the graph:**
  ◦ **estimate frequency greater/less than a given value;**
  ◦ **find the median and quartile values and interquartile range;**
• **Compare the mean and range of two distributions, or median and interquartile range, as appropriate;**
• **Interpret box plots to find median, quartiles, range and interquartile range and draw conclusions;**
• **Produce box plots from raw data and when given quartiles, median and identify any outliers;**
• **Know the appropriate uses of histograms;**
• **Construct and interpret histograms from class intervals with unequal width;**
• **Use and understand frequency density;**
• **From histograms:**
  ◦ **complete a grouped frequency table;**
  ◦ **understand and define frequency density;**
• Estimate the mean from a histogram;
Estimate the median from a histogram with unequal class widths or any other information from a histogram, such as the number of people in a given interval.
	POSSIBLE SUCCESS CRITERIA
	Construct cumulative frequency graphs, box plots and histograms from frequency tables.
	Compare two data sets and justify their comparisons based on measures extracted from their diagrams where appropriate in terms of the context of the data.
	
	COMMON MISCONCEPTIONS
	Labelling axes incorrectly in terms of the scales, and also using 'Frequency' instead of 'Frequency Density' or 'Cumulative Frequency'.
	Students often confuse the methods involved with cumulative frequency, estimating the mean and histograms when dealing with data tables.
	
	NOTES
	Ensure that axes are clearly labelled.
	As a way to introduce measures of spread, it may be useful to find mode, median, range and interquartile range from stem and leaf diagrams (including back-to-back) to compare two data sets.
	As an extension, use the formula for identifying an outlier, (i.e. if data point is below
	LQ – 1.5 × IQR or above UQ + 1.5 × IQR, it is an outlier). Get them to identify outliers in the data, and give bounds for data.

Geometry 13a

OBJECTIVES	POSSIBLE SUCCESS CRITERIA
By the end of the sub-unit, students should be able to: • **Recognise, sketch and interpret graphs of the trigonometric functions (in degrees) y = sin x, y = cos x and y = tan x for angles of any size.** • Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90° and exact value of tan θ for θ = 0°, 30°, 45° and 60° and find them from graphs. • **Apply to the graph of y = f(x) the transformations y = −f(x), y = f(−x) for sine, cosine and tan functions f(x).** **Apply to the graph of y = f(x) the transformations y = f(x) + a, y = f(x + a) for sine, cosine and tan functions f(x).**	Match the characteristic shape of the graphs to their functions and transformations. **NOTES** Translations and reflections of functions are included in this specification, but not rotations or stretches. This work could be supported by the used of graphical calculators or suitable ICT. Students need to recall the above exact values for sin, cos and tan.

Algebra 17

OBJECTIVES	POSSIBLE SUCCESS CRITERIA
By the end of the unit, students should be able to: • **Rationalise the denominator involving surds;** • **Simplify algebraic fractions**; • **Multiply and divide algebraic fractions;** • **Solve quadratic equations arising from algebraic fraction equations;** • Change the subject of a formula, including cases where the subject occurs on both sides of the formula, or where a power of the subject appears; • Change the subject of a formula such as $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$, where all variables are in the denominators; • **Solve 'Show that' and proof questions using consecutive integers (n, n + 1), squares a^2, b^2, even numbers 2n, odd numbers 2n +1;** • 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;** **For two functions f(x) and g(x), find gf(x).**	Rationalise: $\frac{1}{\sqrt{3}-1}$, $\frac{1}{\sqrt{3}}$, (√18 + 10) +√2. Explain the difference between rational and irrational numbers. Given a function, evaluate f(2). When g(x) = 3 – 2x, find g^{-1} (x). **COMMON MISCONCEPTIONS** √3 x √3 = 9 is often seen. When simplifying involving factors, students often use the 'first' factor that they find and not the LCM. **NOTES** It is useful to generalise $\sqrt{m} \times \sqrt{m} = m$. Revise the difference of two squares to show why we use, for example, (√3 – 2) as the multiplier to rationalise (√3 + 2). Link collecting like terms to simplifying surds (Core 1 textbooks are a good source for additional work in relation to simplifying surds). Practice factorisation where the factor may involve more than one variable. Emphasise that, by using the LCM for the denominator, the algebraic manipulation is easier.

Geometry 16a

OBJECTIVES
By the end of the sub-unit, students should be able to:
• <u>Recall the definition of a circle and identify (name) and draw parts of a circle, including sector, tangent, chord, segment;</u>
• **Prove and use the facts that:**
  • **the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference;**
  • **the angle in a semicircle is a right angle;**
  • **the perpendicular from the centre of a circle to a chord bisects the chord;**
  • **angles in the same segment are equal;**
  • **alternate segment theorem;**
  • **opposite angles of a cyclic quadrilateral sum to 180°;**
• **Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point;**
• Find and give reasons for missing angles on diagrams using:
  • **circle theorems;**
  • isosceles triangles (radius properties) in circles;
  • the fact that the angle between a tangent and radius is 90°;
the fact that tangents from an external point are equal in length.
	POSSIBLE SUCCESS CRITERIA
	Justify clearly missing angles on diagrams using the various circle theorems.
	
	COMMON MISCONCEPTIONS
	Much of the confusion arises from mixing up the diameter and the radius.
	
	NOTES
	Reasoning needs to be carefully constructed and correct notation should be used throughout.
	Students should label any diagrams clearly, as this will assist them; particular emphasis should be made on labelling any radii in the first instance.

Geometry 13b

OBJECTIVES	POSSIBLE SUCCESS CRITERIA
By the end of the sub-unit, students should be able to: • **Know and apply Area = $\frac{1}{2}ab\sin C$ to calculate the area, sides or angles of any triangle.** • **Know the sine and cosine rules, and use to solve 2D problems (including involving bearings).** • **Use the sine and cosine rules to solve 3D problems.** • Understand the language of planes, and recognise the diagonals of a cuboid. • Solve geometrical problems on coordinate axes. • Understand, recall and use trigonometric relationships and Pythagoras' Theorem in right-angled triangles, **and use these to solve problems in 3D configurations.** • **Calculate the length of a diagonal of a cuboid.** **Find the angle between a line and a plane.**	Find the area of a segment of a circle given the radius and length of the chord. Justify when to use the cosine rule, sine rule, Pythagoras' Theorem or normal trigonometric ratios to solve problems. **COMMON MISCONCEPTIONS** Not using the correct rule, or attempting to use 'normal trig' in non-right-angled triangles. When finding angles students will be unable to rearrange the cosine rule or fail to find the inverse of cos θ. **NOTES** The cosine rule is used when we have SAS and used to find the side opposite the 'included' angle or when we have SSS to find an angle. Ensure that finding angles with 'normal trig' is refreshed prior to this topic. Students may find it useful to be reminded of simple geometrical facts, i.e. the shortest side is always opposite the shortest angle in a triangle. The sine and cosine rules and general formula for the area of a triangle are not given on the formulae sheet. In multi-step questions emphasise the importance of not rounding prematurely and using exact values where appropriate. Whilst 3D coordinates are not included in the programme of study, they provide a visual introduction to trigonometry in 3D.

Algebra and Ratio 19b

OBJECTIVES	POSSIBLE SUCCESS CRITERIA
By the end of the sub-unit, students should be able to: • Recognise and interpret graphs showing direct and indirect proportion; • Identify direct proportion from a table of values, by comparing ratios of values, **for x squared and x cubed relationships;** • **Write statements of proportionality for quantities proportional to the square, cube or other power of another quantity;** • **Set up and use equations to solve word and other problems involving direct proportion;** • **Use $y = kx$ to solve direct proportion problems, including questions where students find k, and then use k to find another value;** • Solve problems involving inverse proportion using graphs by plotting and reading values from graphs; • Solve problems involving inverse proportionality; Set up and use equations to solve word and other problems involving direct proportion or inverse proportion.	Understand that when two quantities are in direct proportion, the ratio between them remains constant. Know the symbol for 'is proportional to'. **COMMON MISCONCEPTIONS** Direct and inverse proportion can get mixed up. **NOTES** Consider using science contexts for problems involving inverse proportionality, e.g. volume of gas inversely proportional to the pressure or frequency is inversely proportional to wavelength.

Geometry 16b

OBJECTIVES
By the end of the sub-unit, students should be able to:
• Select and apply construction techniques and understanding of loci to draw graphs based on circles and perpendiculars of lines;
• **Find the equation of a tangent to a circle at a given point, by:**
  • **finding the gradient of the radius that meets the circle at that point (circles all centre the origin);**
  • **finding the gradient of the tangent perpendicular to it;**
  • **using the given point;**
Recognise and construct the graph of a circle using $x^2 + y^2 = r^2$ for radius r centred at the origin of coordinates.
 	
Find the equation of a tangent to a circle/curve
	POSSIBLE SUCCESS CRITERIA
	Find the gradient of a radius of a circle drawn on a coordinate grid and relate this to the gradient of the tangent.
	Justify the relationship between the gradient of a tangent and the radius.
	Produce an equation of a line given a gradient and a coordinate.
	
	COMMON MISCONCEPTIONS
	Students find it difficult working with negative reciprocals of fractions and negative fractions.
	
	NOTES
	Work with positive gradients of radii initially and review reciprocals prior to starting this topic.
	It is useful to start this topic through visual proofs, working out the gradient of the radius and the tangent, before discussing the relationship.

Geometry 18

OBJECTIVES	POSSIBLE SUCCESS CRITERIA
By the end of the unit, students should be able to: • Understand and use vector notation, including column notation, and understand and interpret vectors as displacement in the plane with an associated direction. • **Understand that 2a is parallel to a and twice its length, and that a is parallel to −a in the opposite direction.** • Represent vectors, combinations of vectors and scalar multiples in the plane pictorially. • Calculate the sum of two vectors, the difference of two vectors and a scalar multiple of a vector using column vectors (including algebraic terms). • Find the length of a vector using Pythagoras' Theorem. • Calculate the resultant of two vectors. • Solve geometric problems in 2D where vectors are divided in a given ratio. • **use vectors to construct geometric arguments and proofs**; **Produce geometrical proofs to prove points are collinear and vectors/lines are parallel.**	Add and subtract vectors algebraically and use column vectors. Solve geometric problems and produce proofs. **COMMON MISCONCEPTIONS** Students find it difficult to understand that parallel vectors are equal as they are in different locations in the plane. **NOTES** Students find manipulation of column vectors relatively easy compared to pictorial and algebraic manipulation methods – encourage them to draw any vectors they calculate on the picture. Geometry of a hexagon provides a good source of parallel, reverse and multiples of vectors. Remind students to underline vectors or use an arrow above them, or they will be regarded as just lengths. Extend geometric proofs by showing that the medians of a triangle intersect at a single point. 3D vectors or **i**, **j** and **k** notation can be introduced and further extension work can be found in GCE Mechanics 1 textbooks.

Algebra 19a

OBJECTIVES
By the end of the sub-unit, students should be able to:
• Recognise, sketch and interpret graphs of the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$
• State the value of x for which the equation is not defined;
• **Recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k and integer values of x;**
• **Use calculators to explore exponential growth and decay**;
• Set up, solve and interpret the answers in growth and decay problems;
• Interpret and analyse transformations of graphs of functions and write the functions algebraically, e.g. write the equation of f(x) + a, or f(x − a):
  • apply to the graph of y = f(x) the transformations y = −f(x), y = f(−x) for linear, quadratic, cubic functions;
  • apply to the graph of y = f(x) the transformations y = f(x) + a, y = f(x + a) for linear, quadratic, cubic functions;
• **Estimate area under a quadratic or other graph by dividing it into trapezia;**
• **Interpret the gradient of linear or non-linear graphs, and estimate the gradient of a quadratic or non-linear graph at a given point by sketching the tangent and finding its gradient;**
• Interpret the gradient of non-linear graph in curved distance–time and velocity–time graphs:
  • for a non-linear distance–time graph, estimate the speed at one point in time, from the tangent, and the average speed over several seconds by finding the gradient of the chord;
  • for a non-linear velocity–time graph, estimate the acceleration at one point in time, from the tangent, and the average acceleration over several seconds by finding the gradient of the chord;
• **Interpret the gradient of a linear or non-linear graph in financial contexts as the gradient at a given point**;
• **Interpret the area under a linear or non-linear graph in real-life contexts;**
• **Interpret the rate of change of graphs of containers filling and emptying;**
	POSSIBLE SUCCESS CRITERIA
	Explain why you cannot find the area under a reciprocal or tan graph.
	
	COMMON MISCONCEPTIONS
	The effects of transforming functions is often confused.
	
	NOTES
	Translations and reflections of functions are included in this specification, but not rotations or stretches.
	Financial contexts could include percentage or growth rate.
	When interpreting rates of change with graphs of containers filling and emptying, a steeper gradient means a faster rate of change.
	When interpreting rates of change of unit price in price graphs, a steeper graph means larger unit price.

Interpret the rate of change of unit price in price graphs.	