Year 11

Week	Strand	Topic		Estimated hours
1	N6, N7	Number 1c – Indices, powers, roots		6-8
2		Number 1c – Indices, powers, roots		
3	A2, A4, A5, A7, A21	Algebra 2c – Expressions – Expressions + Substitution		6-8
4		Algebra 2c – Expressions – Expressions + Substitution		
5	G2, G15, S2, S4	Statistics 3c – Pie charts		3-5
6	S4, S6	Statistics 3d - Scattergraphs		5-7
7		**Common Topics**		
8		**REVIEW/ASSESS/DIRT WEEK 1**		
9	N12, R9	Percentages 4c – Basic percentages		6-8
10		Percentages 4c – Basic percentages		
11	A7, A23, A24, A25	Sequences 5c – Basic sequences and nth term		6-8
12		Sequences 5c – Basic sequences and nth term		
13	N7, N15, A4, G6, G20, G21	Trigonometry + Pythagoras 12 – Review		5-7
14		Trigonometry + Pythagoras 12 – Review		
15		**Mocks**		
16		**Mocks**		
17	N11, N13, R1, R4, R5, R6, R7, R8, R10, R12, R14	Ratio + Properties 11a+b – RPR review.		5-7
18	A11, A12, A18	Quadratics + Graphs 16b - Properties and plotting.		3-5
19	G24, G25	Vectors 19b		6-8
20		Vectors 19b		
21		**REVIEW/ASSESS/DIRT WEEK 2**		
22	N1, A3, A5, A6, A9, A12, A14, A19, A21, A22, R10, R14	Rearranging equations 20 –	Cubics, reciprocals and simultaneous equations	4-6
23		Rearranging equations 20 –		
24		**Consolidation and Revision**		
25		**Consolidation and Revision**		
26		**Consolidation and Revision**		
27		**Consolidation and Revision**		
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34		**Consolidation and Revision**		
35		**Consolidation and Revision**		
36		STUDENTS LEAVE		
37				
38				
39				

Number 1c – Indices, powers and roots. Teaching time: 6-8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Find squares and cubes:
  - recall integer squares up to 10 x 10 and the corresponding square roots;
  - understand the difference between positive and negative square roots;
  - recall the cubes of 1, 2, 3, 4, 5 and 10;
- Use index notation for squares and cubes;
- Recognise powers of 2, 3, 4, 5;
- Evaluate expressions involving squares, cubes and roots:
  - add, subtract, multiply and divide numbers in index form;
  - cancel to simplify a calculation;
- Use index notation for powers of 10, including negative powers;
- Use the laws of indices to multiply and divide numbers written in index notation;
- Use the square, cube and power keys on a calculator;
- Use brackets and the hierarchy of operations with powers inside the brackets, or raising brackets to powers;
- Use calculators for all calculations: positive and negative numbers, brackets, powers and roots, four operations.

POSSIBLE SUCCESS CRITERIA

What is the value of 2^3?

Evaluate $(2^3 \times 2^5) \div 2^4$.

COMMON MISCONCEPTIONS

The order of operations is often not applied correctly when squaring negative numbers, and many calculators will reinforce this misconception.

10^3, for example, is interpreted as 10×3.

NOTES

Pupils need to know how to enter negative numbers into their calculator.

Use the language of 'negative' number and not minus number to avoid confusion with calculations.

Note that the students need to understand the term 'surd' as there will be occasions when their calculator displays an answer in surd form, for example, $4\sqrt{2}$.

Algebra 2c – Expressions and substitution. Teaching time: 6-8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Write expressions to solve problems representing a situation;
- Substitute numbers in simple algebraic expressions;
- Substitute numbers into expressions involving brackets and powers;
- Substitute positive and negative numbers into expressions;
- Derive a simple formula, including those with squares, cubes and roots;
- Substitute numbers into a word formula;
- Substitute numbers into a formula.

POSSIBLE SUCCESS CRITERIA

Evaluate the expressions for different values of x: $3x^2 + 4$ or $2x^3$.

COMMON MISCONCEPTIONS

Some students may think that it is always true that $a = 1$, $b = 2$, $c = 3$.

If $a = 2$ sometimes students interpret $3a$ as 32.

Making mistakes with negatives, including the squaring of negative numbers.

NOTES

Use formulae from mathematics and other subjects, expressed initially in words and then using letters and symbols.

Include substitution into the kinematics formulae given on the formula sheet, i.e. $v = u + at$, $v^2 - u^2 = 2as$, and $s = ut + \frac{1}{2}at^2$.

Statistics 3c – Pie charts. Teaching time: 3-5 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Draw circles and arcs to a given radius;
- Know there are 360 degrees in a full turn, 180 degrees in a half turn, and 90 degrees in a quarter turn;
- Measure and draw angles, to the nearest degree;
- Interpret tables; represent data in tables and charts;
- Know which charts to use for different types of data sets;
- Construct pie charts for categorical data and discrete/continuous numerical data;
- Interpret simple pie charts using simple fractions and percentages; $\frac{1}{2}$, $\frac{1}{4}$ and multiples of 10% sections;
- From a pie chart:
  - find the mode;
  - find the total frequency;
- Understand that the frequency represented by corresponding sectors in two pie charts is dependent upon the total populations represented by each of the pie charts.

POSSIBLE SUCCESS CRITERIA

From a simple pie chart identify the frequency represented by $\frac{1}{4}$ and $\frac{1}{2}$ sections.

From a simple pie chart identify the mode.
Find the angle for one item.

COMMON MISCONCEPTIONS

Same size sectors for different sized data sets represent the same number rather than the same proportion.

NOTES

Relate $\frac{1}{4}$, $\frac{1}{2}$, etc to percentages.

Practise dividing by 20, 30, 40, 60, etc.
Compare pie charts to identify similarities and differences.
Angles when drawing pie charts should be accurate to 2°.

Statistics 3d – Scatter graphs. Teaching time: 5-7 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- 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;
- Use the line of best fit make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing;
- 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;
- Interpret correlation in terms of the problem;
- Understand that correlation does not imply causality;
- State how reliable their predictions are, i.e. not reliable if extrapolated.

POSSIBLE SUCCESS CRITERIA

Justify an estimate they have made using a line of best fit.
Identify outliers and explain why they may occur.
Given two sets of data in a table, model the relationship and make predictions.

COMMON MISCONCEPTIONS

Lines of best fit are often forgotten, but correct answers still obtained by sight.
Interpreting scales of different measurements and confusion between x and y axes when plotting points.

NOTES

Students need to be constantly reminded of the importance of drawing a line of best fit.
Support with copy and complete statements, e.g. as the ___ increases, the ___ decreases.
Statistically the line of best fit should pass through the coordinate representing the mean of the data.
Students should label the axes clearly, and use a ruler for all straight lines and a pencil for all drawing.

Remind students that the line of best fit does not necessarily go through the origin of the graph.

Percentages 4c – Basic percentages. Teaching time: 6-8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Express a given number as a percentage of another number;
- Find a percentage of a quantity without a calculator: 50%, 25% and multiples of 10% and 5%;
- Find a percentage of a quantity or measurement (use measurements they should know from Key Stage 3 only);
- Calculate amount of increase/decrease;
- Use percentages to solve problems, including comparisons of two quantities using percentages;
- Percentages over 100%;
- Use percentages in real-life situations, including percentages greater than 100%:
  - Price after VAT (not price before VAT);
  - Value of profit or loss;
  - Simple interest;
  - Income tax calculations;
- Use decimals to find quantities;
- Find a percentage of a quantity, including using a multiplier;
- Use a multiplier to increase or decrease by a percentage in any scenario where percentages are used;
- Understand the multiplicative nature of percentages as operators.

POSSIBLE SUCCESS CRITERIA

What is 10%, 15%, 17.5% of £30?

COMMON MISCONCEPTIONS

It is not possible to have a percentage greater than 100%.

NOTES

When finding a percentage of a quantity or measurement, use only measurements they should know from Key Stage 3.

Amounts of money should always be rounded to the nearest penny.

Use real-life examples where possible.

Emphasise the importance of being able to convert between decimals and percentages and the use of decimal multipliers to make calculations easier.

Sequences 5c – Basic sequences and nth terms. Teaching time: 6-8 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Recognise sequences of odd and even numbers, and other sequences including Fibonacci sequences;
- Use function machines to find terms of a sequence;
- Write the term-to-term definition of a sequence in words;
- Find a specific term in the sequence using position-to-term or term-to-term rules;
- Generate arithmetic sequences of numbers, triangular number, square and cube integers and sequences derived from diagrams;
- Recognise such sequences from diagrams and draw the next term in a pattern sequence;
- Find the next term in a sequence, including negative values;
- Find the nth term for a pattern sequence;
- Find the nth term of a linear sequence;
- Find the nth term of an arithmetic sequence;
- Use the nth term of an arithmetic sequence to generate terms;
- Use the nth term of an arithmetic sequence to decide if a given number is a term in the sequence, or find the first term over a certain number;
- Use the nth term of an arithmetic sequence to find the first term greater/less than a certain number;
- Continue a geometric progression and find the term-to-term rule, including negatives, fraction and decimal terms;
- Continue a quadratic sequence and use the nth term to generate terms;
- Distinguish between arithmetic and geometric sequences.

POSSIBLE SUCCESS CRITERIA

Given a sequence, 'Which is the 1st term greater than 50?'

What is the amount of money after x months saving the same amount or the height of tree that grows 6 m per year?

What are the next terms in the following sequences?

1, 3, 9, … 100, 50, 25, … 2, 4, 8, 16, …

Write down an expression for the nth term of the arithmetic sequence 2, 5, 8, 11, …

Is 67 a term in the sequence 4, 7, 10, 13, …?

NOTES

Emphasise use of $3n$ meaning $3 \times n$.

Students need to be clear on the description of the pattern in words, the difference between the terms and the algebraic description of the nth term.

Students are not expected to find the nth term of a quadratic sequence.

Right Angled Triangles 12 – Pythagoras and trigonometry review. Teaching time: 5-7 hours

OBJECTIVES

By the end of the unit, students should be able to:

- Understand, recall and use Pythagoras' Theorem in 2D, including leaving answers in surd form;
- Given 3 sides of a triangle, justify if it is right-angled or not;
- Calculate the length of the hypotenuse in a right-angled triangle, including decimal lengths and a range of units;
- Find the length of a shorter side in a right-angled triangle;
- Apply Pythagoras' Theorem with a triangle drawn on a coordinate grid;
- Calculate the length of a line segment AB given pairs of points;
- Understand, use and recall the trigonometric ratios sine, cosine and tan, and apply them to find angles and lengths in general triangles in 2D figures;
- Use the trigonometric ratios to solve 2D problems;
- Find angles of elevation and depression;
- Round answers to appropriate degree of accuracy, either to a given number of significant figures or decimal places, or make a sensible decision on rounding in context of question;
- Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of tan θ for θ = 0°, 30°, 45° and 60°.

POSSIBLE SUCCESS CRITERIA

Does 2, 3, 6 give a right angled triangle?

Justify when to use Pythagoras' Theorem and when to use trigonometry.

COMMON MISCONCEPTIONS

Answers may be displayed on a calculator in surd form.

Students forget to square root their final answer or round their answer prematurely.

NOTES

Students may need reminding about surds.

Drawing the squares on the 3 sides will help to illustrate the theorem.

Include examples with triangles drawn in all four quadrants.

Scale drawings are not acceptable.

Calculators need to be in degree mode.

To find in right-angled triangles the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°, use triangles with angles of 30°, 45° and 60°.

Use a suitable mnemonic to remember SOHCAHTOA.

Use Pythagoras' Theorem and trigonometry together.

Ratio and Proportion 11a – Ratio review. Teaching time (for both **a** and **b**): 5-7 hours

OBJECTIVES

By the end of the sub-unit, students should be able to:

- Understand and express the division of a quantity into a of number parts as a ratio;
- Write ratios in their simplest form;
- Write/interpret a ratio to describe a situation;
- Share a quantity in a given ratio including three-part ratios;
- Solve a ratio problem in context:
  - use a ratio to find one quantity when the other is known;
  - use a ratio to compare a scale model to a real-life object;
  - use a ratio to convert between measures and currencies;
  - problems involving mixing, e.g. paint colours, cement and drawn conclusions;
- Compare ratios;
- Write ratios in form $1 : m$ or $m : 1$;
- Write a ratio as a fraction;
- Write a ratio as a linear function;
- Write lengths, areas and volumes of two shapes as ratios in simplest form;
- Express a multiplicative relationship between two quantities as a ratio or a fraction.

POSSIBLE SUCCESS CRITERIA

Write a ratio to describe a situation such as 1 blue for every 2 red, or 3 adults for every 10 children.

Recognise that two paints mixed red to yellow 5 : 4 and 20 : 16 are the same colour.

Express the statement 'There are twice as many girls as boys' as the ratio 2 : 1 or the linear function $y = 2x$, where x is the number of boys and y is the number of girls.

COMMON MISCONCEPTIONS

Students find three-part ratios difficult.

Using a ratio to find one quantity when the other is known often results in students 'sharing' the known amount.

NOTES

Emphasise the importance of reading the question carefully.

Include ratios with decimals 0.2 : 1.

Converting imperial units to imperial units aren't specifically in the programme of study, but still useful and provide a good context for multiplicative reasoning.

It is also useful generally for students to know rough metric equivalents of commonly used imperial measures, such as pounds, feet, miles and pints.

Ratio and Proportion 11b – Proportion. Teaching time (for both **a** and **b**): 5-7 hours

OBJECTIVES By the end of the sub-unit, students should be able to: • Understand and use proportion as equality of ratios; • Solve word problems involving direct and indirect proportion; • Work out which product is the better buy; • Scale up recipes; • Convert between currencies; • Find amounts for 3 people when amount for 1 given; • Solve proportion problems using the unitary method; • Recognise when values are in direct proportion by reference to the graph form; • Understand inverse proportion: as x increases, y decreases (inverse graphs done in later unit); • Recognise when values are in direct proportion by reference to the graph form; • Understand direct proportion ---> relationship $y = kx$.	**POSSIBLE SUCCESS CRITERIA** Recognise that two paints mixed red to yellow 5 : 4 and 20 : 16 are the same colour. If it takes 2 builders 10 days to build a wall, how long will it take 3 builders? Scale up recipes and decide if there is enough of each ingredient. Given two sets of data in a table, are they in direct proportion? **NOTES** Find out/prove whether two variables are in direct proportion by plotting the graph and using it as a model to read off other values. Possible link with scatter graphs.

Quadratics and Graphs 16b – Properties and plotting. Teaching time: 3-5 hours

OBJECTIVES By the end of the sub-unit, students should be able to: • 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 to quadratic equations using a graph; • Interpret graphs of quadratic functions from real-life problems; • Identify and interpret roots, intercepts and turning points of quadratic graphs.	**POSSIBLE SUCCESS CRITERIA** Recognise a quadratic graph from its shape. **COMMON MISCONCEPTIONS** Squaring negative numbers can be a problem. **NOTES** The graphs should be drawn freehand and in pencil, joining points using a smooth curve. Encourage efficient use of the calculator. Extension work can be through plotting cubic and reciprocal graphs, solving simultaneous equations graphically.

Vectors 19b. Teaching time: 6-8 hours

OBJECTIVES
By the end of the sub-unit, students should be able to:

- Understand and use column notation in relation to vectors;
- Be able to represent information graphically given column vectors;
- Identify two column vectors which are parallel;
- Calculate using column vectors, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector.

POSSIBLE SUCCESS CRITERIA
Know that if one vector is a multiple of the other, they are parallel.
Add and subtract vectors using column vectors.

COMMON MISCONCEPTIONS
Students find it difficult to understand that two vectors can be parallel and equal as they can be in different locations in the plane.

NOTES
Students find manipulation of column vectors relatively easy compared to the pictorial and algebraic manipulation methods – encourage them to draw any vectors that they calculate on the picture.

Rearranging Equations 20 – Cubics, reciprocals and simultaneous equations.

Teaching time: 4-6 hours

OBJECTIVES

By the end of the unit, students should be able to:

- Know the difference between an equation and an identity and use and understand the ≠ symbol;
- Change the subject of a formula involving the use of square roots and squares;
- Answer 'show that' questions using consecutive integers (n, $n + 1$), squares a^2, b^2, even numbers $2n$, and odd numbers $2n + 1$;
- Solve problems involving inverse proportion using graphs, and read values from graphs;
- Find the equation of the line through two given points;
- Recognise, sketch and interpret graphs of simple cubic functions;
- Recognise, sketch and interpret graphs of the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$;
- Use graphical representations of indirect proportion to solve problems in context;
- identify and interpret the gradient from an equation $ax + by = c$;
- Write simultaneous equations to represent a situation;
- Solve simultaneous equations (linear/linear) algebraically and graphically;
- Solve simultaneous equations representing a real-life situation, graphically and algebraically, and interpret the solution in the context of the problem;

POSSIBLE SUCCESS CRITERIA

Solve two simultaneous equations in two variables (linear/linear) algebraically and find approximate solutions using a graph.
Identify expressions, equations, formulae and identities from a list.

COMMON MISCONCEPTIONS

The effects of transforming functions are often confused.

NOTES

Emphasise the need for good algebraic notation.