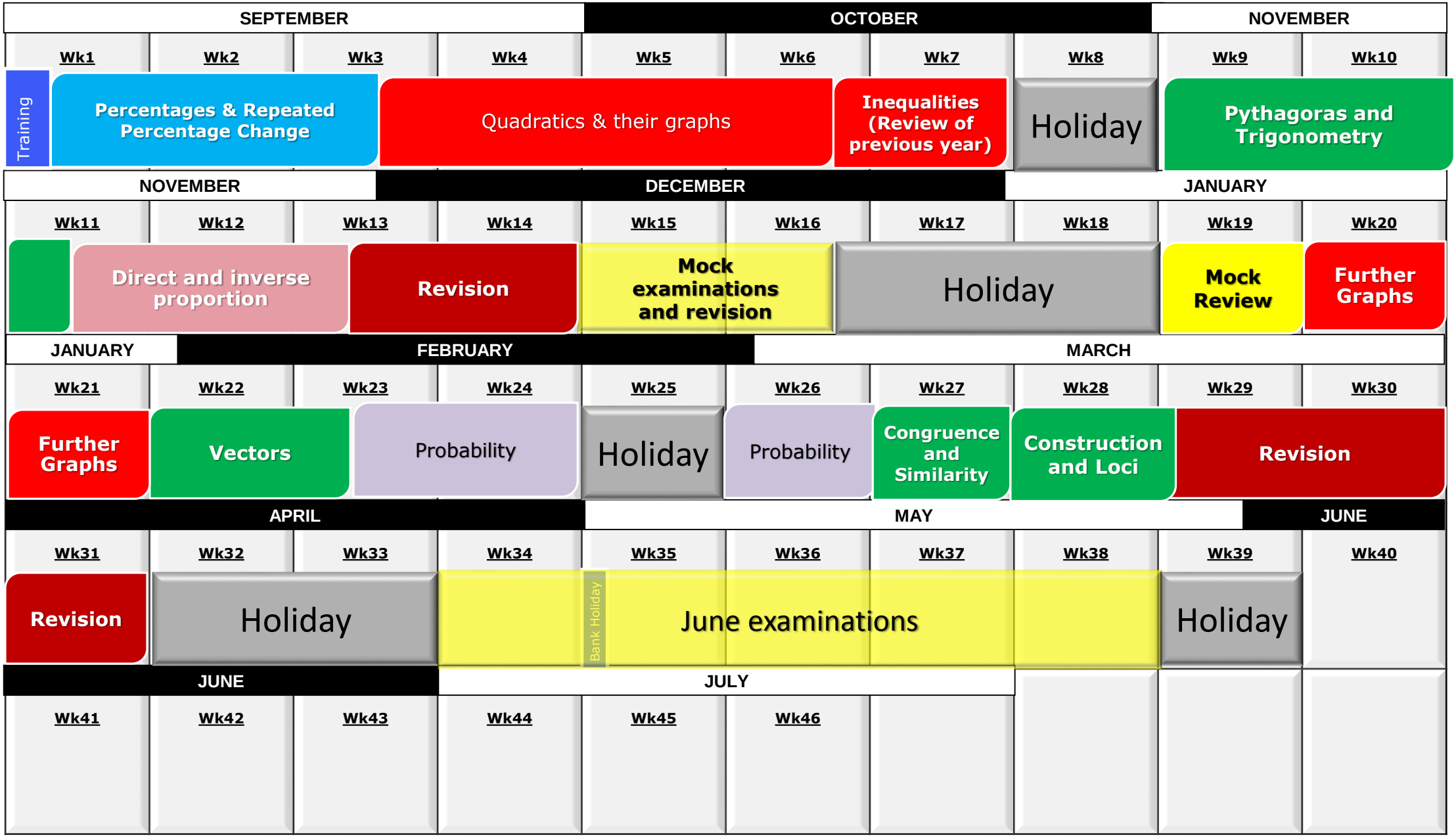
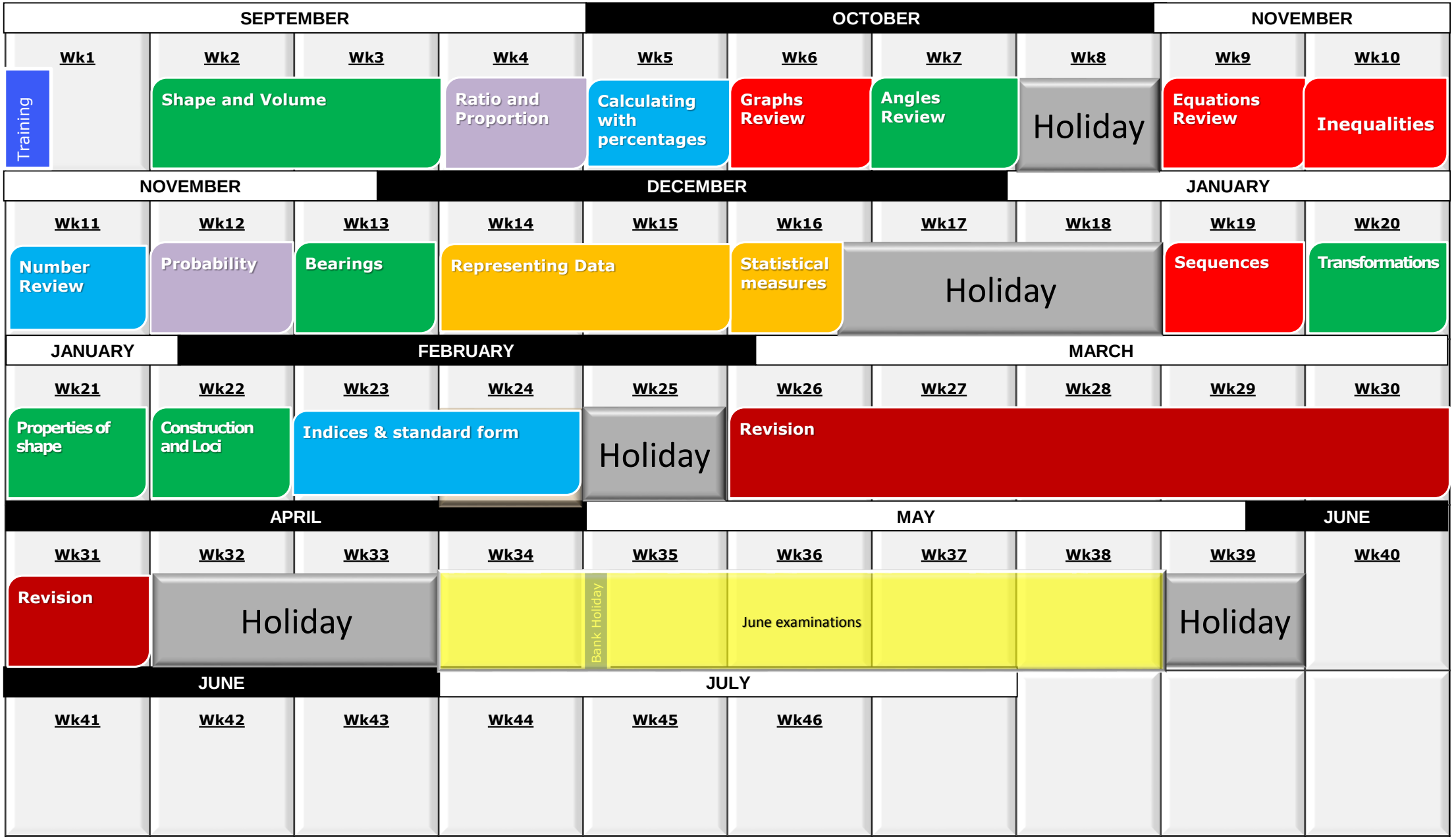
Year 11 Foundation + Scheme of Work



ESD Topics Year 11



Factors and Multiples

Year 10

Objectives

- Use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation, and the unique factorisation theorem.
- Apply prime factor decomposition including product of prime factors written in index form.
- Apply systematic listing strategies including using lists, tables and diagrams.

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Angles & Bearings

Year 10

Objectives

Recap:

- Use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries.
- Use the standard conventions for labelling and referring to the sides and angles of triangles and draw diagrams from written descriptions.
- Apply the properties of:

- angles at a point
- angles at a point on a straight line
- vertically opposite angles

- Understand and use alternate and corresponding angles on parallel lines (colloquial terms such as Z angles are not acceptable and should not be used)
- Use scale factors, scale diagrams and maps
- Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings including the eight compass point bearings and three-figure bearings

New content:

- Know names and properties of a pentagon, hexagon, octagon and decagon
- Derive and use the sum of angles in a triangle to deduce and use the angle sum in any polygon, and to derive properties of regular polygons
- Derive and apply the properties and definitions of :

- special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus
- Special triangles and other plane figures using appropriate language including knowing names and properties of isosceles, equilateral, scalene, right-angled, acute-angled, obtuse-angled triangles.

Problem Solving/Reasoning

- Finding a location given bearings

Links to other topics

Misconceptions

Return to Routemap

Statistical Measures

Year 10

Objectives

- Find the mean of data given in an ungrouped frequency distribution
- Find the mode, median and range for a small set of data
- Find the median by using (n+1)/2 where n is the number of data
- Find the mean from a frequency table (grouped and ungrouped). Use the mid point of equal class intervals to find an estimate for the mean of grouped data.
- Know the advantages/disadvantages of using the different measure of average
- Find the median and quartiles for large sets of ungrouped data
- Interpret, analyse and compare the distributions of data sets from by looking at the spread of data (range, including consideration of outliers)
- Apply statistics to describe a population
- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Indices and Standard form

Year 10

Objectives

- Use positive integer powers and associated real roots (square, cube and higher)
- Recognise powers of 2, 3, 4, 5 5
- Apply basic numerical index laws including negative indices (fractional NOT needed at foundation)
- **Calculate with roots (surds)** and with integer indices
- Understand and use place value (e.g. when working with very large or very small numbers)
- Calculate with and interpret standard form $A \times 10^n$ where $1 \leq A < 10$ and n is an integer (with and without a calculator)

Problem Solving/Reasoning

Links to other topics

- Geometric progressions

Misconceptions

Return to Routemap

Expressions, Equations and Formulae

Year 10

Objectives

- Understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors
- Simplify and manipulate algebraic expressions (including those involving surds) by:
  - collecting like terms
  - multiplying a single term over a bracket
  - taking out common factors
- Understand and use standard mathematical formulae.
- Substitute numerical values into formulae and expressions, including scientific formulae
- Solve linear equations in one unknown algebraically including those with the unknown on both sides of the equation including use of brackets
- Set up and solve equations using geometric problems and interpret the solution.
- Solve two simultaneous equations in two variables (linear / linear) algebraically
- Set up and solve two simultaneous equations and interpret the solution
- Understand and use standard mathematical formulae
- Rearrange formulae to change the subject
- Where appropriate, interpret simple expressions as functions with inputs and outputs

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Fractions

Year 10

Objectives

- Order positive and negative fractions
- Apply the four operations, including formal written methods, to simple fractions (proper and improper) and mixed numbers - both positive and negative
- Calculate exactly with fractions

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Perimeter and Area Recap

AQA

Year 10

Objectives

Recap:

- Calculate the perimeter of a 2D shape and composite shapes
- Know and apply formulae to calculate area of:
  - Triangles
  - Parallelograms
  - Trapezia
- Calculate the area of composite shapes
- Identify and apply circle definitions and properties, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- Know and use the formulae
  - Circumference of a circle $= 2\pi r^2 = \pi d$
  - Area of a circle $= \pi r^2$
- Calculate the perimeter of 2D shapes including circles and composite shapes (solutions in terms of π may be asked for)
- Calculate areas of circles and composite shapes (solutions in terms of π may be asked for)

New Content

- Calculate arc lengths, angles and areas of sectors of circles
- Calculating exactly with multiples of π

Problem Solving/Reasoning

Links to other topics

- Solving Equations
- Substitution

Misconceptions

Return to Routemap

Volume and Surface Area

Year 10

Objectives

- Identify properties of the faces, surfaces, edges and vertices of: cube, cuboids, prisms, cylinders, pyramids, cones and spheres
- Know and apply the formulae to calculate the volume of cuboids and other right prisms (including cylinders)
- Calculate the volume of spheres, pyramids, cones and composite solids
- Find the surface area of pyramids and composite solids
- Calculate surface area of spheres, cones and composite solids
- Calculate exactly with multiples of π

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Congruence and Similarity

Year 10

Objectives

- Use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)
- Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides including Pythagoras' Theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs
- Apply and use the concepts of congruence and similarity, including the relationships between lengths in similar figures
- Compare lengths, areas and volumes using ratio notation
- Make links to similarity and scale factors

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Ratio and Proportion

Year 10

Objectives

- Identify and work with fractions in ratio problems
- Express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1
- Use ratio notation, including reduction to simplest form
- Divide a given quantity into two parts in a given part:part or part:whole ratio
- Express the division of a quantity into two parts as a ratio
- Apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing and concentrations)
- Including better value or best buy problems
- Express a multiplicative relationship between two quantities as a ratio or fraction
- Understand and use proportion as equality of ratios
- Relate ratios to fractions and to linear functions

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Sequences

Year 10

Objectives

- Generate terms of a sequence from either a term-to-term or a position-to-term rule
- Recognise and use:
  - sequences of triangular, square and cube numbers
  - simple arithmetic progression
  - Fibonacci type sequences
  - quadratic sequences
  - and simple geometric progressions (r^n where n is an integer and r is a rational number > 0)
- Deduce expressions to calculate the nth term of linear sequences

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Linear Graphs

Year 10

Objectives

- Solve geometrical problems on co-ordinate axes
- Draw linear graphs
- Find approximate solutions to an equation using a graph
- Use the form $y = mx + c$ to identify parallel lines
- Find the equation of the line through two given points, or through one point with a given gradient
- Identify and interpret gradients and intercepts of linear functions graphically and algebraically
- Solve two simultaneous equations in two variables (linear / linear) graphically

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Collecting and Representing Data

Year 10

Objectives

- Interpret and construct tables, charts and diagrams including, for categorical data:
  - frequency tables
  - bar charts
  - pie charts
  - pictograms
  - vertical line charts for ungrouped discrete numerical data
  - tables and line graphs for time series data
  - know their appropriate use
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data
- Use and interpret scatter graphs of bivariate data (incl frequency polygons)
- Recognise correlation and know that it does not indicate causation
- Draw estimated lines of best fit
- Make predictions
- Interpolate and extrapolate apparent trends whilst knowing the dangers of doing so

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Transformations

Year 10

Objectives

- Identify, describe and construct congruent and similar shapes, including on co-ordinate axes, by considering rotation, reflection, translation and enlargement (including fractional scale factors)
- Describe translations as 2D vectors

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Compound Measures & Accuracy

Year 10

Objectives

- Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures)
- Use inequality notation to specify simple error intervals due to truncation or rounding
- Apply and interpret limits of accuracy
- Use standard units of measure and related concepts (length, area, volume / capacity, mass, time, money etc.)
- Use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Inequalities

Year 10

Objectives

- Solve linear inequalities in one variable
- Represent the solution set on a number line
- Know the conventions of an open circle on a number line for a strict inequality and a closed circle for an included boundary

Problem Solving/Reasoning

Links to other topics

- Equations
- Bounds
- Factorising Quadratics
- Straight line graphs

Misconceptions

Return to Routemap

Construction and Loci

Year 10

Objectives

- Use the standard ruler and compass constructions:
  - perpendicular bisector of a line segment
  - constructing a perpendicular to a given line from / at a given point
  - bisecting a given angle
- Know that the perpendicular distance from a point to a line is the shortest distance to the line
- Use these to construct given figures and solve loci problems

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Percentages & Repeated Percentage Change

Year 11

Objectives

- Solve problems involving percentage change, including :
  - percentage increase / decrease problems
  - original value problems
  - simple interest, including in financial mathematics
  - problems set in context
  - using a multiplier
- **Understand the meaning of growth and decay**
- **Set up and solve problems with growth and decay**
- **Interpret answers in growth and decay problems, including compound interest.**

Problem Solving/Reasoning

Links to other topics

- Iteration
- Compound interest
- Percentages
- Iteration
- Compound interest
- Percentages

Misconceptions

Return to Routemap

Quadratics & their graphs

AQA

Year 11

Objectives

- Simplify and manipulate algebraic expressions (including those involving surds) by:
  - expanding products of two binomials
  - factorising quadratic expressions of the form $x^2 + bx + c$ including the difference of two squares
  - simplifying expressions involving sums, products and powers, including the laws of indices
- Recognise, sketch and interpret graphs of quadratic functions
- Identify and interpret roots, intercepts and turning points of quadratic functions graphically
- Deduce roots algebraically
- Solve quadratic equations algebraically by factorising
- Find approximate solutions using a graph

Problem Solving/Reasoning

- Solving quadratics in a rearranged form
- Find the height of a throw that follows a quadratic curve.

Links to other topics

- Simultaneous equations – linear
- Linear equations
- Linear graphs

Misconceptions

Return to Routemap

Pythagoras' Theorem and Trigonometry

Year 11

Objectives

- Know the formula for Pythagoras' Theorem $a^2 + b^2 = c^2$
- Apply it to find length in right angled triangles in two dimensional figures
- Know and use the trigonometric ratios

$$\sin\theta = \frac{opposite}{hypotenuse}, cos\,\theta = \frac{adjacent}{hypotenuse}, tan\,\theta = \frac{opposite}{adjacent}$$

- Apply them to find angles and lengths in right-angled triangles in two dimensional figures
- Know the exact values of sinθ and cosθ for $\theta = 0°, 30°\ 45°, 60°$ and $90°$
- Know the exact value of tanθ for $\theta = 0°, 30°, 45°$ *and* $60°$
- Compare lengths using ratio notation
- Make links to trigonometric ratios

Problem Solving/Reasoning

Links to other topics

- Bearings

Misconceptions

Return to Routemap

Direct and inverse proportion

Year 11

Objectives

- Solve problems involving direct and inverse proportion, including graphical and algebraic representations
- Understand that x is inversely proportional to y is equivalent to x is proportional to $\frac{1}{Y}$
- Interpret equations that describe direct and inverse proportion
- Recognise and interpret graphs that illustrate direct and inverse proportion

Problem Solving/Reasoning

Links to other topics

- Ratio
- Proportion
- Equations
- Graphs

Misconceptions

Return to Routemap

Further Graphs

Year 11

Objectives

- Plot and interpret graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematics problems involving distance, speed and acceleration including problems requiring a graphical solution
- Interpret the gradient of a straight line as a rate of change
- Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions and the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$ including using the symmetry of functions

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Vectors

Year 11

Objectives

- Understand the diagrammatic and column representation of vectors
- Add and subtract vectors
- Multiply vectors by a scalar (number)

Problem Solving/Reasoning

Links to other topics

- Collecting like terms
- Proof
- Perimeter of shapes

Misconceptions

Return to Routemap

Probability (Slide 1 of 2)

AQA
Year 11

Objectives

Recap:

- Record, describe and analyse the frequency of outcomes of probability experiments using tables and **frequency trees** (probabilities should be written as fractions, decimals or percentages)
- Know that if the probability of an event occurring is p than the probability of it not occurring is 1 – p
- Find the missing probability from a list or table
- List all the outcomes from mutually exclusive events, e.g. from two coins, and sample space diagrams and use these to calculate theoretical probabilities

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Probability (Slide 2 of 2)

AQA
Year 11

Objectives

New Content:

- Apply ideas of randomness, fairness and equally likely events to calculate expected outcomes or multiple future experiments
- Find estimates of probabilities by considering relative frequency in experimental results (including two-way tables)
- Know that the more an experiment is repeated the better the estimate of probability
- Enumerate sets and combinations of sets systematically using tables, grids, Venn diagrams and tree diagrams
- Know that the probability of A or B is P(A) + P(B)
- Know that the probability of A and B is P(A) x P(B)
- Draw and use tree diagrams to solve probability problems

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Probability ESD 2 sessions

AQA ESD

Objectives

- Record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees
- Apply the property that the probabilities of an exhaustive set of outcomes sum to one
- Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one
- Construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities

Problem Solving/Reasoning

Links to other topics

- Fractions
- Decimals

Misconceptions

Return to Routemap

Graphs Review ESD

2 sessions

AQA ESD

Objectives

- Solve geometrical problems on co-ordinate axes
- Plot graphs of equations that correspond to straight line graphs in the co-ordinate plane
- Use the form $y = mx + c$ to identify parallel lines
- Find the equation of the line through two given points, or through one point with a given gradient
- Identify and interpret gradients and intercepts of linear functions graphically and algebraically
- Plot and interpret graphs (including reciprocal graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematics problems involving distance, speed and acceleration
- Interpret the gradient of a straight line as a rate of change

Problem Solving/Reasoning

Links to other topics

- Substitution
- Sequences
- Perpendicular/parallel lines

Misconceptions

Return to Routemap

Angles Review ESD

1 session

AQA ESD

Objectives

- Apply the properties of:
  - angles at a point
  - angles at a point on a straight line
  - vertically opposite angles
- Understand and use alternate and corresponding angles on parallel lines
- Deduce and use the angle sum in any polygon, and to derive properties of regular polygons)
- Derive and apply the properties and definitions of:
  - special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus

Problem Solving/Reasoning

Links to other topics

- Area

Misconceptions

Return to Routemap

Number Review ESD

3 session

AQA ESD

Objectives

- Order positive and negative fractions
- Apply the four operations, including formal written methods, to simple fractions (proper and improper) and mixed numbers - both positive and negative
- Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures)
- Order positive and negative decimals
- Understand and use place value
- Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)
- Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures)
- Use inequality notation to specify simple error intervals due to truncation or rounding

Problem Solving/Reasoning

Links to other topics

- Measures
- Area
- Pythagoras (standard form)
- Equations
- Circles
- Any problem with a decimal solution

Misconceptions

Return to Routemap

Equations Review ESD

2 sessions

AQA ESD

Objectives

- Substitute numerical values into formulae and expressions, including scientific formulae
- Solve linear equations in one unknown algebraically including those with the unknown on both sides of the equation
- Solve two simultaneous equations in two variables algebraically
- Translate simple situations or procedures into algebraic expressions or formulae; Derive two simultaneous equations
- Solve the equations and interpret the solution

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Bearings ESD

1 session

AQA ESD

Objectives

- Use scale factors, scale diagrams and maps
- Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings including the eight compass point bearings and three-figure bearings

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Representing Data ESD

2 session

AQA ESD

Objectives

- Interpret and construct tables, charts and diagrams including, for categorical data and know their appropriate use:
  - frequency tables
  - bar charts
  - pie charts
  - pictograms
  - vertical line charts for ungrouped discrete numerical data
  - tables and line graphs for time series data
- Interpret, analyse and compare distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Statistical measures ESD

1 session

ESD

Objectives

- Understand the differences between averages and know how to solve problems to find values
- Find averages from a frequency table including grouped.
- Find an estimate of the mean from a grouped frequency table
- Understand properties of a frequency table (including grouped)
- Apply statistics to describe a population
- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Sequences ESD

1 session

AQA ESD

Objectives

- Generate terms of a sequence from either a term-to-term or a position-to-term rule
- Recognise and use:
  - sequences of triangular, square and cube numbers
  - simple arithmetic progression
  - Fibonacci type sequences
  - quadratic sequences
  - and simple geometric progressions (r^n where n is an integer and r is a rational number > 0)

Problem Solving/Reasoning

Links to other topics

- Quadratic graphs

Misconceptions

Return to Routemap

Shape and Volume review ESD

2 session

AQA ESD

Objectives

- Recall how to calculate the area and perimeter of a circle including working backwards
- Calculate areas of circles and composite shapes
- Calculate arc lengths, angles and areas of sectors of circles
- Compare lengths, areas and volumes using ratio notation
- Know and apply the formulae to calculate the volume of cuboids and other right prisms (including cylinders)
- Calculate the volume and surface area of spheres, pyramids, cones and composite solids (formula given within the question)
- Find the volume and surface area of pyramids and composite solids
- Calculate exactly with multiples of π

Problem Solving/Reasoning

Links to other topics

- Make links to similarity and scale factors

Misconceptions

- Solutions may be asked in terms of π

Return to Routemap

Ratio and Proportion ESD

1 session

AQA ESD

Objectives

- Express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1
- Use ratio notation, including reduction to simplest form
- Divide a given quantity into two parts in a given part:part or part:whole ratio
- Express the division of a quantity into two parts as a ratio
- Apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing and concentrations)
- Express a multiplicative relationship between two quantities as a ratio or fraction
- Understand and use proportion as equality of ratios
- Relate ratios to fractions and to linear functions

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Transformations and properties of shapes ESD

2 sessions

AQA ESD

Objectives

- Construct congruent and similar shapes, including on co-ordinate axes, by considering rotation, reflection, translation and enlargement (including fractional scale factors)
- Describe translations as 2D vectors
- Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides including the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs
- Apply and use the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures

Problem Solving/Reasoning

Links to other topics

Misconceptions

Return to Routemap

Constructions and Loci ESD

1 session

AQA ESD

Objectives

- Use the standard ruler and compass constructions :
  - perpendicular bisector of a line segment
  - constructing a perpendicular to a given line from / at a given point
  - bisecting a given angle
- Know that the perpendicular distance from a point to a line is the shortest distance to the line
- Use these to construct given figures and solve loci problems

Problem Solving/Reasoning

Links to other topics

- Area/perimeter

Misconceptions

Return to Routemap

Percentage Review ESD

1 session

AQA ESD

Objectives

- Solve problems involving percentage change, including :
- percentage increase / decrease problems
- original value problems
- simple interest, including in financial mathematics
- problems set in context
- using a multiplier

Problem Solving/Reasoning

Links to other topics

- Area problems
- Growth and decay

Misconceptions

Return to Routemap

Indices Review ESD

1 session

AQA ESD

Objectives

- Use positive integer powers and associated real roots (square, cube and higher)
- Recognise powers of 2, 3, 4, 5
- Calculate with roots and with integer indices

Problem Solving/Reasoning

Links to other topics

- Algebraic fractions

Misconceptions

Return to Routemap