Toynbee Curriculum
KS3 Topic Summaries

MATHS (Year 9)

Toynbee School

Scheme of Learning: Year 9 Autumn Term

Topic Sequence: Reasoning with Algebra

1	2	3
Straight Line Graphs	**Forming and Solving Equations**	**Testing Conjectures**

Topic Overview: Straight Line Graphs

Straight Line Graphs in Year 9 builds on Year 8 content where students plotted simple straight line graphs. They now study y = mx + c as the general form of the equation of a straight line, interpreting m and c in abstract and real-life contexts, and reducing to this form in simple cases. This will be explored further when students rearrange formulae. Top sets will also consider inverse relationships and perpendicular lines.

Learning Sequence:

Lines parallel to the axis
This small step revises content covered earlier in KS3. Students need to be able to plot and recognise lines in the form '*x = a, y = b, y = x and y = -x*'. Students should understand that the equation of a line describes a relationship between any pair of coordinates on that line and so that any point at any line *y = 3*, the y coordinate is equal to 3.

Using tables of values (R)
Students need to be able to complete and use a table of values to plot a straight line graph. The use of function machines can enable students to understand how the y coordinate is generated. Students should start to look for patterns in their tables of values using varying amounts of increases in *x*.

Compare gradients
Students need to recognise that the coefficient of *x* in the equation *y = mx + c* tells us the gradient of the line using both positive and negative values of m in lines of the form *y = mx* before moving onto lines in the form *y = mx + c*. Students should be aware that the greater the gradient of the line, the steeper the line is.

Compare intercepts
Students focus on how the value of *c* affects a line, looking first at lines in the form *y = x + c* before moving onto lines in the form *y = mx + c*. Students need to be familiar with the term *y-intercept* to describe the point at which a graph intersects with the y-axis.

Understand and use *y = mx + c*
Students bring together what they have covered in previous small steps to interpret the equation of a line, identifying both gradient and the y-intercept. They need to know that when two lines have the same gradient, they are parallel and that the coordinates of the y-intercept are (0, c).

Write an equation in the form *y = mx + c* (H)
Students study simple equations that require one step of rearrangement / deduction to analyse straight line graphs.

Find the equation of a line from a graph
Students need to find the gradient and the y-intercept from a graph, remembering to look carefully at the scales of the graphs before calculating the gradients.

Gradient / Intercept of real life graphs
Students continue to find the gradient and y-intercept of a line, now interpreting it in a given context. They should be aware that graphs that do not start at (0, 0) do not represent direct proportion.

Model real-life graphs involving inverse proportion (H)
Students continue to look at real life graphs, but focus of graphs that show inverse proportion. Students should understand that as the graph is not straight, they will be unable to find a gradient or y-intercept, but understand that impact of having no resources or infinite resources. A house cannot be built with no workers, and even with infinite workers it will still take time to construct.

Explore perpendicular lines (H)
This step should build upon students knowledge of perpendicular lines, being able to recognise them on a graph. Looking a lines such as *y = 2x* and *y = 0.5x*, students should recognise the products of gradients of a pair of perpendicular lines will always be -1. This should lead to students knowing that the gradient of one perpendicular line is the negative reciprocal of the other.

Sequence of Learning:

1	Lines parallel to the axes (R)
2	Using tables of values (R)
3	Compare gradients
4	Compare intercepts
5	Understand and use y = mx + c
6	Write an equation in the form y = mx + c
7	Find the equation of a line from a graph
8	Interpret gradient and intercepts of real-life graphs
9	Model real-life graphs involving inverse proportion (H)
10	Explore perpendicular lines (H)

Topic Resources:

Knowledge Maps:	Linear Graphs
Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Autumn Term

Topic Sequence: Reasoning with Algebra

1	2	3
Straight Line Graphs	**Forming and Solving Equations**	Testing Conjectures

Topic Overview: Forming & Solving Equations

During this topic, students will revisit and extend their knowledge of forming and solving linear equations / inequalities, which builds upon and supports other areas of the curriculum. Students will also explore rearranging formulae and this links to solving equations and reinforcing the difference between equations, formulae, identities and expressions.

Learning Sequence:

One and Two-step Equations / Inequalities (R)
Students will revisit key ideas of equations and inequalities before looking at complex examples, starting to solve one- and two-step equations.. This will help remedy any common misconceptions to enable students to extend their knowledge.

Equations / Inequalities with brackets (R)
Building upon students knowledge of solving equations, this topic has equations with brackets, which can result in non integer answers, allowing pupils to learn how they can use fractions to express the answer.

Inequalities with negative numbers
Students will explore the effects of multiplying and dividing inequalities with negative numbers. Students will compare and contrast solving equations to solving inequalities. Students can also use their skills of substitution or number lines to verify their answers.

Solve Equations with unknows on both sides
Students will be confident using the 'balance' method to sole equations / inequalities and now will focus on solving equations with unknows on both sides. Bar models will be shown along side standard method to help reinforce the process to solve equations.

Solve Inequalities with unknowns on both sides
Students will build upon their knowledge of solving equations on both sides and apply it to solving inequalities with unknows on both sides.

Equations / Inequalities in other mathematical contexts
Students will use their skills at forming and solving equations in different contexts, visiting topics such as probability, averages, angles, area and perimeter with unknowns.

Formulae and Equations
Students will now explore the difference between formulae and equations, substituting values into formulae to produce solvable equations. The concept of subject of the formulae will be introduced as this is needed for future steps in the topic, by showing students formulae they have used before such as area of a triangle.

Rearrange formulae (one-step)
Here students will explore the link between solving one-step equations and rearranging one-step formulae, using previously learnt methods to answer question.

Rearrange (two-step)
Building upon the previous step, students will begin to look at more complex formulae, and students can revisit and build upon what they learnt on straight line graphs and the $y = mx + x$, learning how it can be rearrange to help find the gradient and y-intercept.

Rearrange complex formulae (H)
This final step looks at more complex rearrangement that will involve multiple steps. Look at formulae which contain brackets or require squaring / square rooting to rearrange.

Sequence of Learning:

1	One and Two-step Equations / Inequalities (R)
2	Equations / Inequalities with brackets (R)
3	Inequalities with negative numbers
4	Solve Equations with unknows on both sides
5	Solve Inequalities with unknowns on both sides
6	Equations / Inequalities in other mathematical contexts
7	Formulae and Equations
8	Rearrange formulae (one-step)
9	Rearrange (two-step)
10	Rearrange complex formulae (H)

Topic Resources:

Knowledge Maps:	Algebraic Manipulation and Notation Solving Linear Equations
Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Autumn Term

Topic Sequence: Reasoning with Algebra

1	2	3
Straight Line Graphs	Forming and Solving Equations	Testing Conjectures

Topic Overview: Testing Conjectures

Reasoning is encouraged throughout the maths curriculum, and this block allows time for direct teaching of this. The opportunity is taken to revisit primes, factors and multiples which provides a wealth of opportunity to make and test simple conjectures. Students also develop their algebraic skills through developing chains of reasoning and learning how to expand a pair of binomials.

Learning Sequence:

Factors, Multiples and Primes (R)
This step will review previous knowledge on factors, multiples and primes which will be the base on forthcoming work on conjectures. Misconceptions will be addressed as well as a recap of how to express a number as a product of primes.

True or False
This step is an introduction into forming and testing conjectures, looking at identifying whether a given statement is true or false. This will mostly use students prior knowledge, with some questions requiring some reasoning to determine whether true or false, before moving into more complex scenarios.

Always, Sometimes, Never true
This step builds on the previous step of true or false, requiring students to find and identify examples to prove that a statement can be true and false, which proves it is sometimes true. This step will require students to consider fractions and negative numbers, as statements often appear true when only considering positive integers.

Show that
This step develops more formal demonstrations that a statement is true or not. Starting with simple numerical verification, students will proceed to verifying algebraic identities and simple proofs.

Conjectures about Numbers
Students will use conjectures about sums and products of odd and even numbers that can be verified with diagrams. This step is a vital part of understanding the later algebraic approach.

Expand a pair of binomials
This step focuses on expansion where all terms are positive, but can be extended to include negatives. The expansions produced will be used to form and test conjectures in this and future steps. Students need to be familiar with the language of binomial (i.e. having two terms) and quadratic (i.e. having four terms, although these will simplify to three or fewer).

Conjectures with algebra
Building upon previous steps, students will now look at forming and testing conjectures with algebra. A key aspect would be to understand that expressions of the form $2n$ are even and those of the form $2n + 1$ are odd.

Explore the 100 grid
This step provides an introduction to more formal proof with students using the hundred square to form expressions and then practising the skills of simplification and expanding two binomials.

Expand three binomials (H)
This step extends upon expanding a pair of binomials with the expansion of three binomials. Students need to be work carefully and be confident with directed number to find the expansions involving negative terms accurately.

Sequence of Learning:

1	Factors, Multiples and Primes (R)
2	True or False
3	Always, Sometimes, Never true
4	Show that
5	Conjectures about Numbers
6	Expand a pair of binomials
7	Conjectures with algebra
8	Explore the 100 grid
9	Expand three binomials (H)

Topic Resources:

Knowledge Maps:	Algebraic Manipulation and Notation

Assessment

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Autumn Term

Topic Sequence: Constructing in 2 and 3 Dimensions

4	5
Three-dimensional Shapes	**Constructions and Congruency**

Topic Overview: Three-dimensional Shapes

This will be the first time students will have formally studied 3 dimensional shapes in KS3. Students will revisit correct vocabulary required to describe different 3D shapes. Students will look at surface area and volume, as well as looking at plans and elevations of 3 dimensional shapes.

Learning Sequence:

Names of 2D and 3D shapes
Students should already be aware of most of the names of shapes, but may need a recap on key vocabulary for describing shapes, such as faces, edges and vertices.

Recognise prisms (including language of edges and vertices)
Students will need to tell the difference between prisms and no prisms, looking for uniform cross-sectional face, which can be defined as a polygon.

Accurate nets of cuboids and other 3D shapes
Students will learn how to draw an accurate net of a 3D shape, which will help build understanding of surface area in the later step.

Sketch and recognise nets of cuboids and other 3D shapes
This step builds upon the last, but allows students to quickly draw a net and label key lengths which further builds on the skills needed to find the surface area of prisms.

Plans and Elevations
Students will use their knowledge of 3D shapes to draw plans and elevations, drawing what can be seen from the front, side and top of a shape.

Find area of 2D shapes (R)
In this step, students will revisit finding the area of 2D shapes which is a vital skill for finding the surface area of 3D shapes.

Surface area of cubes and cuboids
This step builds upon students knowledge of nets and 2D shapes to find the surface area of cubes and cuboids. Students should be able to identify matching sides, and will look at the difference between open and closed shapes.

Surface area of triangular prisms
Similar to the last step, students will use knowledge of sketching nets and 2D shapes to find all the shapes needed to work out the surface area of triangular prisms.

Surface area of cylinder
Students will revisit the difference between finding the area and circumference of a circle as both are needed to find the surface area of a cylinder. Then using the same skills as previous steps will be able to find the surface area of cylinders.

Volume of cubes and cuboids
Students will look at the links between area and volume (how a shape can be broken into unit squares or unit cubes) to help them build a better understanding of volume and the required formula. Students will then find the volume of cubes and cuboids.

Volume of other 3D shapes – prisms and cylinders
Students will learn that the volume of a prism is the product of the area of the prisms cross-section and its length by comparing volumes of right-angled triangular prisms to that of a cuboid. Using the knowledge of cross-sectional area multiplied by length students will work out the volume of various prisms and cylinders.

Sequence of Learning:	
1	Names of 2D and 3D shapes
2	Recognise prisms (including language of edges and vertices)
3	Accurate nets of cuboids and other 3D shapes
4	Sketch and recognise nets of cuboids and other 3D shapes
5	Plans and Elevations
6	Find area of 2D shapes (R)
7	Surface area of cubes and cuboids
8	Surface area of triangular prisms
9	Surface area of cylinder
10	Volume of cubes and cuboids
11	Volume of other 3D shapes – prisms and cylinders

Topic Resources:	
Knowledge Maps:	2D shapes 3D shapes
Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Autumn Term

Topic Sequence: Constructing in 2 and 3 Dimensions

4	5
Three-dimensional Shapes	Constructions and Congruency

Topic Overview: Constructions and Congruency

This block builds upon constructions students learnt in year 7 and 8 to formally look at the idea of a locus and the standard constructions using a straight edge and a pair of compasses. Students will also explore the idea of congruency, before looking at the formal aspect of identifying congruent triangles.

Learning Sequence:

Draw and measure angles (R): Students will recap measuring angles as it is a vital skill in constructions, and this will help students develop better accuracy. Recapping the types of angles and estimation can help prevent students using the wrong scale on a protractor.
Construct and interpret scale drawings (R): Students will recap scale, linking it to ratio and enlargement. Students will need to determine whether to divide or multiply when performing calculations, and may need to convert units of length.
Locus of distance from a point: Students will learn about locus, looking at how locus are a set of points with a common property, such as all the points been equally distanced from a central point, such as the circumference of a circle. Students will also consider the locus of points that are the same difference from a vertex.
Locus of distance from a straight line: Students will now look at how to find the locus of points at the same distance from a straight line. Students may be familiar with the concept as sports stadiums are designed to have a set distance between the edges of the pitch and the stands. Practice using a pair of compasses is important for this step.
Locus equidistant from two points: This step builds upon a previous step, students will need to find the locus equidistant from two points, and will start to build up the knowledge that is explored in the next step.
Construct a perpendicular bisector: Building upon the previous step, students will see that the locus equidistant from two points forms a perpendicular bisector of the two points, and will explore the formal method of bisecting a line using a pair of compasses.
Construct a perpendicular from a point: Expanding upon the previous step, students will learn how to create a perpendicular line from a given point separate to a line segment, and will compare the similarities and differences between this step and the previous. This step can also be used to demonstrate facts about shape construction, and topics such as the area of a triangle can be revisited, particularly with triangles where the vertex is beyond the end of the base, looking at the concept of perpendicular height.
Construct a perpendicular to a point: Following the previous step, students will learn the formal method to create a perpendicular from a given point of a line segment.
Locus of distance from two lines: This step provides the introduction to the construction of angle bisectors, looking at finding points that are equally distant from the point two line segments meet. This helps students see the similarities between perpendicular and angle bisectors, and can help reduce the chances of students mixing up which process to follow.
Construct an angle bisector: Students will now learn the formal method of constructing an angle bisector using a pair of compasses, practicing on different size angles in different orientations.
Construct triangles from given information (R): Students will recap constructing triangles given SSS, SAS and ASA, and this step can be linked to previous steps, exploring how angles can be bisected to form an angle half the size.
Identify congruent figures: Students will learn to recognise congruent figures, looking to find matching side lengths and angles to identify which shapes are congruent and which are not.
Explore congruent triangles: In this step, students will use the different triangle construct methods to help them learn how to identify and prove when triangles are congruent and when they are not. Students need to remember that a given angle and two sides is different from an included angle and two sides.
Identify congruent triangles: Students will now use the knowledge of the four different conditions to prove and recognise pairs of congruent triangles. Students will also look at cases of AAS where they need to identify the missing angle in the triangle to identify whether the triangles are congruent. More formal proof is covered in year 10.

Sequence of Learning:

1	Draw and measure angles (R)
2	Construct and interpret scale drawings (R)
3	Locus of distance from a point
4	Locus of distance from a straight line
5	Locus equidistant from two points
6	Construct a perpendicular bisector
7	Construct a perpendicular from a point
8	Construct a perpendicular to a point
9	Locus of distance from two lines
10	Construct an angle bisector
11	Construct triangles from given information (R)
12	Identify congruent figures
13	Explore congruent triangles
14	Identify congruent triangles

Topic Resources:

Knowledge Maps:	Constructions

Assessment

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Spring Term

Topic Sequence: Reasoning with numbers

6	7	8
Numbers	**Using Percentages**	**Maths and Money**

Topic Overview:

During this topic students will develop their knowledge of the number system to include rational and real numbers. Students will revisit standard form, LCM and HCF, directed numbers and fractions.

Lesson Sequence:

Integers, real and rational numbers
Students will develop their knowledge of integers by looking at rational and real numbers. This can be related to previous fraction and ratio work.

Understand and use surds (H)
Students will be introduced to the concept of surds and where they will encounter them. This topic is explored in depth in Key Stage 4.

Work with directed numbers
This step is to further embed students knowledge of directed numbers seeing them in more contexts such as equations and inequalities.

Solve problems with integers
Students will revisit the written methods for the four operations of arithmetic. They will practice interpreting questions and choosing the correct operation.

Solve problems with decimals
Building from the last step, students will strengthen their skills with the four operations when decimals are involved. They will practice interpreting questions and choosing the correct operation.

HCF and LCM
Students will be revisiting factors, multiples and primes as well as HCF, LCM and prime factorisation.

Adding and subtracting fractions
Students will revisit adding & subtracting fractions. They will estimate answers and compare the estimated answers with their calculated values. They will become confident in using the fraction key on their calculators.

Multiplying and dividing fractions
Students will revisit multiplying & dividing fractions. They will estimate answers and compare the estimated answers with their calculated values. They will practice interpreting questions and choosing the correct operation.

Solve problems with fractions
They will practice interpreting questions and choosing the correct operation. They will estimate answers and compare the estimated answers with their calculated values.

Numbers in standard form
Students will revisit both conversions to/from standard form. They will solve questions with and without calculators

Sequence of Lessons:	
1	Integers, real and rational numbers
2	Understand and use surds (H
3	Work with directed numbers
4	Solve problems with integers
5	Solve problems with decimals
6	HCF and LCM
7	Adding and subtracting fractions
8	Multiplying and dividing fractions
9	Solve problems with fractions
10	Numbers in standard form

Topic Resources	
Knowledge Maps	
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths: www.sparxmaths.co.uk Corbettmaths: www.corbettmaths.com AQA Revision Guide

Scheme of Learning: Year 9 Spring Term

Topic Sequence: Reasoning with Numbers

6	7	8
Numbers	**Using Percentages**	Maths and Money

Topic Overview:

Building on their revision of fractions in the last block, students relate these to fractions and decimals, extending their learning in Year 8. All students will look at 'reverse' percentage problems with higher attainers stretched by looking at repeated percentage change. Both calculator and non-calculator methods are encouraged, with the use of decimal multipliers again key.

Lesson Sequence:

Use the equivalence of fractions, decimals and percentages (R)
Students will review the fraction, decimal and percentage conversions that they know and use these to derive new ones. They will then revise the formal methods of conversion through multiplication and division by 100 and simplifying fractions.

Calculate percentage increase and decrease (R)
Students will review the multiplier method used for percentage increase and decrease.

Express a change as a percentage (R)
Students will revise writing one number as a percentage of another. They will then calculate the percentage increase and decrease.

Solve 'reverse' percentage problems
Students will solve problems where they need to find the original amount when given the final amount and the percentage increase/decrease. They will look at solving problems with and without a calculator.

Recognise and solve percentage problems (non-calculator)
Students will develop their reasoning skills by recognising the type of problem and selecting the correct approach. They will start with simple numbers first advancing to those that require more complex working with division and/or fractions.

Recognise and solve percentage problems (calculator) (R)
Students will now tackle problems with greater arithmetic demand. The focus remains on recognising whether they need to find an increase, a decrease, an original value or to express a quantity as a percentage.

Solve problems with repeated percentage change (H)
Students will explore the effect of repeated percentage change.

Sequence of Lessons:

1	Use the equivalence of fractions, decimals and percentages (R)
2	Calculate percentage increase and decrease (R)
3	Express a change as a percentage (R)
4	Solve 'reverse' percentage problems
5	Recognise and solve percentage problems (non-calculator)
6	Recognise and solve percentage problems (calculator) (R)
7	Solve problems with repeated percentage change (H)

Topic Resources

Knowledge Maps	
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths: www.sparxmaths.co.uk Corbettmaths: www.corbettmaths.com AQA Revision Guide

Scheme of Learning: Year 9 Spring Term

Topic Sequence: Reasoning with Numbers

6	7	8
Numbers	**Using Percentages**	**Maths and Money**

Topic Overview:

Students practice their number skills in various financial contexts in this block. The language of financial mathematics, already introduced in Years 7 and 8 is further developed. Simple ideas of tax and wages are introduced, and the percentages studied in the last block are applied in various contexts including simple and compound interest.

Lesson Sequence:

Solve problems with bills and bank statements
Students should be familiar with the language of financial mathematics from their learning in previous years. They will practice using a calculator and non – calculator skills as appropriate.

Calculate simple interest
Students will use both calculator and non – calculator methods to find simple interest. They will need to read questions carefully to determine whether they are finding the interest or the total value of an investment.

Calculate compound interest
Students will see that the interest is added to the current value of the investment at the end of each year and so next year`s interest is greater. They will calculate the total compound interest as well as the total value of an investment.

Solve problems with Value Added Tax
Students will find out what value added tax (VAT) is, as well as the current rate. Students will then practice both increasing by a percentage and finding the original amount within this context.

Calculate wages and taxes
Students will be shown the similarities and differences between wages and salary. The meaning and workings of tax thresholds will be explained and modelled.

Solve problems with exchange rates
Students have seen exchange rates in previous learning in year 8 so this small step gives plenty of chance to build on these skills. Students will be encouraged to estimate their answers before calculating to ensure they have a sensible result from using a calculator.

Solve unit pricing problems
This small step focuses on the use of the unitary method where students find the cost of one item or the amount of an item that can be bought for £1 or 1p as appropriate.

Sequence of Lessons:

1	Solve problems with bills and bank statements
2	Calculate simple interest
3	Calculate compound interest
4	Solve problems with Value Added Tax
5	Calculate wages and taxes
6	Solve problems with exchange rates
7	Solve unit pricing problems

Topic Resources

Knowledge Maps	Percentages
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths: www.sparxmaths.co.uk Corbettmaths: www.corbettmaths.com AQA Revision Guide

Scheme of Learning: Year 9 Spring Term

Topic Sequence: Reasoning with Geometry

9	10	11
Deduction	**Rotation and Translation**	**Pythagoras' theorem**

Topic Overview: Deduction

In this block, students will revise and extend their knowledge of angle rules and properties of shapes, applying them to increasingly complex problems. The block also builds on the ideas of the earlier Testing conjectures block looking at deduction in a geometric rather than algebraic and numerical contexts. Students also revise the constructions covered in Year 8 and look more deeply at how and why these work.

Lesson Sequence:

Angles in parallel lines (R)
This review step provides students with a reminder of the rules connecting the angles formed by a pair of parallel lines and a transversal. Knowledge of basic angle rules such as angles at a point, angles on a straight line and vertically opposite angles is also needed.

Solving angle problems (using chains of reasoning)
Building on the previous step, students now look at more complex problems with more steps of working. The focus is the use of correct mathematical language as students begin to use longer chains of reasoning.

Angles problems with algebra
In this step, students interleave the forming and solving of equations with their use of the angles rules.

Conjectures with angles
Here students revisit the ideas of "True or false" and "Always, Sometimes, Never true?" in the context of angles.

Conjectures with shapes
Students will revisit the properties of shapes as well as the differences between the various types of quadrilaterals and symmetry whilst investigating conjectures.

Link constructions and geometrical reasoning (H)
Students will have the opportunity to revisit the standard constructions with ruler and compasses in this step. Students will be challenged to see the links between the properties of shapes formed and the bisectors.

Sequence of Lessons:

1	Angles in parallel lines (R)
2	Solving angle problems (using chains of reasoning)
3	Angles problems with algebra
4	Conjectures with angles
5	Conjectures with shapes
6	Link constructions and geometrical reasoning (H)

Topic Resources

Knowledge Maps	Angles 2D shapes

Assessment:

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

	Sparx Maths: www.sparxmaths.co.uk Corbettmaths: www.corbettmaths.com AQA Revision Guide

Scheme of Learning: Year 9 Spring Term

Topic Sequence: Reasoning with Geometry

9	10	11
Deduction	Rotation and Translation	Pythagoras' theorem

Topic Overview: Deduction

Building on the study of line symmetry and reflection in year 8, students now look at rotational symmetry and rotation. They then move on to study translations which are described in vector form. They compare the different effects of the transformations studied so far, noticing that objects and images are congruent.

Lesson Sequence:

Identify the order of rotational symmetry of a shape:
This small step introduces students to the idea of rotational symmetry and finding the order of rotational symmetry of a shape.

Compare and contrast rotational symmetry with lines of symmetry:
This step revises line symmetry from year 8 and compares it with rotational symmetry. It's important that students understand that the number of lines of symmetry a shape has is not necessarily equal to the order of its rotational symmetry

Rotate a shape around a point:
Students rotate shapes using a centre of rotation both inside and outside their given shape, considering how the position of the centre affects the position of the image

Translate points and shapes by a given vector:
In this step students translate both points and shapes by a given vector. Students will have seen translations previously in KS2 but the idea of describing the translation using a vector is new learning.

Compare rotation and reflection of shapes:
Students should be able to perform both rotations and reflections and compare the two. Work may be extended to consider variant and invariant points and lines within this

Find the result of a series of transformations (H)
Students have so far studied single transformations and looked into them in detail. This step provides the opportunity to perform a series of transformations. Students explore how changing the order affects the final image

Sequence of Lessons:	
1	Identify the order of rotational symmetry of a shape:
2	Compare and contrast rotational symmetry with lines of symmetry:
3	Rotate a shape around a point
4	Translate points and shapes by a given vector:
5	Compare rotation and reflection of shapes:
6	Find the result of a series of transformations (H)

Topic Resources	
Knowledge Maps	Transformations
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths: www.sparxmaths.co.uk Corbettmaths: www.corbettmaths.com AQA Revision Guide

Scheme of Learning: Year 9 Spring Term

Topic Sequence: Reasoning with Geometry

9	10	11
Deduction	Rotation and Translation	Pythagoras' Theorem

Topic Overview: Pythagoras' Theorem

Students will revise square and square roots before moving on to investigate the relationship between the sides of a right – angled triangle. The converse of the theorem is emphasized so that students are aware that if the sides of a triangle satisfy the rule $a^2 + b^2 = c^2$ then the triangle must be right-angled. Students explore using the theorem in a variety of context, including on co-ordinate axes, and a higher step is included using 3-D shapes.

Lesson Sequence:

Squares and square roots
This small step provides an opportunity for retrieval on squaring and square roots from earlier in KS3.

Identify the hypotenuse of a right-angled triangle
This is a key prerequisite for students before they meet Pythagoras' theorem. Students will be given plenty of exposure to examples/non – examples with triangles in various orientations.

Determine whether a triangle is right-angled
This small step provides an opportunity for students to use Pythagoras' theorem without moving straight to calculating unknown sides.

Calculate the hypotenuse of a right-angled triangle
Students will now move on to calculating the length of a hypotenuse meeting both integer and non-integer answers. Knowing the hypotenuse is the longest side provides a check. Using non-standard right -angled triangles in various orientations provides opportunity for students to correctly identify the hypotenuse. Exploring the lengths of diagonals within 2D shapes widens the network of applications of Pythagoras' theorem.

Calculate missing sides in right-angled triangle
Students will have practice of using Pythagoras' theorem to calculate the unknown sides which are not the hypotenuse as well as calculating the unknown side which is the hypotenuse. They should check their answers using the knowledge that the hypotenuse must be the longest side.

Use Pythagoras' theorem on co-ordinate axes
This small step interleaves learning on the Cartesian plane working in all four quadrants.

Explore proofs of Pythagoras' theorem
This small step requires students to explore some of the hundreds of proofs that exist.

Use Pythagoras' theorem in 3-D shapes
This small step expands on the previous step where the students will apply their knowledge of Pythagoras' theorem in a new context by looking at 3-D shapes.

Sequence of Lessons:	
1	Squares and square roots
2	Identify the hypotenuse of a right-angled triangle
3	Determine whether a triangle is right-angled
4	Calculate the hypotenuse of a right-angled triangle
5	Calculate missing sides in right-angled triangle
6	Use Pythagoras` theorem on co-ordinate axes
7	Explore proofs of Pythagoras` theorem
8	Use Pythagoras` theorem in 3-D shapes

Topic Resources	
Knowledge Maps	Pythagoras
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths: www.sparxmaths.co.uk Corbettmaths: www.corbettmaths.com AQA Revision Guide

Scheme of Learning: Year 9 Summer Term

Topic Sequence: Reasoning with Proportion

12	13	14
Enlargement and Similarity	**Solving Ratio and Proportion problems**	**Rates**

Topic Overview: Enlargement and Similarity

Students will develop their knowledge of transformations to include enlargement and learning the mathematical meaning of the word similar. Students will be able to work out missing sides on the original or enlarged shape.

Learning Sequence:

Recognise enlargement and similarity
Students already know that if all pairs of sides of a shape are in the same ratio, a shape is similar. This knowledge will be used to define enlargement. Students will then apply this knowledge to spot shapes that are similar or have been enlarged, noting that the scale factor can be greater than 1 and also between 0 and 1. Students will also look at how during an enlargement, the angles within a shape will remain the same.

Enlarge a shape by a positive integer scale factor
Students will practise drawing accurate enlargements. Students will start with shapes with straight horizontal and vertical lines, before moving onto diagonal lines, where students can describe how to get from the start to the end of the diagonal, and then applying the scale factor of this to accurately draw the enlarged diagonal line.

Enlarge a shape by a positive integer scale factor from a point
Students will now enlarge a shape from a given point using the knowledge gained enlarging diagonals. Students can count the distance from the centre on enlargement to a vertex, and use the scale factor to find the location of the vertex after enlargement. This process can be linked to vectors in future topics.

Enlarge a shape by a positive fractional scale factor
Students will build upon previous steps, but using a scale factor between 0 and 1. Students will notice than scale factors greater than 1 will make a shape bigger, and a scale factor between 0 and 1 will make the shape smaller.

Enlarge a shape by a negative scale factor (H)
Students will build upon their knowledge of enlargements, and begin to compare enlargements such and using a scale factor of 2 and -2. This can be down on the cartesian plane, using the origin as the centre of enlargement. Students can also compare an enlargement with a scale factor of -1 to a 180° rotation.

Work out missing sides and angles in a pair of given similar shapes
Students will now compare similar shapes to identify the scale factor of enlargement, and apply this to find out missing sides of both the original and enlarged shape.

Solve problems with similar triangles (H)
Students will have identified missing sides in pairs of similar triangles in the previous step, however they will now look at more complex questions that might be seen in a GCSE paper. Students will need to be careful to accurately label vertices and sides to show the method and working they have used, which is a vital step in exam questions.

Explore ratio in right-angled triangles (H)
Students will look at right angled triangles with 30° and 60° angles before formally learning trigonometry. They will look at the ratio of the length of the Hypotenuse, the adjacent and the opposite, as well as learning the definitions of the three sides. Using these findings students will be able to work out missing sides.

Sequence of Learning:

1	Recognise enlargement and similarity
2	Enlarge a shape by a positive integer scale factor
3	Enlarge a shape by a positive integer scale factor from a point
4	Enlarge a shape by a positive fractional scale factor
5	Enlarge a shape by a negative scale factor (H)
6	Work out missing sides and angles in a pair of given similar shapes
7	Solve problems with similar triangles (H)
8	Explore ratio in right-angled triangles (H)

Topic Resources:

Knowledge Maps:	Transformations Congruence and Simliarity

Assessment

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Summer Term

Topic Sequence: Reasoning with Proportion

12	13	14
Enlargement and Similarity	**Solving Ratio and Proportion problems**	Rates

Topic Overview: Solving Ratio and Proportion problems

Building upon students previous learning on ratios, they will solve all types of ratio problems and make links to direct proportion graphs. Students will study inverse proportion formally for the first time. Students may be extended to look into inverse proportion graphs and solve complex problems involving algebra.

Learning Sequence:

Solve problems with direct proportion (R)
Students will be familiar with direct proportion from previous learning. Student will review their learning, comparing different methods for finding solutions, such as the unitary method and using factors of multiples. Students will be reminded of the relationship between variables, such as that if one variable is multiplied by *x*, the other variable must also be multiplied by *x*.

Direct proportion and conversion graphs (R)
Students will be reminded of previous learning on direct proportion graphs, and will be able to spot which graphs show direct proportion and which do not. They will note that graphs must be linear, and starting from the origin, and the reasons why other graphs are non examples of direct proportion. The link between the gradient of a direct proportion graph and the constant of proportionality will also be explored.

Solve problems with inverse proportion
Here students will explore inverse proportion relationships, discovering that as one variable is multiplied by a scale factor, the other variable must be divided by the same scale factor. Students will learn that in inverse proportion questions, assumptions need to be made, such as that all workers will perform at the same rate.

Graphs of inverse relationships (H)
Students will compare and contrast graphs of inverse and direct proportional relationships. Key features of the graphs will be investigated, including the fact that the lines do not meet the axes.

Solve ratio problems given the whole or a part (R)
Students will revisit and apply their knowledge and understanding of ratio problems. Students will also explore ratios where comparisons are between more than two items.

Solve 'best buy' problems
Students have already considered unit pricing in the 'Maths and Money' block in the Spring term. Here students can revise this idea and compare with different alternative methods. This will allow class discussion on the most efficient methods for various questions. Students can then look at problems involving special offers and percentage reductions.

Solve problems ratio and algebra (H)
Students will combine they algebraic and ratio knowledge to solve complex problems. Students should be confident with fractions associated with ratios, in particular realising that is $\boldsymbol{a : b = c : d}$ then $\frac{a}{b} = \frac{c}{d}$. This can be checked with numerical examples. Students will also consider how to form equations from given problems and what steps are needed to solve them.

Sequence of Learning:

1	Solve problems with direct proportion (R)
2	Direct proportion and conversion graphs (R)
3	Solve problems with inverse proportion
4	Graphs of inverse relationships (H)
5	Solve ratio problems given the whole or a part (R)
6	Solve 'best buy' problems
7	Solve problems ratio and algebra (H)

Topic Resources:

Knowledge Maps:	Ratio and Scale Direct and Inverse Proportion

Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Summer Term

Topic Sequence: Reasoning with Proportion

12	13	14
Enlargement and Similarity	Solving Ratio and Proportion problems	Rates

Topic Overview: Rates

Students develop their knowledge of inverse relationships to explore speed, distance and time in detail. They will also look at graphs and the link between speed/distance/time formular and density/mass/volume. Students go on to explore other compound units including exploring flow problems such as how long it will take to fill/empty tanks of different shapes at different rates.

Learning Sequence:

Solve speed, distance and time problems without a calculator
Students will work on speed, distance and time problems that can be solved without a calculator. Key points such as 60mp/h means 60 miles travelled in 1 hour, and that 1 hour 15minutes is 1.25 hours will be covered to help reduce mistakes and errors.

Solve speed, distance and time problems with a calculator
Building upon the previous step, a formal method of converting time with a calculator will be learnt. Students will also need to be able to confidently be able to rearrange an equation with the structure $a = \frac{b}{x}$ to find the unknown. Using this knowledge students will solve more complex speed, distance and time questions.

Use distance-time graphs
Students will begin by learning what the different line segments on a distance/time graph represent. They can also link they knowledge of gradients to determine where different line segments represent the same speed. Students will then also learn how to draw accurate distance/time graphs.

Solve problems with density, mass and volume
Students will look at problems involving density, mass and volume. Linking back to speed units (such as miles 'per' hour) will help students understand the units used in this section, such as g/cm^3 (grams 'per' cubic centimetre). Students will also practice substitution into a formula.

Solve flow problems and their graphs
Students will start by comparing different shaped and sized containers and considering what the difference to the rate that they will fill or drain will be. They will identify which containers will fill at a constant rate (that will be represented by a straight line graph) compared to those that will fill at a varying rate (represented by a curve). Students will then look at solving flow problems, thinking about units as in the previous steps.

Rates of change and their units
This step gives students time to explore the units involved in rates of change questions. Interpreting the gradient of a graph in a given context is important in supporting students to connect the rate of change to gradient.

Convert compound units (H)
Students will begin by looking at the units in a given question and determining which units must be converted to solve the problem to plan their solution. Students will then work through questions on a step by step basis, changing units suck as metres per second to metres per minute, metres by hour then km per hour.

Sequence of Learning:	
1	Solve speed, distance and time problems without a calculator
2	Solve speed, distance and time problems with a calculator
3	Use distance-time graphs
4	Solve problems with density, mass and volume
5	Solve flow problems and their graphs
6	Rates of change and their units
7	Convert compound units (H)

Topic Resources:	
Knowledge Maps:	Ratio and Scale
Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Summer Term

Topic Sequence: Representations and Revision

15	16
Probability	**Algebraic Representations**

Topic Overview:

Students build on their learning in years 7 and 8 to calculate the probabilities of single and combined events. A key focus is the introduction of the idea of independent events and the use of the multiplication rule for these. Students also look at a variety of diagrams that support probability such as sample space diagrams, Venn diagrams and two way tables. Tree diagrams considering both with and without replacement are included as Higher steps

Learning Sequence:

Single event probability:
Revision step reminding students that probabilities can be written as fractions, decimals (or percentage) but not in words or as a ratio. Students consider equally likely events and discuss bias

Relative frequency:
This step considers the relationship between relative frequency and probability, considering that relative frequency is based on experiments

Expected outcomes:
Students consider that the expected number of times an outcome will occur is a long-term average rather than a prediction. Students should be able to find the expected number of times a particular outcome will occur given the probability in any format, not just a fraction

Independent events:
Students need to find the probability of independent events, working with both fractions and decimals in order to support later work on tree diagrams. Students consider the difference between independent events when outcomes do not affect each other, and mutually exclusive events, where they cannot occur together

Using tree diagrams (H):
Students use tree diagrams to list the possible outcomes from a series of events and support finding their probabilities. They need to be confident with using the fact that the sum of all possible outcomes is 1, both for each pair of 'branches' and for the total of all the combined outcomes. Students can then quickly find eg the probability of at least one head by subtracting the probability of no heads from 1. They should also realise that they don't always need tree diagrams

Using tree diagrams to solve 'without replacement' problems (H):
The more complex tree diagrams where outcomes change depending on previous outcomes are explored here

Use diagrams to work out probabilities:
This step provides an opportunity to review other diagrams used to calculate probabilities so that students do not think they always have to use a tree diagram. Sample space / two way tables or Venn diagrams can also be used.

Sequence of Learning:

1	Single event probability:
2	Relative frequency:
3	Expected outcomes:
4	Independent events:
5	Using tree diagrams (H):
6	Using tree diagrams to solve 'without replacement' problems:
	Use diagrams to work out probabilities:

Topic Resources:

Knowledge Maps:	Basic Probability Further Probability

Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 9 Summer Term

Topic Sequence: Representations and Revision

15	16
Probability	Algebraic Representations

Topic Overview: Solving Ratio and Proportion problems

Students extend their knowledge of graphs to look at interpretation and creation of different types of graphs. The first non-linear graph explored is the quadratic graph, where students are encouraged to look at the symmetry of the curve and read off x/y values. They also explore reciprocal and exponential graphs. Students' knowledge of straight line graphs is extended by looking at inequalities in graphical and also represented as number lines. IN addition, solution of simultaneous equations by graphical methods is also included in a Higher step.

Learning Sequence:

Draw and interpret quadratic graphs:
Students need to be confident with substituting numbers, especially negative numbers, into quadratic expressions in order to produce trable of values for their own graphs. They need to produce smooth curves.

Interpret other graphs, including reciprocal and exponential:
Students need to be able to read from any graphs, including cubic, reciprocal and exponential. Students also read from other real-life graphs such as distance- time graphs

Investigate graphs of simultaneous equations (H):
Students should be aware that a single equation in two unknowns has an infinite number of possible solutions, but a pair of linear simultaneous equations have a single solution pair. Students should be aware that the solutions need not be integers and the graphical method is limited.

Representing inequalities:
Building on their knowledge of straight line graphs, students shade regions to represent given inequalities in one variable, and if appropriate, two variables. Dotted lines are used to show when borderline values are not included in the solution. Set. Students compare this to empty circles for the corresponding number line representation.

Sequence of Learning:

1	Draw and interpret quadratic graphs:
2	Interpret other graphs, including reciprocal and piece-wise:
3	Investigate graphs of simultaneous equations (H):
4	Represent inequalities

Topic Resources:

Knowledge Maps:	Algebraic Notation Linear Graphs Non-linear Graphs Inequalities Simultaneous Equations
Assessment	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide