

(Mathematics – KS3) Year 7 Long Term Plan

Rationale (with end points): In year 7 we want to build on their skills from KS2 and extend their understanding further. Students will learn key skills in the 4 main areas, number, algebra, data and shape and then encouraged to apply these to help solve problems.

Term	Topic	Knowledge	Skills	Reading /wider reading
Autumn term 1	Order of operations Unit 4.1 Equal and Non-Equal Priority Unit 4.2 Writing Calculations Unit 4.3 Area Expressions Unit 4.4 Calculations with Variables	<ul style="list-style-type: none"> • Understand the equal priority of addition with subtraction and multiplication with division in written calculations • Understand that operations of equal priority can be evaluated in any order • Understand that written calculations follow rules of 'syntax' determining the order of operations • Understand the higher priority of multiplication with division over addition with subtraction in written calculations • Interpret the order of operations from written calculations, function machines and worded descriptions • Form written calculations, function machines and worded descriptions correctly embedding the order of operations • Form and identify equivalent calculations based on distributivity, commutativity and the order of operations • Form and interpret expressions involving variables correctly embedding the order of operations 	<ul style="list-style-type: none"> • Develop understanding of equal and non-equal priority of the four operations • Interpret and form written calculations using brackets • Deepen understanding of equal and non-equal priority of four operations • Form multi-step calculations in function machines and as written calculations • Form calculations to work out compound area of rectilinear shapes • Understand equivalent calculations including brackets and variables • Express and describe multi-step calculations including variables • Form expressions for multi-step calculations including variables 	The Triumph of Numbers by IB Cohen
	Axioms and Arrays	<ul style="list-style-type: none"> • Use arrays and area models to develop understanding of commutativity of 	<ul style="list-style-type: none"> • Explore contexts leading to multiplication and division calculations 	

	<p>Unit 2.1 What is multiplication? Unit 2.2 What is commutativity? Unit 2.3 Multiplication and division</p>	<p>multiplication</p> <ul style="list-style-type: none"> ● Use arrays and area models to develop understanding of associativity and distributivity ● Make use of and generalise the commutative, associative and distributive properties ● Use commutativity, associativity and distributivity to solve calculations efficiently ● Compare and contrast scaling, area, repeated addition and grouping/sharing models for multiplication and division ● Develop number sense and efficient calculation strategies ● Make links between efficient calculation strategies and the axioms 	<ul style="list-style-type: none"> ● Develop and interpret models for multiplication and division ● Define commutativity of multiplication ● Use arrays to define fact families ● Use commutativity of multiplication to solve division problems ● Develop models for the commutativity of multiplication ● Define associativity of multiplication ● Develop models for the associativity of multiplication ● Develop understanding of the distributive property of multiplication over addition ● Use the distributive property to calculate efficiently ● Use the commutative, associative and distributive properties to describe relationships between different multiplication tables ● Explore common multiples ● Explore conjectures using tracking calculations ● Use algebraic notation to represent distributivity ● Use understanding of the axioms to calculate using a range of strategies deciding on most efficient. 	
	<p>Factors and multiples Unit 3.1 Factors, primes and squares Unit 3.2 Squares</p>	<ul style="list-style-type: none"> ● Understand the terms factor and multiple ● Recognise and define prime, square and cube numbers ● Use the definitions of factors and multiples to find common factors and common 	<ul style="list-style-type: none"> ● Use factor pairs to find all factors of an integer ● Recognise primes and square numbers ● Investigate the structure of square numbers 	

	Unit 3.3 “Lots of” Unit 3.4 More “lots of” Unit 3.5 Factor Polygons Unit 3.6 Common Multiples Unit 3.7 Number grids Unit 3.8 Prime patterns	multiples <ul style="list-style-type: none"> ● Express an integer as a product of its factors ● Interpret and create representations of integers that reveal their structure ● Conjecture and make generalised statements e.g.: <ul style="list-style-type: none"> ○ Square numbers cannot be prime ○ The common multiples of 5 and 4 are always multiples of 20 ○ Prime numbers greater than 3 are one more or one less than a multiple of 6 ● Solve problems involving factors and multiples in unfamiliar contexts 	<ul style="list-style-type: none"> ● Explore different ways of constructing square numbers ● Developing a new representation to reveal the structure of positive integers ● Using the “lot of” representation to find the factors of an integer ● Using the “lot of” representation to express an integer as a product of two or more of its factors ● Explore a geometric application of factors ● Define the “common multiples” of a set of integers ● Use Venn diagrams to categorise multiples of two or more numbers ● Express the multiples of a number using algebra ● Explore patterns involving multiples in number grids ● Identify the prime numbers in a 6-column number grid using a sieve algorithm ● Deduce that prime numbers greater than 3 can be written as $6n + 1$ or $6n - 1$ 	
	Prime Factorisation Unit 13.1 Indices Unit 13.2 Prime building blocks Unit 13.3 Prime factorisation Unit 13.4 Prime deductions	<ul style="list-style-type: none"> ● Factors and multiples, square numbers, cube numbers, prime number, triangular ● Write a number as a product of primes ● Find the highest common factor and lowest common multiple using the prime factorisation ● Determine LCM by prime factorisation ● Find squares, square roots, cubes and cube roots using prime factorisation 	<ul style="list-style-type: none"> ● Index notation for positive integer powers beyond two are introduced ● Students explore conjecture involving powers. Purpose of this is to give students the opportunity to practice using the notation and to develop their mathematical thinking. Formal conclusions are not required ● Students ‘build’ numbers by considering 	

		<ul style="list-style-type: none"> • Use indices to record repeated multiplication • Calculate with the use of a calculator, including squares, cubes, square roots and cube roots 	<p>products</p> <ul style="list-style-type: none"> • This is an opportunity to practice using index notation and to sow the seeds for prime factorisation which is formally introduced next lesson • Students are introduced to the fundamental theorem of arithmetic • Students are given the opportunities to connect array representations, factor tree diagrams and 'lots of' diagrams • This lesson prepares students for the work to follow on HCF • Students are required to identify factors using the prime factorisation of a number • Students are given the opportunity to revisit common factors. The HCF is introduced • Students explore common factors through cutting up arrays into squares. This allows students to connect the HCF as a geometrical visual. We see that all common factors are factors of the HCF • Prime factorisation is used to identify common factors and the HCF • Venn diagrams are used to sort prime factors and to help with this identification • Students are given the opportunity to revisit common multiples. The LCM is introduced • Students explore common factors through building squares with rectangles. This allows students 	
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			<p>to connect the LCM as a geometrical visual. We see that all common multiples are multiples of the LCM</p> <ul style="list-style-type: none"> • Prime factorisation is used to identify common multiples and the LCM • Venn diagrams are used to sort prime factors and to help with this identification 	
<p>Autumn 2</p>	<p>Positive and negative numbers Unit 5.1 Negative numbers in Context Unit 5.2 Order and absolute value Unit 5.3 Modelling addition Unit 5.4 Further addition Unit 5.5 Subtracting positive numbers Unit 5.6 Subtracting negative numbers Unit 5.7 Multiplication as scaling Unit 5.8 Negative scale factors Unit 5.9 Further Multiplication Unit 5.10 Division Unit 5.11 Further division Unit 5.12 Axioms and negative numbers</p>	<ul style="list-style-type: none"> • Interpret negative numbers in a variety of contexts • Compare and order positive and negative numbers • Use positive and negative numbers to express change and difference • Understand the meaning of absolute value • Calculate using all four operations with positive and negative values • Form and manipulate expressions involving negative numbers • Use number lines to model calculations with negative numbers • Explore scaling with negative multipliers 	<ul style="list-style-type: none"> • Interpret negative numbers in a variety of contexts • Explore movement on an 'extended' number line • To interpret the absolute value of a number as its distance from zero • To understand how to order negative numbers using inequality notation • To be able to model addition of a positive number as a translation on a number line • To use this model to develop strategies for addition • To be able to model addition of a negative number as a translation on the number line • To understand that if two numbers are additive inverses they sum to zero 	<p>Numbers Don't Lie: 71 Things You Need to Know About the World by Vaclav Sm</p>

	<p>Expressions, equations and inequalities Unit 6.1 Algebraic expressions</p>	<ul style="list-style-type: none"> • Develop understanding of algebraic notation including: $a \times b = ab$, $y + y + y = 3y$, $a \times a = a^2$, $a = a \div b$ • Collect like terms to simplify expressions and understand that this is a result of the distributive 	<ul style="list-style-type: none"> • Substitute variables to evaluate simple expressions • Understand the algebraic notation of multiplication • Collecting together like terms using tracking arithmetic and algebra 	
<p>Spring 1</p>	<p>Place value-Number and Numerals Unit 1.1 Representing number Unit 1.2 Base 10 and base 5 Unit 1.3 Indian number system Unit 1.4 Mayan number system</p>	<ul style="list-style-type: none"> • Understand the value of different place value columns in base 10 number systems • Understand the multiplicative relationships between different columns in base 10 number systems • Recognise and name nine- and ten-digit numbers in base 10 • Understand a range of notation for quantities of time and time of day • Develop a sense of flexible number composition by solving problems involving time of day and quantities of time • Have an awareness of different numerical systems and their representation 	<ul style="list-style-type: none"> • Experience different representations of number and grouping • Reason using base 10 equivalences • Explore base 10 and base 5 number grouping • Convert between base 10 and base 5 • Understand the Indian base 10 number system • Compare and evaluate using the Indian number system • Understand Mayan numeral representation of number • Informally explore base 20 place value grouping 	<p>Perimeter, Area, and Volume: A Monster Book of Dimensions</p>
	<p>Area and Perimeter of 2D shapes Unit 11.1 Describing perimeters Unit 11.2 Describing area</p>	<ul style="list-style-type: none"> • Develop understanding of counting strategies in arrays to using similar strategies to calculate the area of shapes • Finding the area of rectilinear shapes • Finding the area of other 2-D shapes including triangles, and special quadrilaterals • Generalise formulae for finding the area of 2-D shapes using the language of height, base, width, length etc. 	<ul style="list-style-type: none"> • Using different units of length to describe perimeter • Calculating the perimeter of polygons • Estimating perimeter of 'curved' shapes • Using different square units to describe area • Using informal counting strategies to calculate area • Estimating area of 'curved' shapes • Analysing the effect of cutting, moving 	

	<p>Unit 11.3 Cutting and combining shapes Unit 11.4 Exploring rectangles Unit 11.5 Rectilinear shapes Unit 11.6 Area of parallelogram Unit 11.7 Area of triangles Unit 11.8 Further triangles</p>	<ul style="list-style-type: none"> ● Rearrange formulae to make a different subject ● Reason about generalised statements of the relationship between area and perimeter 	<p>and combining shapes on area</p> <ul style="list-style-type: none"> ● Analysing the effect of cutting, moving and combining shapes on perimeter ● Exploring the perimeter and area of rectangles as the dimensions change ● Calculating the area (and perimeter) of rectilinear shapes by 'combining' rectangles ● Calculating the area of parallelograms by rearranging rectangles ● Arriving at a formula for the area of a parallelogram ● Calculating the area of triangles ● Linking the area of triangles to the area of parallelogram ● Further problems involving area of triangles 	
<p>Spring 2</p>	<p>Conceptualising and comparing fractions Unit 14.1 Equal parts of a whole Unit 14.2 Fractions and units of measure Unit 14.3 Fair shares Unit 14.4 Equivalence Unit 14.5 Comparing fractions 1 Unit 14.6 Comparing fractions 2 Unit 14.7 Ordering</p>	<ul style="list-style-type: none"> ● Explore multiple representations of fractions ● Represent fractions using area diagrams, bar models and number lines ● Recognise and name equivalent fractions ● Convert fractions to decimals ● Convert terminating decimals to fractions in their simplest form ● Convert between mixed numbers and improper fractions ● Compare and order numbers (including like and unlike fractions) ● Convert simple fractions and decimals to percentages ● Express one quantity as a fraction of 	<ul style="list-style-type: none"> ● Derive the concept of a fraction by exploring equal parts of a whole ● Express fractions greater than one as a mixed number and as a single fraction. ● Express fractions of units of measure ● Explore problems involving fractions of quantities ● Experience fractions as a division of two integers ● Explore different ways to divide integers into fractional parts ● Represent and understand equivalent fractions ● Using reasoning to compare fractions ● Compare mixed numbers, proper and 	<p>Think of a number by Johnny Ball</p>

	decimal fractions	another	improper fractions <ul style="list-style-type: none"> ● Using common denominators to compare fractions ● Representing common denominators through area models ● Representing and ordering decimal fractions ● Comparing fractions through reasoning ● Comparing fractions with accurate methods 	
	Manipulating and calculating with fractions Unit 15.1 Modelling multiplication 1 Unit 15.2 Modelling multiplication 2 Unit 15.3 Multiplying fractions 1 Unit 15.4 Multiplying fractions 2 Unit 15.5 Dividing fractions by integers Unit 15.6 Modelling division by fractions 1 Unit 15.7 Modelling division by fractions 2 Unit 15.8 Dividing with	<ul style="list-style-type: none"> ● Find a fraction of a set of objects or quantity ● Find the whole given a fractional part ● Multiply and divide fractions by a whole number or fraction ● Solve word problems involving multiplication of a fraction by a whole number or fraction using models and equations to represent the problem ● Add and subtract fractions with like denominators ● Add and subtract fractions with unlike denominators ● Add and subtract fractions mixed numbers and improper fractions ● Convert between improper fractions and mixed numbers ● Calculate with decimals 	<ul style="list-style-type: none"> ● Multiplying unit fractions with integers comparing 'lots of' and 'of' models ● Applying the same models to non-unit fractions ● Using area models to multiply two fractions ● Applying knowledge of decimals and percentages to use the area model of fraction multiplication ● Exploring models for dividing fractions by integers, and noticing the effect on the numerator and denominator ● Dividing by fractions using the linguistic frame "____is____of what?" ● Dividing fractions considering how many of the divisor 'fit' in the dividend ● Exploring the relationship between division of fractions and multiplication ● Inspecting division of fractions using 	

	<p>fractions in mixed contexts</p> <p>Unit 15.9 Adding and subtracting 1</p> <p>Unit 15.10 Adding and subtracting 2</p> <p>Unit 15.11 Adding and subtracting 3</p> <p>Unit 15.12 Distributivity</p>		<p>function machines</p> <ul style="list-style-type: none"> ● Applying division of fractions to area ● Adding and subtracting fractions with common denominators ● Addition and subtraction of related fractions ● Comparing fraction additions and subtractions through reasoning ● Representing fraction addition and subtraction ● Adding and subtracting fractions with the ● (lowest) common denominator ● Using the distributive property with fraction calculations ● Manipulating and simplifying calculations 	
<p>Summer 1</p>	<p>Ratio</p> <p>Unit 16.1 Groups</p> <p>Unit 16.2 In the same ratio</p> <p>Unit 16.3 Equivalent ratios</p> <p>Unit 16.4 Rule of four</p> <p>Unit 16.5 Ratio and proportion in geometry 1</p> <p>Unit 16.6 Ratio and proportion in geometry 2</p> <p>Unit 16.7 Dividing into a ratio 1</p>	<ul style="list-style-type: none"> ● Understand the concept of ratio and use ratio language and notation ● Connect ratio with understanding of fractions ● Compare two or more quantities in a ratio ● Recognise and construct equivalent ratios ● Express ratios involving rational numbers in their simplest form ● Construct tables of values and use graphs as a representation for a given ratio ● Compare ratios by finding a common total value 	<ul style="list-style-type: none"> ● Students solve numerical problems about multiple copies of identical groups ● Students use ratio notation to describe the composition of each group ● Students scale up from one group to ‘many’ groups, preserving the ratio of the components of each group ● They use multiplicative relationships to calculate unknown values in the ‘many’ groups ● Students represent ratios concretely or pictorially ● They use these representations to justify 	<p>Understanding Charts and Graphs by Christine TaylorButler</p>

	Unit 16.8 Dividing into a ratio 2	<ul style="list-style-type: none"> Solve ratio and proportion problems in a variety of contexts 	<p>the equivalence of ratios</p> <ul style="list-style-type: none"> Students identify multiplicative relationships between 'times tables' They use similar patterns to solve problems in direct proportionality contexts (but they don't discuss this concept explicitly) Students compare the side lengths of triangles, one of which is an enlargement of the other, and calculate the ratios of the lengths of corresponding sides. Students divide oblique line segments into specified ratios by dividing the segment's horizontal and vertical displacements in the same ratio. Students divide a quantity into a ratio of the form $a : b$. They compare the relative sizes of the parts to each other and to the whole. Students use part-part bar models to support their calculations and express their reasoning. Students divide a quantity into a ratio of the form $a : b : c$. They compare the relative sizes of two parts to each other and to the whole. Students use part-part-part bar models to support their calculations and express their reasoning. 	
	Coordinates	<ul style="list-style-type: none"> Reading and writing coordinates of points in all four quadrants. Including non-integer coordinates 	<ul style="list-style-type: none"> Describe positions on a coordinate grid Identify and compare line segmented 	

	<p>Unit 10.1 The 2-D coordinate axes Unit 10.2 Line segments Unit 10.3 Finding midpoints Unit 10.4 Solving geometric problems Unit 10.5 Forming shapes from midpoints Unit 10.6 Forming shapes from diagonals Unit 10.7 Equations of lines Unit 10.8 Exploring horizontal and vertical lines</p>	<ul style="list-style-type: none"> ● Solving geometric problems involving missing coordinates ● Finding the mid-point of a line segment or two points ● Using the midpoint and a point on the line to find the coordinates of another point on the line ● Recognise and plot horizontal and vertical lines on a coordinate axis 	<ul style="list-style-type: none"> ● Use horizontal and vertical lengths of line segments ● Find midpoints of line segments ● Solve problems involving midpoints ● Solving tilted square problems ● Solving problems involving midpoints ● Finding and using midpoints ● Solving shape problems involving midpoints ● Comparing line segment lengths ● Solving shape problems involving diagonals ● Drawing horizontal and vertical lines on a coordinate grid ● Understanding equations of horizontal and vertical lines ● Solving problems involving horizontal and vertical lines 	
<p>Summer 2</p>	<p>Angles Unit 7.1 Describing and comparing angles Unit 7.2 Measuring and drawing angles Unit 7.3 Partitioning angles Unit 7.4 Finding unknown angles Unit 7.5 Exploring intersections Unit 7.6 Transversal</p>	<ul style="list-style-type: none"> ● Draw and measure acute and obtuse angles reliable to the nearest degree ● Estimate the size of a given angle ● Know and use angle facts: angles at a point, angles at a point on a straight line, vertically opposite angles. ● Generalisations and reasoning – ● e.g. going beyond two angles ● Define parallel and perpendicular lines ● Use angle facts around corresponding, alternate and co interior angles to find missing angles ● Find unknown angles. Form algebraic 	<ul style="list-style-type: none"> ● Comparing and classifying angles ● Estimating angles ● Using a protractor to measure angles ● Use a protractor to draw angles. ● Find known angles that partition a known angle ● Introduce the vocabulary of ‘vertically opposite’ angles ● More problems ● Understanding properties of parallel lines 	<p>Sir Cumference and the Great Knight of Angeland by Cindy Neuschwander</p>

	<p>angles Unit 7.7 Alternate angles Unit 7.8 Corresponding and allied angles</p>	<p>expressions. Solve for unknowns on one side.</p>	<ul style="list-style-type: none"> ● Explore intersections formed with two lines and a transversal ● Understand and identify vertically opposite angles ● Identify alternate angles ● Understand equality of alternate angles for parallel lines ● Understand and identify allied angles ● Understand and identify corresponding angles 	
	<p>Classifying 2-D shapes</p> <p>Unit 8.1 Rotational symmetry Unit 8.2 Reflection symmetry Unit 8.3 Classifying triangles Unit 8.4 Angles in triangles Unit 8.5 Comparing quadrilaterals Unit 8.6 Diagonals in quadrilaterals Unit 8.7 Internal angles in quadrilaterals Unit 8.8 Tessellating quadrilaterals</p>	<ul style="list-style-type: none"> ● Classifying polygons by symmetry, regularity, intersection of diagonals, number of parallel sides ● Classify triangles and quadrilaterals according to properties (angles, regularity, symmetry) ● Know and use the angle sum of triangles and quadrilaterals ● Generalise results for properties of special types of triangles and quadrilaterals ● Form and solve equations from contexts arising from properties of triangles and quadrilaterals 	<ul style="list-style-type: none"> ● Defining and identifying the order of rotational symmetry ● Creating and testing conjectures regarding rotational symmetry in polygons ● Identifying and counting the lines of symmetry ● Creating and testing conjectures regarding reflectional symmetry in polygons ● Describing the properties of scalene, isosceles and equilateral triangles ● Identifying and classifying triangles inscribed in circles ● Understanding that the interior angles in a triangle sum to 180° ● Solve problems involving unknown angles in triangles 	

			<ul style="list-style-type: none"> ● Providing the opportunity to revisit the names of quadrilaterals from KS2 ● Comparing the symmetry, side length, number of parallel sides and angles in quadrilaterals ● Comparing the diagonals in quadrilaterals ● Using triangles to deduce the sum of the interior angles in quadrilaterals ● Finding the angles in quadrilaterals ● Using the properties of triangles and quadrilaterals to create and describe tessellation patterns 	
	<p>Constructing triangles and quadrilaterals</p> <p>Unit 9.1 Exploring circles</p> <p>Unit 9.2 Constructing triangles</p> <p>Unit 9.3 Impossible triangles</p> <p>Unit 9.4 Drawing similar triangles</p> <p>Unit 9.5 Triangle constructions</p>	<ul style="list-style-type: none"> ● Construct triangles and quadrilaterals for given conditions using ruler, protractor and compasses ● Explore constructions through use of dynamic geometry software ● Explore and define the minimum conditions for constructing triangles ● Become familiar with the different cases of minimum conditions for the construction of triangles ● Recognise when two triangles are congruent using the criteria of minimum conditions 	<ul style="list-style-type: none"> ● Naming the basic features of circles and reasoning using their properties ● Drawing circles using a pair of compasses ● Constructing triangles using a pair of compasses and ruler given the length of the three sides ● Determining when it is impossible to construct a triangle given three lengths ● Drawing triangles with the same interior angles using a protractor ● Informally discussing the properties of similar triangles ● Constructing triangles given two sides and an angle ● Forming quadrilaterals using the properties of circles ● Using the symmetrical properties of special quadrilaterals ● Constructing kites and rhombuses 	

	Unit 9.6 Quadrilaterals in circles Unit 9.7 Constructing quadrilaterals Unit 9.8 Further constructions		<ul style="list-style-type: none">● Identifying symmetry in constructions● Constructing kites and rhombuses● Exploring diagonals and symmetry in constructions	
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