Year 6 Mathematics Objectives 2014-15

Programme of study	Non Statutory Guidance	Objectives
Number and place Value • Read, write, order and compare numbers up to 10 000 000 and determine the value of each digit • Round any whole number to a required degree of accuracy • Use negative numbers in context, and calculate intervals across zero • Solve number and practical problems that involve all of the above.	Pupils use the whole number system, including saying, reading and writing numbers accurately.	**Counting** • To order numbers to 10 000 000 • To order negative numbers • To calculate intervals across zero. **Comparing numbers** • To compare numbers up to 10 000 000 (including decimals to 3 decimal places) **Reading and writing numbers** • Read and write numbers to 10 000 000 **Place Value** • To know what each digit in a number represents (to 3 decimal places) • To multiple and divide numbers by 10,100 and 1000 **Rounding** • Round numbers to a required degree of accuracy **Solving Problems** • To solve problems using place value
Addition, subtraction, multiplication and division • Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication • Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context • Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where	Pupils practise addition, subtraction, multiplication and division for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division. They undertake mental calculations with increasingly large numbers and more complex calculations. Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency. Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant	**Mental Calculations** • To recall and use all multiplication tables • To recognise common factors (and how this is linked to equivalent fractions) • To undertake mental calculations, including mixed operations and large numbers **Written methods** • To use formal written methods of columnar addition and subtraction. • Multiply numbers up to 4 digits by a 2 digit whole number using formal written method. • Divide numbers up to 4 digit by a 2 digit whole number using a formal written

appropriate, interpreting remainders according to the context
• Perform mental calculations, including with mixed operations and large numbers
• Identify common factors, common multiples and prime numbers
• Use their knowledge of the order of operations to carry out calculations involving the four operations
• Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
• Solve problems involving addition, subtraction, multiplication and division
• Use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.
	figures.
	Pupils explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$.
	Common factors can be related to finding equivalent fractions.
		method including:
		  - short and long division methods
		• To interpret remainders as:
		  o whole number remainders
		  o fractions
		  o by rounding
		  o interpreting remainders according to the context
		Properties of numbers
		• Identify common factors, common multiples and prime numbers
		• Estimate and calculate the volumes of cubes and cuboids using cm3, m3 and other units
		Inverse operations, estimating and checking answers
		• Use rounding to work out approximate answers, considering levels of accuracy
		Order of operations
		• use their knowledge of the order of operations to carry out calculations involving the four operations.
		Solving Problems
		• Solve multi-step problems involving the 4 operations.
		• Explain which methods to use to solve problems and why.

Fractions (including decimals and percentages) ▪ Use common factors to simplify fractions; use common multiples to express fractions in the same denomination ▪ Compare and order fractions, including fractions > 1 ▪ Add and subtract fractions with different	Pupils should practise, use and understand the addition and subtraction of fractions with different denominators by identifying equivalent fractions with the same denominator. They should start with fractions where the denominator of one fraction is a multiple of the other (for example, $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$) and progress to varied and increasingly complex	**Comparing fractions** • Compare and order fractions, including fractions >1 **Comparing decimals** • Identify the value of each digit in numbers given to three decimal places **Rounding** • solve problems which require answers to

denominators and mixed numbers, using the concept of equivalent fractions
- Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]
- Divide proper fractions by whole numbers [for example, $\frac{1}{3} \div 2 = \frac{1}{6}$]
- Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $\frac{3}{8}$]
- Identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places
- Multiply one-digit numbers with up to two decimal places by whole numbers
- Use written division methods in cases where the answer has up to two decimal places
- Solve problems which require answers to be rounded to specified degrees of accuracy
- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

problems.

Pupils should use a variety of images to support their understanding of multiplication with fractions. This follows earlier work about fractions as operators (fractions of), as numbers, and as equal parts of objects, for example as parts of a rectangle.

Pupils use their understanding of the relationship between unit fractions and division to work backwards by multiplying a quantity that represents a unit fraction to find the whole quantity (for example, if $\frac{1}{4}$ of a length is 36cm, then the whole length is 36 × 4 = 144cm).

They practise calculations with simple fractions and decimal fraction equivalents to aid fluency, including listing equivalent fractions to identify fractions with common denominators.

Pupils can explore and make conjectures about converting a simple fraction to a decimal fraction (for example, 3 ÷ 8 = 0.375). For simple fractions with recurring decimal equivalents, pupils learn about rounding the decimal to three decimal places, or other appropriate approximations depending on the context. Pupils multiply and divide numbers with up to two decimal places by one-digit and two-digit whole numbers. Pupils multiply decimals by whole numbers, starting with the simplest cases, such as 0.4 × 2 = 0.8, and in practical contexts, such as measures and money.

Pupils are introduced to the division of decimal numbers by one-digit whole number, initially, in practical contexts involving measures and money.

be rounded to specified degrees of accuracy

Equivalence
- use common factors to simplify fractions
- use common multiples to express fractions in the same denomination
- Calculate decimal fraction equivalents (e.g. 0.375) for a simple fraction (e.g. 3/8)
- recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

Adding and subtracting fractions
- add and subtract fractions with different denominators and mixed numbers(using the concept of equivalent fractions)

Multiplying and dividing fractions
- Multiply simple pairs of proper fractions, writing the answer in its simplest form (e.g. 1/4 × 1/2 = 1/8)
- Multiply one-digit numbers with up to two decimal places by whole numbers
- divide proper fractions by whole numbers (e.g. 1/3 ÷ 2 = 1/6)

Multiplying and dividing decimals
- multiply one-digit numbers with up to two decimal places by whole numbers
- multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places
- identify the value of each digit to three decimal places and multiply and divide numbers by 10, 100 and 1000 where the answers are up to three decimal places.
- use written division methods in cases

	They recognise division calculations as the inverse of multiplication.	where the answer has up to two decimal places
	Pupils also develop their skills of rounding and estimating as a means of predicting and checking the order of magnitude of their answers to decimal calculations. This includes rounding answers to a specified degree of accuracy and checking the reasonableness of their answers.	**Solve Problems involving Fractions** • Using equivalence between fractions, decimals and percentages in different contexts • Develop skills of rounding and estimating to predict magnitude of answers of decimal calculations • Rounding answers to a specified degree of accuracy
Ratio and Proportion • Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts • Solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison • Solve problems involving similar shapes where the scale factor is known or can be found • Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.	Pupils recognise proportionality in contexts when the relations between quantities are in the same ratio (for example, similar shapes and recipes). Pupils link percentages or 360° to calculating angles of pie charts. Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They might use the notation $a:b$ to record their work. Pupils solve problems involving unequal quantities, for example, 'for every egg you need three spoonfuls of flour', '$\frac{3}{5}$ of the class are boys'. These problems are the foundation for later formal approaches to ratio and proportion.	**Solving Problems** • To find one part of a given ratio • solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts • solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison • Know how 2 quantities are linked by using integer multiplication or division facts • Calculating angles in pie charts • Use proportion to find similar shapes using a scale factor or finding a scale factor • Solve problems involving unequal sharing and grouping
Algebra • Use simple formulae • Generate and describe linear number sequences • Express missing number problems algebraically	Pupils should be introduced to the use of symbols and letters to represent variables and unknowns in mathematical situations that they already understand, such as: • missing numbers, lengths, coordinates and angles	**Sequences** • To find patterns in numbers • To make number patterns which follow a given rule (term-to-term rule) • To describe and continue number sequences

• Find pairs of numbers that satisfy an equation with two unknowns
• Enumerate possibilities of combinations of two variables.
	• formulae in mathematics and science
	• equivalent expressions (for example, $a + b = b + a$)
	• generalisations of number patterns number puzzles (for example, what two numbers can add up to).
		• To find the nth term of a linear sequence in algebraic terms (position-to-term)
		• To find sequences from diagrams and patterns.
		
		Simplifying Expressions
		• To use letters to represent unknown variables in familiar contexts such as:
		   - missing numbers
		   - lengths of shapes
		   - coordinates
		   - missing angles in diagrams, lines or shapes
		• To simplify expressions by collecting like terms using addition and subtraction
		• To simplify expressions using conventions of multiplication
		• To find equivalent expressions
		
		Solving Equations (including formulae)
		• Express missing number problems algebraically
		• Substitute known values into simple formulae
		• To solve simple linear equations

Measurement • Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate • Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit,	Pupils connect conversion (for example, from kilometres to miles) to a graphical representation as preparation for understanding linear/proportional graphs. They know approximate conversions and are able to tell if an answer is sensible. Using the number line, pupils use, add and subtract positive and negative integers for	**Comparing and estimating** • calculate, estimate and compare volume of cubes and cuboids using standard units, including centimetre cubed (cm3) and cubic metres (m3), and extending to other units such as mm3 and km3. **Measuring and calculating** • solve problems involving the calculation and conversion of units of measure, using

and vice versa, using decimal notation to up to three decimal places
- Convert between miles and kilometres
- Recognise that shapes with the same areas can have different perimeters and vice versa
- Recognise when it is possible to use formulae for area and volume of shapes
- Calculate the area of parallelograms and triangles
- Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3].

measures such as temperature.
They relate the area of rectangles to parallelograms and triangles, for example, by dissection, and calculate their areas, understanding and using the formulae (in words or symbols) to do this.

Pupils could be introduced to compound units for speed, such as miles per hour, and apply their knowledge in science or other subjects as appropriate.

decimal notation up to three decimal places where appropriate.
- recognise that shapes with the same areas can have different perimeters and vice versa
- To calculate the area of a parallelogram
  - by dissecting a rectangle
  - using the formulae (in words or symbols)
- To calculate the area of a triangle
  - by dissecting a rectangle
  - using the formulae (in words or symbols)
- To estimate and compare volumes of cubes and cuboids using standard units (cm^3 and m^3, extending to mm^3 and km^3)
- To recognise where it is possible to use formulae when calculating areas and volumes of shapes.
- To read negative numbers in the context of temperature
- To add and subtract positive and negative integers in the context of temperature, with the use of a number line
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Converting
- use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places
- To convert between standard units and from smaller units of measure to a larger unit of measure for:

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- Length (mm, cm, m, km)
- Mass (ml, l)
- Volume (g, kg)
- Time (sec, min, hrs, 12/24 hr clock, days, weeks, months, years)

- To convert between miles and kms

Solving Problems
- To use graphical representations to convert between two units of measure (miles and kilometres)
- solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate
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Geometry – Properties of Shapes
- Draw 2-D shapes using given dimensions and angles
- Recognise, describe and build simple 3-D shapes, including making nets
- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons
- Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.

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Pupils draw shapes and nets accurately, using measuring tools and conventional markings and labels for lines and angles.

Pupils describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements.

These relationships might be expressed algebraically for example, $d = 2 \times r$, $a = 180 - (b + c)$.

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Identifying shapes and their properties
- Use conventional markings and labels for lines and angles
- To visualise and describe 3D shapes
- To use nets to construct 3D shapes.
- To illustrate and name parts of a circle.

Drawing and constructing
- To draw 2D shapes accurately using straight lines and angles

Compare and classify
- To sort and classify geometric shapes based on:
  - their properties
  - sizes
  - unknown angles in any triangle, quadrilateral and regular polygons
- To explore and identify the properties of a circle and express these algebraically
- To find unknown angles in any triangles,

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quadrilaterals, and regular polygons

Angles
- To identify angle sums on triangles, quadrilaterals and regular pentagons
- To recognise angles around a point
- To recognise angles on a straight line
- To recognise vertically opposite angles
- To find missing angles using properties of shapes

Solve problems involving shapes
- To show how relationships can be expressed algebraically to find unknowns
  - $d = 2 \times r$
  - $a = 180 - (b+c)$

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Geometry – position and direction
- Describe positions on the full coordinate grid (all four quadrants)
- Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.

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Pupils draw and label a pair of axes in all four quadrants with equal scaling. This extends their knowledge of one quadrant to all four quadrants, including the use of negative numbers.

Pupils draw and label rectangles (including squares), parallelograms and rhombuses, specified by coordinates in the four quadrants, predicting missing coordinates using the properties of shapes. These might be expressed algebraically for example, translating vertex (a, b) to ($a - 2$, $b + 3$); (a, b) and ($a + d$, $b + d$) being opposite vertices of a square of side d.

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Position direction and movement
- To describe position on a full coordinate grid (four quadrants)
- To use properties of shapes to identify missing coordinates on a grid, including the use of negative numbers (squares, parallelograms and rhombuses)
- To reflect simple shapes in both the x and y axis
- To translate shapes, given a simple set of instructions
- To express the relationship between coordinates algebraically

Solving problems involving position and direction
- To draw the position of a new shape after a given set of instructions
- To describe the position of a shape after a given movement

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Statistics	Pupils connect their work on angles, fractions and percentages to the interpretation of pie charts.	Interpreting, constructing and presenting
- Interpret and construct pie charts and line graphs and use these to solve problems - Calculate and interpret the mean as an average	Pupils both encounter and draw graphs relating two variables, arising from their own enquiry and in other subjects. They should connect conversion from kilometres to miles in measurement to its graphical representation. Pupils know when it is appropriate to find the mean of a data set.	- To construct a simple pie chart using angles - To interpret a pie chart using angles, fractions and percentages - To construct a line graph - To interpret a line graph - To interpret a conversion graph between two variables such kilometres and miles - To find a mean of a data set - To interpret the mean of a data set - To know when to find the mean of a data set

Created by St Marks Teaching School Alliance, East Sussex Standards and Learning Effectiveness Service and East Sussex teachers.

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