



St. Mary's C of E Primary School

St Mary's C. E. Primary School
Maths Policy

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Person (s) Responsible	Maths Leader (currently Alice Brown)

Introduction

“Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history’s most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.”

The National Curriculum in England Framework, September 2013

Aims

The National Curriculum for Mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **reason** mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and nonroutine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

At St Mary’s, we want to ensure teaching is consistent with all lessons considered as highly effective, so that every pupil receives a great mathematics education. Our ambition is that all children will leave St Mary’s with a love of maths and a deep understanding of the fundamentals in key areas. We aim for 100% to be working at age-related expectations, with many above, by the time they leave us for secondary school.

We aim for all of our children to be strong mathematicians who:

- have a strong conceptual understanding of maths, its structures and its relationships;
- can recall and apply their knowledge confidently and efficiently;
- are secure in using written methods for which they have a clear understanding.

We aim to place problem-solving and investigative skills at the heart of our mathematics teaching. We recognise that collaboration and communication are crucial life skills and should be developed in our mathematics teaching. The expectation is that all children welcome challenge and that teachers foster the attitude that we all, even the most able among us, should expect to struggle. Through careful assessment, planning and preparation we aim to ensure that all children progress when they are ready.

Decisions about when a child will progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

Spoken Language

The national curriculum for Mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

Curriculum

Our curriculum will work to the expectations set out in the framework document for The National Curriculum in England, September 2013 for Years 1 to 6; and the Early Years Foundation Stage Curriculum, 2014. We do not follow a commercially published scheme of work; rather our curriculum for mathematics will be tailored to meet the individual needs of each cohort and to fulfil our ambition for the children by the time they leave us. Our curriculum draws on a variety of resources and best practice, such as those materials published by The White Rose Maths Hub, NRICH, and the NCETM. Our long-term progression map broadly follows that which is advocated by the White Rose Maths Hub.

Each class teacher is responsible for the Mathematics in their class in consultation with, and with guidance from, the Mathematics Subject Leader. Teachers plan small steps in learning, enabling deep coverage and mastery of the school's curriculum, through both daily maths lessons and additional opportunities to develop number fluency. Whilst there is a suggested weekly planning format, teachers are encouraged to adapt their approach to short term planning, so as to best meet the identified needs of their cohort.

Maths is taught daily in a morning lesson that will last around 60 minutes. Daily maths lessons will include teaching, practising, applying and reviewing; and will offer learning tasks that use concrete manipulatives and pictorial models to secure understanding. In addition, to further develop fluency, children in Y1-6 have a No-Nonsense Number Facts lesson of between 20-30 minutes every day; and a Number of the Day activity. At least twice a week, children in Y3-6 will also complete a Quadrant Quiz and access Times Tables Rock Stars for multiplication practice.

In daily lessons, classes are mixed-ability and the groups within this are fluid. Teachers will use a range of grouping methods when planning. During a sequence of learning, all children will have access to high quality teaching and learning time with their class teacher, who is best placed to help them make progress. Children's next steps in learning are at the forefront of all planning and achievements are clearly reviewed through regular assessments. Occasionally children may spend additional time working with an adult on a one-to-one basis or in small groups, to close a gap that has been identified in their mathematical understanding or to provide stretch and challenge activities for those who have grasped concepts swiftly.

Teachers in the Early Years Foundation Stage (Reception) base their teaching on "Development Matters" to ensure that the children are working towards the "Early Learning Goals for Mathematical Development". Additional documentation provided by the Maths and Early Years Co-ordinators is also used. The Early Years Foundation Stage teachers deliver some whole class teaching and adult focus led Maths activities together with the teaching assistant, each day. The children also access a range of Maths activities within continuous provision; and investigate a "Number of the Week" together as a class.

Knowledge, Skills and Understanding

Through careful planning and preparation, we aim to ensure that throughout the school children are given opportunities for:

- practical activities and mathematical games
- problem solving
- individual, group and whole class discussions and activities
- open and closed tasks
- a range of methods of calculating (recalling a known fact, mental, a jotting, a formal written method)

Lessons will be structured so that children are exposed to **variation**. There are two types of variation:

- **Conceptual variation** means that children have the opportunity to work on different representations of the same mathematical idea. This might be for instance looking at multiple representations of the number 54, with Dienes, Place Value counters, a Gattegno grid or arrow cards. These multiple representations will 'showcase' to pupils the different conceptual ideas that underpin a mathematical idea. So, in the context of place value, some will reveal the quantity/value of a digit, some will reveal the importance of position of a digit, others will support the order of the number and some will reveal the additive or multiplicative nature of place value.

Experiencing **concrete**, **pictorial** and **abstract** representations of a concept during a lesson, strengthens children's conceptual understanding and fluency. Moving between the concrete and the abstract helps children to connect abstract symbols with familiar contexts, thus providing the opportunity to make sense of and develop fluency in the use of abstract symbols. (see calculation policy for examples).

- **Procedural variation** is used to support pupils' deeper understanding of a mathematical procedure or process. This might be to compare the same procedure used to calculate two different sets of

numbers. By asking the pupils to compare two successive procedures where the first is linked to a second, one can observe relationships, observe the variant and invariant properties of the procedure - i.e. **what stays the same and what changes?** (depending on the numbers/ conditions) leading to generalising about the procedure.

For example: What do you notice? Is there a relationship between the calculations?

$500 + 400 =$	$523 + 400 =$	$523 + 28 =$
$400 + 500 =$	$423 + 500 =$	$423 + 28 =$
$300 + 600 =$	$323 + 600 =$	$323 + 28 =$
$200 + 700 =$	$223 + 700 =$	$223 + 28 =$
$100 + 800 =$	$123 + 800 =$	$123 + 48 =$

Using conceptual or procedural variation in the design of lessons and pupil tasks, encourages the dialogue that enables deeper understanding. Examples are carefully chosen to support pupils to make the desired connections and relationships and ultimately generalisations.

Reasoning is fundamental to knowing and doing mathematics, it enables children to make use of all their other mathematical skills. At St Mary's, once children have mastered the skills, they are given opportunities to apply them becoming systematic thinkers and also acquiring the ability to articulate such thinking in a clear, succinct and logical manner.

We have adopted the NRICH five-step **progression in reasoning**: a spectrum that shows us whether children are moving on in their reasoning from novice to expert. Children are unlikely to move fluidly from one step to the other, rather flow up and down the spectrum settling on a particular step that best describes their reasoning skills at any one time.

1. **Describing**: simply tells what they did.
2. **Explaining**: offers some reasons for what they did. These may or may not be correct. The argument may yet not hang together coherently. This is the beginning of inductive reasoning.
3. **Convincing**: confident that their chain of reasoning is right and may use words such as, 'I reckon' or 'without doubt'. The underlying mathematical argument may or may not be accurate yet is likely to have more coherence and completeness than the explaining stage. This is called inductive reasoning.
4. **Justifying**: a correct logical argument that has a complete chain of reasoning to it and uses words such as 'because', 'therefore', 'and so', 'that leads to' ...
5. **Proving**: a watertight argument that is mathematically sound, often based on generalisations and underlying structure. This is also called deductive reasoning.

The National Curriculum sets out specific expectations with regard to what children should be able to achieve by a certain age (see appendix for objectives by year group). However, it is vital that pupils are taught according to the stage that they are currently working at. Moving on too rapidly, before they are secure with understanding, can lead to gaps in key learning and foster misconceptions which are hard to unpick later on.

The National Curriculum states that: *‘The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace’* (DfE 2013 Page 99). This, coupled with the teaching for mastery agenda as set out by the National Centre for the Excellence in Teaching Mathematics (NCETM), has encouraged many schools to adopt a full mastery approach, using schemes such as Maths, No Problem.

One of the key aims of teaching for mastery is to ensure that all children have:

“...a deep understanding of the mathematics they are learning so that:

- future mathematical learning is built on solid foundations which do not need to be retaught;
- there is no need for separate catch-up programmes due to some children falling behind;
- children who, under other teaching approaches, can often fall a long way behind, are better able to keep up with their peers, so that gaps in attainment are narrowed whilst the attainment of all is raised.”

Teaching for Mastery: Questions, tasks and activities to support assessment Askew et al 2015

As children come into school with vastly different experiences, one of the challenges is how to provide each child with the necessary experiences for them to understand deeply. In ‘Learning for Mastery’, written in the 1960s, Bloom identifies that: *“Our basic task in education is to find strategies which will take individual differences into consideration, but which will do so in such a way as to promote the fullest development of the individual.”* He goes on to say:

“...Carroll’s (1963) view that *aptitude is the amount of time required by the learner to attain mastery of a learning task*. Implicit in this formulation is the assumption that, given time, enough, all students can conceivably attain mastery of a learning task. If Carroll is right, then learning mastery is theoretically available to all, if we can find the means for helping each student. It is this writer’s belief that this formulation of Carroll’s has the most fundamental implications for education.”

Learning for Mastery Bloom 1968

The phrase **‘given time, enough’** contains a challenge; the challenge of providing additional time for children who need it in a form that will maximise impact, whilst minimising disruption to the rest of their learning. In Shanghai, ‘rapid intervention’ is suggested.

Pupils’ difficulties and misconceptions are identified through immediate formative assessment and addressed with rapid intervention – commonly through individual or small group support later the same day: there are very few ‘closing the gap’ strategies, because there are very few gaps to close.

Mastery approaches to mathematics and the new national curriculum NCETM October 2014

If a pupil fails to grasp a concept or procedure, this is identified quickly, and early intervention ensures the pupil is ready to move forward with the whole class in the next lesson.

The Essence of Maths Teaching for Mastery NCETM June 2016

At St Mary's, whilst we appreciate the rationale of the Shanghai Mastery approach, it is not a pedagogy that meets the needs of our children - yet.

Each cohort contains a broad spectrum of prior ability; and whilst no teacher places a ceiling on attainment for any child, we also do not have the financial or human resources required to provide the same day catch-up strategy that a Shanghai approach requires for success. It is for these reasons that our teachers will vary the teaching approaches they take, lesson by lesson, according to the prior learning that children have secured in the particular mathematical concept being considered. Children are encouraged to move from "Try it" to "Apply it" and onto "Deepen it" challenges as soon as they are ready. Whilst whole class teaching may be used in some instances – for example if the task is "high ceiling, low threshold" in nature - it is more usual to see groups within classes that are fluid and formed in response to assessments of children's next steps in learning. All groups have equality of access to a teacher for focussed and guided work that seeks to meet individual needs.

Intervention

Within any cohort, there will be children who need support in Mathematics to secure attainment at age-related expectations. Whilst we cannot offer a Shanghai approach to intervention, we do ensure that pupils who need it benefit from other interventions. This could take the form of:

- being supported through additional meetings between teachers and parents to discuss ways of collaborative working and strategies to close the gap
- being observed/assessed by the SENCO to ensure that any obvious barriers have been identified, and so that appropriate provision can be put in place
- receiving some pre-teaching of concepts before they are encountered as a class
- being part of an additional teacher focus group during daily lessons / early morning time, to address misconceptions
- being invited to attend additional teaching sessions (either one-to-one or as a small group) - usually after school, but not exclusively)
- being timetabled to join in Rapid Maths, which is an evidence-based intervention programme, delivered by Mrs Game (TA)

Presentation

In Years 1 -6 maths learning is recorded in both Big Blue workbooks and smaller, blue Maths Journals. When working in the Big Blue books, every piece of work has a date and a Learning Focus (LF). Pages are split down the middle with the left-hand side being used for concrete or pictorial recording; and the right-hand side being used for pictorial and abstract recording – according to the stage that children are working at. Scaled down versions (A6) of any sheet-based activities are included in the Big Blue books from Y3-6; and are generally stuck at the top left-hand corner of the page. There is an expectation across the school that 1 square = 1 digit.

Marking

In line with our marking policy all class work should be marked by the teacher daily, whether work is in the Big Blue workbooks or the small blue Maths Journals.

Daily marking from teacher may be a 'light' mark which gives an oversight of the child's understanding and may be as well as self/peer marking that has taken place in the lesson; or a deeper mark from the teacher which would involve 'find and fix it' style corrections, and next steps to build on current understanding.

Assessment

Teachers are expected to make regular assessments of pupils' progress and to systematically record this against NC Objectives/EYFS Development Matters in School Pupil Tracker Online. The Assessment Leader monitors SPTO records on a frequent basis.

In order to make accurate assessments of progress, teachers may draw upon a range of sources:

- Assessments made whilst a lesson is in progress (AfL)
- Elicitation and exit tasks
- Observations of learning
- Quadrant Quizzes
- Times Tables Rock Stars records
- White Rose Assessments
- NFER tests / Statutory Assessment Tests, and subsequent question analysis
- Gem steps (used to benchmark fluency in key instant recall facts)
- Pupil conferencing
- Pupil's written work
- Pupil's oral work
- Feedback from teaching assistants
- Intervention records and discussions with the SENDCO
- Feedback from parents

All assessment will then be used to inform planning, set individual pupil targets and contribute to the child's annual report.

Leadership

To tackle barriers to success and ensure consistency, our Mathematics Leader is responsible for:

- Writing and delivering an annual action plan to address areas of concern, with consideration for the wider school improvement needs
- Ensuring teachers understand the requirements of the new National Curriculum and support them to plan lessons, where needed.

- Monitoring and evaluating teaching and learning through lesson observations; work; planning; and planning and progress reviews; sharing the outcomes of this work with the Headteacher, Governors and external advisors as required.
- Robustly challenging weak teaching and identifying what support or development is needed.
- Using the information gathered from data analysis and monitoring activities to improve teaching and the curriculum.
- Tracking the effectiveness of maths interventions, in conjunction with class teachers, the Headteacher and SENDCO.
- Attending CPD and disseminate knowledge through staff meeting/INSET
- Preparing, organising and leading CPD for colleagues as necessary, sometimes supported by consultants.
- Ensuring each classroom has the appropriate resources required to deliver the curriculum effectively and, where necessary, use the maths budget to fill gaps.
- Keeping parents informed about mathematics issues.

The Maths Subject Leader must work in partnership with other members of the leadership team, particularly the Inclusion Manager and our Interim Governing Body, in raising standards in Mathematics across our school and maintaining the high profile of mathematics in the School Improvement Plan.

Appendix:
Early Learning Goals
The National Curriculum Y1 -6

EYFS Early Learning Goals for Mathematics	
Number	Children count reliably with numbers from 1 to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.
Shape, Space and Measures	Children use everyday language to talk about size, weight, capacity, position, distance, time and money to compare quantities and objects and to solve problems. They recognise, create and describe patterns. They explore characteristics of everyday objects and shapes and use mathematical language to describe them.

Maths

Number: Number & Place Value

- count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens
- count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens
- given a number, identify one more and one less
- identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least
- read and write numbers from 1 to 20 in numerals and words

Number: Addition & Subtraction

- read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as $7 = \square - 9$.

Number: Multiplication & Division

- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Number: Fractions

- recognise, find and name a half as one of two equal parts of an object, shape or quantity
- recognise, find and name a quarter as one of four equal parts of an object, shape or quantity

Measurement

Compare, describe and solve practical problems for:

- lengths and heights [for example, long/short, longer/shorter, tall/short, double/half]
- mass/weight [for example, heavy/light, heavier than, lighter than]
- capacity and volume [for example, full/empty, more than, less than, half, half full, quarter]
- time [for example, quicker, slower, earlier, later]
- measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time (hours, minutes, seconds)
- recognise and know the value of different denominations of coins and notes
- sequence events in chronological order using language [for example, before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening]
- recognise and use language relating to dates, including days of the week, weeks, months and years
- tell the time to the hour and half past the hour and draw the hands on a clock face to show these times

Geometry: Properties of Shapes

Recognise and name common 2-D and 3-D shapes, including:

- 2-D shapes [for example, rectangles (including squares), circles and triangles]
- 3-D shapes [for example, cuboids (including cubes), pyramids and spheres]

Geometry: Position & Direction

- describe position, direction and movement, including whole, half, quarter and three-quarter turns.

Maths

Number: Number & Place Value

- count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward
- recognise the place value of each digit in a two-digit number (tens, ones)
- identify, represent and estimate numbers using different representations, including the number line
- compare and order numbers from 0 up to 100; use $<$, $>$ and $=$ signs
- read and write numbers to at least 100 in numerals and in words
- use place value and number facts to solve problems.

Number: Addition & Subtraction

Solve problems with addition and subtraction:

- using concrete objects and pictorial representations, including those involving numbers, quantities and measures
- applying their increasing knowledge of mental and written methods
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100

Add and subtract numbers using concrete objects, pictorial representations, and mentally, including:

- a two-digit number and ones
- a two-digit number and tens
- two two-digit numbers
- adding three one-digit numbers
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Number: Multiplication & Division

- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication ($\times$), division ($\div$) and equals ($=$) signs
- show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Number: Fractions

- recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$, and $\frac{3}{4}$ of a length, shape, set of objects or quantity
- write simple fractions for example, $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$

Measurement

- choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature ($^{\circ}\text{C}$); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels
- compare and order lengths, mass, volume/capacity and record the results using $>$, $<$ and $=$
- recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value
- find different combinations of coins that equal the same amounts of money
- solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change
- compare and sequence intervals of time
- tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times
- know the number of minutes in an hour and the number of hours in a day.

Geometry: Properties of Shapes

- identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line
- identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces
- identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid]
- compare and sort common 2-D and 3-D shapes and everyday objects.

Geometry: Position & Direction

- order and arrange combinations of mathematical objects in patterns and sequences
- use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise).

Statistics

- interpret and construct simple pictograms, tally charts, block diagrams and simple tables
- ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity
- ask and answer questions about totalling and comparing categorical data.

Maths

Number: Number & Place Value

- count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- recognise the place value of each digit in a three-digit number (hundreds, tens, ones)
- compare and order numbers up to 1000
- identify, represent and estimate numbers using different representations
- read and write numbers up to 1000 in numerals and in words
- solve number problems and practical problems involving these ideas.

Number: Addition & Subtraction

Add and subtract numbers mentally, including:

- a three-digit number and ones
- a three-digit number and tens
- a three-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.

Number: Multiplication & Division

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Number: Fractions

- count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10
- recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators
- recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- recognise and show, using diagrams, equivalent fractions with small denominators
- add and subtract fractions with the same denominator within one whole [for example, $5/7 + 1/7 = 6/7$]
- compare and order unit fractions, and fractions with the same denominators
- solve problems that involve all of the above.

Measurement

- measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- measure the perimeter of simple 2-D shapes
- add and subtract amounts of money to give change, using both £ and p in practical contexts
- tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks
- estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight
- know the number of seconds in a minute and the number of days in each month, year and leap year
- compare durations of events [for example to calculate the time taken by particular events or tasks].

Geometry: Properties of Shapes

- draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them
- recognise angles as a property of shape or a description of a turn
- identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle
- identify horizontal and vertical lines and pairs of perpendicular and parallel lines.

Statistics

- interpret and present data using bar charts, pictograms and tables
- solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables.

Maths

Number: Number & Place Value

- count in multiples of 6, 7, 9, 25 and 1000
- find 1000 more or less than a given number
- count backwards through zero to include negative numbers
- recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)
- order and compare numbers beyond 1000
- identify, represent and estimate numbers using different representations
- round any number to the nearest 10, 100 or 1000
- solve number and practical problems that involve all of the above and with increasingly large positive numbers
- read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.

Number: Addition & Subtraction

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.

Number: Multiplication & Division

- recall multiplication and division facts for multiplication tables up to 12 12
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Number: Fractions

- recognise and show, using diagrams, families of common equivalent fractions
- count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.
- solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number
- add and subtract fractions with the same denominator
- recognise and write decimal equivalents of any number of tenths or hundredths
- recognise and write decimal equivalents to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$
- find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths
- round decimals with one decimal place to the nearest whole number
- compare numbers with the same number of decimal places up to two decimal places
- solve simple measure and money problems involving fractions and decimals to two decimal places.

Measurement

- convert between different units of measure (for example, kilometre to metre; hour to minute)
- measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres
- find the area of rectilinear shapes by counting squares
- estimate, compare and calculate different measures, including money in pounds and pence.

Geometry: Properties of Shapes

- compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes
- identify acute and obtuse angles and compare and order angles up to two right angles by size
- identify lines of symmetry in 2-D shapes presented in different orientations
- complete a simple symmetric figure with respect to a specific line of symmetry.

Geometry: Position & Direction

- describe positions on a 2-D grid as coordinates in the first quadrant
- describe movements between positions as translations of a given unit to the left/right and up/down
- plot specified points and draw sides to complete a given polygon.

Statistics

- interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.
- complete a simple symmetric figure with respect to a specific line of symmetry.

Geometry: Position & Direction

- describe positions on a 2-D grid as coordinates in the first quadrant
- describe movements between positions as translations of a given unit to the left/right and up/down
- plot specified points and draw sides to complete a given polygon.

Statistics

- interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.

Maths

Number: Number & Place Value

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000
- interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero
- round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above
- read Roman numerals to 1000 (M) and recognise years written in Roman numerals.

Number: Addition & Subtraction

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- add and subtract numbers mentally with increasingly large numbers
- use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Number: Multiplication & Division

- identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers
- know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establish whether a number up to 100 is prime and recall prime numbers up to 19
- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- multiply and divide numbers mentally drawing upon known facts
- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- recognise and use square numbers and cube numbers, and the notation for squared (2^2) and cubed (3^3)
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

Number: Fractions

- compare and order fractions whose denominators are all multiples of the same number
- identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements >1 as a mixed number [for example, $2/5 + 4/5 = 6/5 = 1 1/5$]
- add and subtract fractions with the same denominator and denominators that are multiples of the same number
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- read and write decimal numbers as fractions [for example, $0.71 = 71/100$]
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with two decimal places to the nearest whole number and to one decimal place
- read, write, order and compare numbers with up to three decimal places
- solve problems involving number up to three decimal places
- recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal
- solve problems which require knowing percentage and decimal equivalents of $1/2$, $1/4$, $1/5$, $2/5$, $4/5$, and those fractions with a denominator of a multiple of 10 or 25.

Measurement

- convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)
- understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres
- calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes
- estimate volume [for example, using 1 cm^3 blocks to build cuboids (including cubes)] and capacity [for example, using water]
- solve problems involving converting between units of time
- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.

Geometry: Properties of Shapes

- identify 3-D shapes, including cubes and other cuboids, from 2-D representations
- use the properties of rectangles to deduce related facts and find missing lengths and angles
- distinguish between regular and irregular polygons based on reasoning about equal sides and angles.
- know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- draw given angles, and measure them in degrees ($^\circ$)
- identify angles at a point and one whole turn (total 360°)
- identify angles at a point on a straight line and half a turn (total 180°)
- identify other multiples of 90° .

Geometry: Position & Direction

- identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed.

Statistics

- solve comparison, sum and difference problems using information presented in a line graph
- complete, read and interpret information in tables, including timetables.

The National Curriculum for Mathematics

YEAR 6

Maths

Number: Number & 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.

Number: Addition & Subtraction

- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- *perform mental calculations, including with mixed operations and large numbers*
- *use their knowledge of the order of operations to carry out calculations involving the four operations*
- *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.*

**** Italic objectives are in both addition and subtraction, and multiplication and division**

Number: Multiplication & 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 appropriate, interpreting remainders according to the context
- identify common factors, common multiples and prime numbers
- *perform mental calculations, including with mixed operations and large numbers*
- *use their knowledge of the order of operations to carry out calculations involving the four operations*
- *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.*

**** Italic objectives are in both addition and subtraction, and multiplication and division**

Number: Fractions

- use common multiples 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 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.

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, 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].

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.

Geometry: Position & 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.

Statistics

- interpret and construct pie charts and line graphs and use these to solve problems
- calculate and interpret the mean as an average.

Ratio & 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.

Algebra

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with two unknowns
- enumerate possibilities of combinations of two variables.