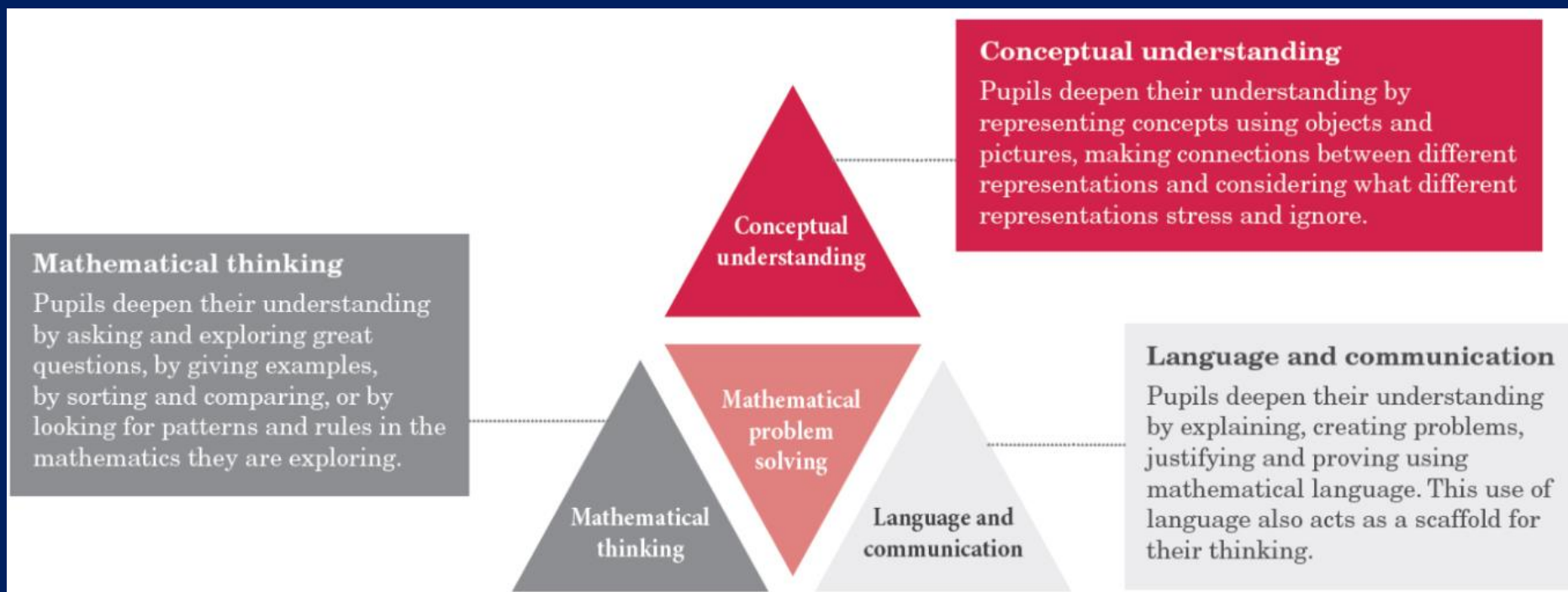# Stocksbridge Junior School Mathematics

Stocksbridge Junior School

*Learning Together*

*"I always knew how many of everything there were. Things were there and could be counted and accounted for, and so that's what I did."*

**The Autobiography of NASA Mathematician Katherine Johnson, 2020**

## SJS Mathematics

**Conceptual understanding**

Pupils deepen their understanding by representing concepts using objects and pictures, making connections between different representations and considering what different representations stress and ignore.

**Mathematical thinking**

Pupils deepen their understanding by asking and exploring great questions, by giving examples, by sorting and comparing, or by looking for patterns and rules in the mathematics they are exploring.

Conceptual understanding

Mathematical problem solving

Mathematical thinking

Language and communication

**Language and communication**

Pupils deepen their understanding by explaining, creating problems, justifying and proving using mathematical language. This use of language also acts as a scaffold for their thinking.

| | |
|---|---|
| **1: Conceptual Understanding** | 1. Mathematics tasks are about constructing meaning and making sense of relationships. Learners deepen their understanding by representing concepts using objects, pictures, symbols and words.<br><br><br><br>2. Different representations stress and ignore different aspects of a concept and so, moving between representations and making explicit links between them allows learners to construct a comprehensive conceptual framework that can be used as the foundation for future learning.<br>3. We use the content of the National Curriculum as the starting point for our curriculum, but this is expanded upon by making explicit the foundational knowledge that learners need to understand in order to access this.<br>4. Tasks are sequenced to help learners build a narrative through different threshold concepts. These concepts are then sequenced in a logical progression that allows learners to establish connections and draw comparisons.<br>5. Multiple representations are carefully selected so that they are extendable within and between different areas of Mathematics. Using these rich models encourages learners to develop different perspectives on a concept.<br>6. Tasks are designed so that learners are active participants and construct their own understanding of concepts (schema). |
| **2: Language and Communication** | 1. Mathematical language strengthens conceptual understanding by enabling pupils to explain and reason. This is carefully introduced and reinforced through frequent discussion to ensure it is meaningfully understood.<br>2. The more learners use mathematical words, the more they feel themselves to be mathematicians. Talk is an essential element of every lesson and time is dedicated to developing confidence with specific vocabulary as well as verbal reasoning.<br>3. The content of our curriculum carefully progresses in order to induct learners into the mathematical community. A large part of this community is confident use of the language, signs and symbols of Mathematics. Verbal and non-verbal communication is part of every sequence of learning in the curriculum.<br>4. This often starts with more informal language initially, building up to formal and precise mathematical language.<br>5. Talk tasks are part of every lesson in the curriculum to help with this development. |
| **3: Mathematical Thinking** | 1. By the time they reach school, all pupils have demonstrated a significant range of innate ways of thinking that can be harnessed in the classroom to develop mathematical thinking.<br>2. We support pupils to develop mathematical 'habits of mind' – to be systematic, generalise and seek out patterns.<br>3. The creation of a conjecturing environment and considered use of questions and prompts are important elements of encouraging learners to think like mathematicians.<br>4. Our curriculum is designed to give learners the opportunities to think mathematically. Throughout the curriculum you will see tasks that require learners to specialise and generalise, to work systematically, to generate their own examples, to classify and to make conjectures.<br>5. This is aided by our prompts for thinking which help make these important parts of Mathematics more explicit. |

## End Points in Learning in the Mathematics Curriculum

| Year 3 End Points | Year 4 End Points |
|---|---|

**Number - number and place value. Pupils can:**
- 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 3-digit number (100s, 10s, 1s)
- compare and order numbers up to 1,000
- identify, represent and estimate numbers using different representations
- read and write numbers up to 1,000 in numerals and in words
- solve number problems and practical problems involving these ideas

**Number - addition and subtraction. Pupils can:**
- add and subtract numbers mentally, including:
- a three-digit number and 1s
- a three-digit number and 10s
- a three-digit number and 100s
- add and subtract numbers with up to 3 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 and division. Pupils can:**
- 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. Pupils can:**
- 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

**Number - number and place value. Pupils can:**
- count in multiples of 6, 7, 9, 25 and 1,000
- find 1,000 more or less than a given number
- count backwards through 0 to include negative numbers
- recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s)
- order and compare numbers beyond 1,000
- identify, represent and estimate numbers using different representations
- round any number to the nearest 10, 100 or 1,000
- 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 0 and place value

**Number - addition and subtraction. Pupils can:**
- 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 and division. Pupils can:**
- 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 3 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 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects

**Number – fractions (including decimals). Pupils can:**
- 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 100 and dividing tenths by 10
- 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 within one whole [for example,   +   =  ]
- compare and order unit fractions, and fractions with the same denominators
- solve problems that involve all of the above

**Measurement - Pupils can:**
- 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, am/pm, 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. Pupils can:**
- 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 2 right angles make a half-turn, 3 make three-quarters of a turn and 4 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 - Pupils can:**
- 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

- add and subtract fractions with the same denominator
- recognise and write decimal equivalents of any number of tenths or hundreds

  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 1 decimal place to the nearest whole number
- compare numbers with the same number of decimal places up to 2 decimal places
- solve simple measure and money problems involving fractions and decimals to 2 decimal places

**Measurement - Pupils can:**
- 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
- read, write and convert time between analogue and digital 12- and 24-hour clocks
- solve problems involving converting from hours to minutes, minutes to seconds, years to months, weeks to days

**Geometry - properties of shapes. Pupils can:**
- 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 2 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 and direction. Pupils can:**
- 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 - Pupils can:**
- 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

| Year 5 End Points | Year 6 End Points |
|---|---|
| **Number - number and place value. Pupils can:**<br>• read, write, order and compare numbers to at least 1,000,000 and determine the value of each digit<br>• count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000<br>• interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through 0<br>• round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000<br>• solve number problems and practical problems that involve all of the above<br>• read Roman numerals to 1,000 (M) and recognise years written in Roman numerals<br><br>**Number - addition and subtraction. Pupils can:**<br>• add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)<br>• add and subtract numbers mentally with increasingly large numbers<br>• use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy<br>• solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why<br><br>**Number - multiplication and division. Pupils can:**<br>• identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers<br>• know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers<br>• establish whether a number up to 100 is prime and recall prime numbers up to 19<br>• 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<br>• multiply and divide numbers mentally, drawing upon known facts<br>• 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<br>• multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000<br>• recognise and use square numbers and cube numbers, and the notation for squared ($^2$) and cubed ($^3$)<br>• solve problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes<br>• solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign | **Number - number and place value. Pupils can:**<br>• read, write, order and compare numbers up to 10,000,000 and determine the value of each digit<br>• round any whole number to a required degree of accuracy<br>• use negative numbers in context, and calculate intervals across 0<br>• solve number and practical problems that involve all of the above<br><br>**Number – addition, subtraction, multiplication and division. Pupils can:**<br>• multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication<br>• 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<br>• 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<br>• perform mental calculations, including with mixed operations and large numbers<br>• identify common factors, common multiples and prime numbers<br>• use their knowledge of the order of operations to carry out calculations involving the 4 operations<br>• solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why<br>• solve problems involving addition, subtraction, multiplication and division<br>• use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy<br><br>**Number – fractions (including decimals and percentages). Pupils can:**<br>• use common factors to simplify fractions; use common multiples to express fractions in the same denomination<br>• compare and order fractions, including fractions >1<br>• add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions<br>• multiply simple pairs of proper fractions, writing the answer in its simplest form<br>• divide proper fractions by whole numbers<br>• associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction<br>• identify the value of each digit in numbers given to 3 decimal places and multiply and divide numbers by 10, 100 and 1,000 giving answers up to 3 decimal places<br>• multiply one-digit numbers with up to 2 decimal places by whole numbers<br>• use written division methods in cases where the answer has up to 2 decimal places |

- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates

**Number – fractions (including decimals and percentages). Pupils can:**
- 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
- 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
- recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- round decimals with 2 decimal places to the nearest whole number and to 1 decimal place
- read, write, order and compare numbers with up to 3 decimal places
- solve problems involving number up to 3 decimal places
- recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per 100', and write percentages as a fraction with denominator 100, and as a decimal fraction
- solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$ and those fractions with a denominator of a multiple of 10 or 25

**Measurement - Pupils can:**
- 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), including using standard units, square centimetres (cm²) and square metres (m²), and estimate the area of irregular shapes
- estimate volume [for example, using 1 cm³ 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

- 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

**Ratio and proportion - Pupils can:**
- solve problems involving the relative sizes of 2 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 - Pupils can:**
- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with 2 unknowns
- enumerate possibilities of combinations of 2 variables

**Measurement - Pupils can:**
- solve problems involving the calculation and conversion of units of measure, using decimal notation up to 3 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 3 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 (cm³) and cubic metres (m³), and extending to other units [for example, mm³ and km³]

**Geometry - properties of shapes. Pupils can:**
- 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

**Geometry - properties of shapes. Pupils can:**
- identify 3-D shapes, including cubes and other cuboids, from 2-D representations
- know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- draw given angles, and measure them in degrees (°)
- identify:
    - angles at a point and 1 whole turn (total 360°)
    - angles at a point on a straight line and half a turn (total 180°)
    - other multiples of 90°
    - 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

**Geometry - position and direction. Pupils can:**
- 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 - Pupils can:**
- solve comparison, sum and difference problems using information presented in a line graph
- complete, read and interpret information in tables, including timetables

- recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

**Geometry - position and direction. Pupils can:**
- describe positions on the full coordinate grid (all 4 quadrants)
- draw and translate simple shapes on the coordinate plane, and reflect them in the axes

**Statistics - Pupils can:**
- interpret and construct pie charts and line graphs and use these to solve problems
- calculate and interpret the mean as an average

## At Stocksbridge Junior School, every child is a mathematician!