IGNITE INNOVATE INSPIRE

Fluency in Mathematics Policy

Updated September 2022

Education is not the learning of facts, but the training of the mind to think.

Albert Einstein

RATIONALE:

One of the three aims of the 2014 curriculum states that pupils will: *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.*

At Monkhouse Primary School we recognise that basic skills in mathematics are the building blocks which allow the children to become fluent, confident and accurate mathematicians. Without these skills children cannot solve problems and reason mathematically.

AIMS:

- To allow children to become fluent in the fundamentals of maths so that they are able to recall and apply their knowledge rapidly and accurately to solve problems.

- To allow children to become fluent in multiplication and quick recall of multiplication and division facts
- To provide a consistent and progressive framework across school in the teaching of fluency of skills.
- To foster effective learning in basic skills in mathematics by suggesting appropriate ways of teaching these skills.
- To meet the requirements of the 2014 Primary National Curriculum

TEACHING AND LEARNING:

To ensure children become fluent in the fundamentals of maths, the curriculum has been divided into strands and the progression of each strand (see appendix 1). These areas are covered either in a HI5 session, Arithmetic session or both, where appropriate.

At Monkhouse Primary School children are offered the following opportunities to rehearse, recall and practice their basic skills in mathematics:

* Five times a week a Hi 5 Maths session, away from the mathematics lesson which focuses on five key skills. See Appendix 2 for structure of the session.

* Three times a week, an arithmetic session, away from the mathematics lessons which focuses on developing arithmetic proficiency and fluency. See Appendix 3 for the structure of an arithmetic session.

Appendix 1: Progression in fluency of skills

Year	Counting	Place Value	Addition and Subtraction	Multiplication and Division	Fractions	Measure	Time and Money	Statistics	Geometry
1	Count forwards and backwards from any given number up to 100. 1 more/less than any number to 100	Read and write numbers to 20 in numerals and words. Read numbers to 100 in numerals Compare and order numbers to 100. Begin to recognise place value in two digit numbers.	Recall number bonds to 20 and related subtraction facts. Add & subtract 1 digit & 2 digit numbers to 20, including zero.	Count in steps of 2,5 and 10 Solve one-step multiplication and division using objects, pictorial representation and arrays.	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.	Compare, describe and solve practical problems for: lengths and heights [for example, long/short, longer/shorter, tall/short, double/half]	Sequence events in chronological order. Use language of day, week, month and year. Tell time to hour & half past. Recognise and know the value of different denominations of coins and notes	See data presented in different ways e.g. pictograms	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]. Describe position, direction and movement, including whole, half, quarter and three quarter turns.
2	Count forwards and backwards in steps of 2, 3 and 5 from 0 and in tens from any number. Count in halves and quarters to 10.	Compare and order numbers up to 100 and use < > =. Read and write all numbers to 100 in digits & words. Say 10 more/less than any number to 100. Recognise place value of any two digit number. Partition a number in different ways e.g. 46 = 4tens and 6 ones or 3 tens and 16 ones	Have a fluent recall of number bonds of all numbers to to 20 and related subtraction facts. Use number bonds to 10 to derive facts to 100 (10+90 = 100) Add & subtract: 2-digit nos & ones 2-digit nos & tens Two 2-digit nos Three 1-digit nos Recognise and use inverse (+/-).	Count in steps of 2, 3 & 5 from zero and in 10s from any number (forwards and backwards). Recall and use multiplication & division facts for 2, 5 & 10 tables. Calculate and write multiplication & division calculations using multiplication tables.	Calculate simple fractions eg. ½ of 6 Recognise, find, name and write fractions 1/3 , 1/4 , 2/4 and 3/4 of a length, shape, set of objects or quantity	Compare and order lengths, mass, volume/capacity and record the results using >, < and =	Tell and write the time to 5 minutes including quarter past/to the hour on an analogue clock. 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	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	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 anticlockwise).

3	Count forwards and backwards from 0 in multiples of 4, 8, 50 and 100. Count up and down in tenths counting beyond 1	Recognise the place value of each digit in a three digit number. Compare and order numbers up to 1000. Read & write all numbers to 1000 in digits and words. Find 10 or 100 more/less than a given number. Partition a 3 digit number in different ways e.g. 146 = 1hundred, 4tens and 6 ones or 1 hundred, 3 tens and 16 ones	Recall number bonds to 100 (36 + 64). Add and subtract: 3-digit nos and ones 3-digit nos and tens 3-digit nos and hundreds Add and subtract numbers with up to 3-digits using written columnar method. Estimate and use inverse to check.	Recall multiplication and division facts for 2,3,4,5 ,8 and 10 tables up to x 12. Multiply 2-digit by 1-digit (formal method) Estimate and use inverse to check.	Add and subtract fractions with the same denominator within one whole Compare and order unit fractions, and fractions with the same denominators 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	Compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)	Tell time using 12 and 24 hour clocks; and using Roman numerals. Tell time to nearest minute. Know the number of seconds in a minute and the number of days in each month, year and leap year. Add and subtract amounts of money to give change, using both £ and p in practical contexts	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.	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.
4	Count forwards and backwards in multiples of 6, 7, 9, 25 and 1000. Count backwards through 0 to include negative numbers. Count up and down in hundredths	Recognise the place value of each digit in a four digit number. Recognise the place value of digits in decimal numbers up to hundredths. Read Roman numerals to 100. Compare and order numbers beyond 1,000. Compare and order numbers with up to 2 decimal places. Find 1,000 more/less than a given number. Round any number to the nearest 10, 100 or 1,000. Round decimals with 1dp to nearest whole number.	Recall number bonds to 100 (36 + 64) and their related subtraction facts. Add and subtract numbers with up to 4-digits using written columnar method. Estimate and use inverse to check.	Recall multiplication and division facts for all multiplication tables up to 12 x 12 Multiply: 2-digit by 1-digit 3-digit by 1-digit Estimate and use inverse to check. Division of 3 digit by 1 digit	Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten Add and subtract fractions with the same denominator Recognise and write decimal equivalents of any number of tenths or hundredths 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	Convert between different units of measure [for example, kilometre to metre; hour to minute] Find the area of rectilinear shapes by counting squares	Read, write and convert time between analogue and digital, 12 and 24 hour clocks. Convert from hours to minutes; minutes to seconds; years to months; weeks to days. Estimate, compare and calculate different measures, including money in pounds and pence	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.	Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes Identify acute and obtuse angles Compare and order angles up to two right angles by size Identify lines of symmetry in 2-D shapes presented in different orientations 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

					number Compare numbers with the same number of decimal places up to two decimal places				
5	Count forwards and backward with positive and negative numbers through zero. Count forwards/backwards in steps of powers of 10 for any given number up to 1,000,000.	Recognise the place value of each digit in a six digit number, including decimals. Read Roman numerals to 1000 and recognise years written in Roman numerals. Compare and order numbers up to 1,000,000. Compare and order numbers with 3 decimal places. Round any number up to 1,000,000 to the nearest 10, 100, 1000, 10,000 or 100,000. Round decimals with 2 decimal places to nearest whole number and 1 decimal place.	Recall number bonds to 1000 (360 + 640) and their related subtraction facts. To recall decimals totalling 1 and 10. Add and subtract numbers with more than 4-digits using formal written method. Use rounding to check answers	Recall multiplication and division facts for all multiplication tables up to 12 x 12 Identify multiples and factors. Find all factor pairs of a number and common factors of two numbers. Recognise and use square and cube numbers. Use known tables to derive other number facts. Recall prime numbers up to 19. Multiply 4-digits by 1-digit/ 2-digit Divide up to 4-digits by 1-digit Multiply & divide whole numbers & decimals by 10, 100 and 1,000 Use rounding to check answers	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, 52 + 54 = 56 = 1 51] 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 Round decimals with two decimal places to the nearest whole number and to one decimal place	Convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre) Calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes	Read the time with accuracy on analogue, 12 hour and 24 hour digital clocks. Convert between units of time. Use all four operations to solve problems involving, money using decimal notation, including scaling.	Solve comparison, sum and difference problems using information presented in a line graph Complete, read and interpret information in tables, including timetables.	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 Identify: angles at a point and one whole turn (total 360o) angles at a point on a straight line and ½ a turn (total 180o) other multiples of 90o 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. 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.
6	Use negative numbers in context and calculate	Recognise the place value of each digit in numbers up to 10	Recall all previous number bonds including decimals.	Recall multiplication and division facts for all multiplication	Use common factors to simplify fractions; use	Solve problems involving the	Read the time with accuracy on analogue, 12	Interpret and construct pie	Recognise, describe and build simple 3-D shapes, including

	intervals across zero.	million, including decimals. Round any whole number to a required degree of accuracy. Identify the value of each digit to 3 decimal places.	Use knowledge of order of operations to carry out calculations involving four operations. Use rounding to check answers	tables up to 12 x 12 Identify common factors, common multiples and prime numbers. Use knowledge of order of operations to carry out calculations involving four operations. Multiply 4-digit by 2-digit Divide 4-digit by 2-digit Use rounding to check answers multiply one-digit numbers with up to two decimal places by whole numbers	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 [f o r e x a m p l e , 41 × 21 = 81] Divide proper fractions by whole numbers [for example, 31 ÷ 2 = 61] Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 38] Find percentages of amounts 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	calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate	hour and 24 hour digital clocks. Convert between units of time. **Y5 objective** - Use all four operations to solve problems involving, money using decimal notation, including scaling.	charts and line graphs and use these to solve problems calculate Interpret the mean as an average.	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. Describe positions on the full coordinate grid (all four quadrants)

Appendix 2: Structure of a Hi 5 session

Each Hi 5 Maths session lasts for 15 minutes and focuses on the practise of 5 basic skills per session. The session is quick paced and interactive

Teachers organise the class how they wish for the session, some use the carpet others have their class sitting at tables. When recording is needed, the children record on their IPad or whiteboards.

All children should be actively involved in a session and included through differentiated questioning, challenge tasks, choice of entry points to tasks and through support.

The session is structured around a series of 5 slides on the Interactive Whiteboard which is used to display resources to support the children in their mental strategies and conceptual understanding (100 squares and number lines for counting, calendars etc) though some of these activities may be based around playing a game which doesn't involve the whiteboard

The session is planned to allow for maximum discussion and discussion around strategies, the efficiency of these and mental agility.

One session per week is dedicated to the teaching of multiplication. Children will look at arrays, drawing, associated facts, making links with images, counting stick and chanting to assist with the learning of times tables

4 times per week, each session must include one each of the 5 areas (counting, calendar or time,multi step word problem, fractions, 'little and often' :

- **A counting or multiplication fact activity** appropriate to their year group (see progression in fluency of skills document). This could include negative numbers, number sequences, factors and multiples, strategies for bridging through 10 and 100
- **Calendar or time work** where children practise skills such as reading and recording the date or time, calculating the date in X number of days' time, calculating intervals between dates or times, reading timetables.
- **A word problem** which has more than one step needed to solve it. This can include any of the 4 operations and over the week include a range of contexts, including money.
- **Composition of number and fractions (percentages and decimals)** slide where children focus on composition of numbers; specifically looking at using and drawing number lines, composition of numbers and fractions.
- The remaining slide or activity to focus on thinking and reasoning in a range of **'little and often'** areas (geometry, measure, statistics, position and direction, shape) or balance this with the need for place value areas (rounding, Roman Numerals)

Examples of activities

- A mad minute where children have one minute to record as many pairs of number bonds to X as they can, to calculate missing numbers in calculations, find as many totals from a number of coins, read as many times on clocks, add/subtract 10 minutes from a time on clocks.
- Odd One Out – from a selection of numbers, shapes, coins, measures etc children have to explain which is the odd one out and why.
- Sometimes, Always, Never- children are given a statement which they then have to explain if it is sometimes, always or never true e.g. *every multiple of 4 ends in 4, 6 or 8.*
- Images: a range of images are used to encourage children to identify shapes, lines of symmetry, estimate, order, count, memorise. They can also be used as stimulus for word problems, or to pose questions such as Where is the Maths in that?
- Pattern sniffing. Children are given the opportunity to spot patterns and look at the relationship between numbers. Including looking at calculations where parts have changed and discussing same and different.
- What's the same, what's different? Who is more efficient? Spot the mistake

Appendix 3: Arithmetic Sessions

Three times a week, children receive an arithmetic session which is delivered away from any session with a maths focus. This focuses solely on arithmetic computation and is intended to build fluency and stamina independently.

The session may not be delivered to the whole class at the whole time, teachers decide when it is appropriate. Teachers organise the session how they wish. Some children work independently, while some work with the teacher on a particular challenge area. It is expected that on average over a 2 week period each child has received a masterclass during an arithmetic session. The masterclass could come in the form of teaching the concept, teaching the method of solving, focusing on strategies or support. Where possible, this should be delivered by all adults available at the time who are working in that year group.

The class teacher sets a series of questions (see below) which cover a range of curriculum areas and set at the appropriate time of the year. Questions are not differentiated as they are accessible for all children working at that stage in the curriculum, differentiation is given through support and challenge in guided sessions. These match the progression in skills document, though questions from prior year groups may be added prior to the teaching of the content in that year group to keep up this knowledge (e.g. include year 2 fractions questions in Autumn term if year 3 fractions are not being taught till Spring)

Questions are to be completed in arithmetic books and all resources are to be made on Keynote. The questions for that day are printed as slides and are added to children's books. Children should use the book to show all working out where appropriate

Children's responses can be self-marked, peer-marked or marked by the class teacher. Where the responses are not marked, there is an expectation that staff check the child's work in order to identify areas of challenge . Subsequent maths sessions, master classes and support in arithmetic sessions can then be planned for.

Starting in year 3, children should be directed towards 2 questions per day where they should estimate the answer before calculating formally. e.g. 103 + 289 = or 21 x 5. This should lead up to year 6 where they estimate most of the questions they complete formally prior to solving. This can be signified with an E on the question.

Questions are chosen carefully to allow children to use a range of strategies and to allow discussion on the flexibility of strategies (for example 1210 / 11). Missing number questions are given to help children with their understanding of fluency or composition of a number (for example 2 + 3 + ? = 10 or 343 = 123 + ?).

Questions should be tiered to ensure fluency and should focus on deeper understanding and strategy rather than the number. For example:

- Questions over 10 should not be asked till children are fluent in the ways of making 10 (e.g. 3+4+?=10)

- Focus on number bonds and the recall of these. Set questions that allow children to see some patterns or number bonds in their answers

- Questions involving larger number should not be introduced till children are fluent in the strategies of adding mentally without the use of number lines (e.g. seeing that 17+8 is the same as 17 + 3 + 5 and not needing a number line to solve this before moving onto 17 + 18 for example)

- Questions involving carrying or exchanging using of a formal method with larger numbers not to be introduced till the children understand the concept and place value of this and any misconceptions are addressed (e.g. understanding the misconception of 0-4 in the calculation 90 - 34 before moving onto 2761-1643 for example)

Year	Time of session	Number of questions	Types of questions
R - -Summer term only and only children identified by class teacher	5 minutes	3	Addition and subtraction Missing number if appropriate Number bonds to 10 (including more than 2 numbers 4 + 4 + 2 = 10)
1 (Autumn term children identified start immediately, rest start after half term, or earlier if applicable)	Autumn – 10 minutes Spring – 10 minutes Summer – 10 minutes	Autumn – 3 Spring – 5 Summer – 7	Addition and subtraction (within 20) Inverse and missing number Place value (12 = 10 + ??) Multiplication and division facts (2x5=? and 10/2=?) Number bonds to 10 and 20 10 (including more than 2 numbers 4 + 4 + 2 = 10)
2	Autumn – 15 minutes Spring – 15 minutes Summer – 15 minutes	Autumn – 8 Spring – 10 Summer – 12	Addition and subtraction (within 100) Inverse and missing number (45 = ? + 30) Multiplication and division facts (2x5=? and 10/?=2) Place value (46 = 16 + ?) Adding and subtracting money Number bonds Fractions of an amount (½ of 6) Previous year group questions
3	15 minutes	15 2 questions to estimate prior to solving them	Addition and subtraction (3 digit numbers) Inverse and missing number (120 = 23 + ?) Multiplication and division facts (4x6=? and 36/?=6) Multiplication 2 digit by 1 digit Place value (138 = 100 + ? + ? or 138 = 120 + ?) Adding and subtracting money Number patterns (13,18, 23, ?, ?) Fractions of an amount (¼ of 20) Adding fractions of same denominator Previous year group questions
4	15 minutes	15	Addition and subtraction (4 digit numbers) Inverse and missing number (249 = 376 - ?) Multiplication and division facts (4x6=? and

		3-4 questions to estimate prior to solving them	36/?=6) Place value (1,438 = 1000, + 408 + ? or 138 = 120 + ?) Multiplication 3 digit by 1 digit Division 3 digit by 1 digit Add and subtract fractions of same denominator over 1 Multiply and divide numbers by 10 and 100 Adding and subtracting money inc. £ & p Fractions of amounts (e.g. ⅓ of 99) Previous year group questions
5	15 minutes	15 Estimate appropriate questions prior to solving them	Addition and subtraction (4 digit numbers) Inverse and missing number (249 = 376 - ?) Multiplication and division facts (4x6=? and 36/?=6) Place value (10,438 = 1000 + ? + 408 + ? or 198,000 = 120,000 + ?) Multiplication 4 digit by 1 digit Division 4 digit by 1 or 2 digit Square and cube numbers Add and subtract fractions with different denominators, including mixed numbers Multiply fractions and mixed numbers by whole numbers Find fractions of amount (⅗ of 365) Adding and subtracting money inc. £ & p Previous year group questions
6	15 minutes	15 Estimate any appropriate questions prior to solving them	Addition and subtraction (4 digit numbers) Inverse and missing number (249 = 376 - ?) Multiplication and division facts (4x6=? and 36/?=6) Place value (10,438 = 1000 + ? + 408 + ? or 198,000 = 120,000 + ?) Multiplication 4 digit by 1 or 2 digit Division 4 digit by 2 digit Square and cube numbers Order of operations Algebra Add and subtract fractions with different denominators, including mixed numbers Multiply fractions and mixed numbers by whole numbers Multiply fractions by fractions Divide whole numbers by fractions Find percentage of amount Adding and subtracting money inc. £ & p Previous year group questions

Appendix 4: The teaching of multiplication tables

Within HI5 ,questions focus on the memorisation of tables. We recognise that memorisation of these facts supports children by freeing up working memory, which in turn supports the children in problem solving contexts.

Multiplication tables are taught in the order outlined in the Progression in Fluency of Skills document (Appendix 1) and it is expected that children become fluent with these facts and their associated division facts. To support the concept of scaling, we teach the tables using the term ‘times’ not ‘groups/lots of’.

So the 2 times table is taught:

2 x 1 (2 one time)
2 x 2 (2 two times)
2 x 3 (2 three times)
2 x 4 (2 four times)

This is supported in the direct teaching of times tables. We assess children’s knowledge, speed and sticking points to ensure focus is appropriate. Multiplication progress is tracked over the year and we approach the teaching of times tables in a cyclical approach. We would teach a times table, focussing on one at a time, before moving this into arithmetic and applying in practise sessions. Multiplicative reasoning strategies are developed to ensure children see times tables from a variety of ways and utilise a variety of methods in helping with the remembering of them.