INSPECTOR CURRICULUM

Primary mathematics aide-memoire

A high-quality mathematics education engineers successful acquisition, consolidation and application of core mathematical knowledge for all pupils

Contents

- This document has been created to support inspectors undertaking a deep dive in mathematics.
- It provides a summary of stage two training and wider guidance.
- The six focus areas provide a structure to explain subject level outcomes as identified by inspection activities.
- School leaders should not be expected to articulate their intent as it is outlined in this aide-memoire, or supply documents which neatly provide the evidence for the focus areas.

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Curriculum

Scope: The curriculum should meet the minimum expectations set out in the EYFS and National Curriculum. It should be increasingly demanding and broaden and deepen pupils' mathematical knowledge.

Official - For training only

Declarative knowledge

Do plans outline the key number facts to be learned, as well as their benchmarks for automaticity?

How well are mathematical vocabulary and sentence stems developed alongside key facts and methods?

Are pupils equipped with rules and formulae for working with shape, distance, time, angles?

Do plans ensure that pupils are familiarised with principles enabling the conversion of word problems into equations?

Do pupils have a secure grasp of time, fraction and length facts?

$$A = \pi r^2$$

Procedural knowledge

Do curriculum plans acknowledge the most efficient and accurate methods of calculation that pupils will use in their next stage of mathematics education?

Is there a balance between procedures that rely on derivation and those that train recall?

Are pupils equipped with knowledge of how to lay out calculations systematically and neatly?

Are all pupils given procedural knowledge that enables them to work in the abstract?

Can pupils calculate with speed and accuracy?

Conditional knowledge

Do plans help pupils to familiarise themselves with the conditions where combinations of facts and methods will be useful?

Do plans ensure that pupils obtain automaticity in linked facts and methods, before being expect to deploy them in problem solving?

Are problems chosen carefully, so that pupils are increasingly confident with seeing past the surface features and of recognising the deep structure of problems?

Can pupils solve problems without resorting to unstructured trial and error approaches?

Components & Sequencing

Has the content been carefully selected to ensure pupils have the building blocks they need for later work?

Once key facts and methods are learned, do plans allow pupils to apply their learning to different contexts?

Is progression through the curriculum a guarantee for all and not overly influenced by choice?

Do plans engineer the successful opportunities to connect concepts within and between topic sequences?

Do plans rule out the acquisition of common misconceptions?

Are pupil errors immediately highlighted and corrected?

Memory

Do plans ensure that consolidation and overlearning of content takes place at frequent intervals?

Are pupils able to refer to work completed and content learned in previous lessons?

Do plans strike a balance between rehearsal of explanations or proof of understanding and rehearsal of core facts and methods needed to complete exercises and solve problems?

Do plans prioritise thinking about core content by ensuring that pupils know what to do?

Do plans actively prevent the need for guessing, casting around for clues and unstructured trial and error?

Can pupils recall, rather than derive, facts and formulae, without the use of memory aids?

Early Years:

Do plans close the school entry gap in knowledge of number?

Do plans allow for learning of key number facts and an efficient and accurate method of counting before pupils are expected to solve everyday problems?

Are pupils given key mathematical language?

Are curriculum plans equitable?

Disciplinary rigour

Do pupils know that proficiency in mathematics requires sustained effort and focus?

Are pupils encouraged to be precise, accurate and systematic in their mathematical endeavours?

Do plans give pupils undisturbed opportunities to hone their effort and focus?

Pedagogy

Instruction:

Are instructional approaches systematic, with new content introduced in a logical order, building on what pupils know?

Can pupils answer questions without needing to guess or cast around for clues?

Does instruction make sense to pupils?

Are diagrams and physical apparatus helpful?

Pupil practice:

Do plans prioritise successful rehearsal and consolidation over time spent 'finding out' what was intended to be learned?

Does task design minimise the need for equipment choices or expectations that pupils to work out what to do?

Are pupils given enough time to rehearse core content such as efficient methods?

Do pupils experience successful use of core facts and methods to complete exercises and solve problems, in addition to demonstrating their understanding?

Assessment

Component parts (facts and methods):

Are pupils regularly tested on their recall of core maths facts?

Are the prescribed benchmarks for accuracy and speed of recall true indicators of automaticity?

Do pupils know they are improving?

Do plans incorporate opportunities for assessing pupils' knowledge of core methods such as finding equivalent fractions, converting measurements or using short division outside of requirements to use these methods for problem solving?

Composite skills (applied facts and methods):

Are pupils prepared for tests of composite skills?

Are summative tests of this nature kept to a minimum?

Are pupils familiar with the typical language used in these tests?

Systems

Is success engineered?

How do leaders prevent the need for interventions?

Can the school readily explain and qualify potential systemic issues?

What mechanisms are there for curriculum construction, sequencing and improvement?

How well are staff supported in developing their own subject and subject-specific pedagogical knowledge?

Is the subject led and overseen effectively?

How are parents kept informed of their child's proficiency in mathematics?

Policy

Is the homework policy equitable and effective, supporting consolidation of learning and closing knowledge and retention gaps?

Are adequate resources available?

Does the calculation policy prioritise learning/use of efficient and accurate methods of calculation for all pupils?

Is the marking policy reasonable and clear?

Culture

Is proficiency in mathematics celebrated?

Do pupils appreciate the ways in which mathematics underpins advances in technology and science?

Is quiet, focused scholarship in mathematics promoted?

Do pupils know that creativity, motivation and love of mathematics follow success born of hard work?

What enrichment activities are offered?

Mathematics curriculum content (not exhaustive):

National Curriculum (2014), Statutory framework for the early years foundation stage (2017)

Declarative knowledge

Early years: numbers and number bonds to 10; concepts and vocabulary for talking about maths and mathematical patterns (size, weight, capacity, quantity, position, distance, time)

Key Stage 1

Concepts, representations and associated vocabulary:

- simple fractions
- basic arithmetic: the numbering system and its symbols, place value, conventions for expressions and equations, counting, addition, subtraction, equal sharing, doubling, balancing simple arithmetic equations, classifying numbers (odd, even, teens), inverse operations, estimation, numerical patterns
- basic measurement: length; capacity; time; position; relative size, position, direction, motion, quantity
- Currency and coinage
- Basic geometry: 2D and 3D shapes, geometric patterns
- Categorical data
- Maths facts: all number bonds within and between 20; key number bonds within and between 100, all multiplication facts for the 2, 5 and 10 multiplication tables, key 'fraction facts' such as 'half of 6 is 3', key 'time facts' such as the number of minutes in an hour

Lower Key Stage 2

Concepts, representations and associated vocabulary:

- Arithmetic: enhanced knowledge of the code for number (to 1000s) including patterns and associated rules for addition and subtraction of numbers, decimal numbers, place value, negative numbers, associative and distributive laws
- Maths facts: all multiplication facts for the 3, 4, 6, 7, 8, 9, 11, 12 multiplication tables, decimal equivalents of key fractions
- equivalent fractions
- Formulae: Units of measurement conversion rules, formulae for perimeter and area
- Roman Numeral system and associated historical facts
- Geometry facts: right angles, acute and obtuse angles, right angles in whole and half turns, symmetry, triangle and quadrilateral classifications**;** horizontal, perpendicular, parallel and perpendicular lines
- Links between words/phrases in word problems and their corresponding operations in mathematics (e.g. 'spending' is associated with 'subtraction from an amount')
- The rules for multiplying and dividing by 10, 100 and 1000
- First quadrant grid coordinate principles

Upper Key Stage 2

Concepts, representations and associated vocabulary:

- Enhanced knowledge of the code for number: up to and within 1 000 000, multiples, factors, decimals, prime number facts to 100, composite numbers, indexation for square and cubed numbers
- Properties of linear sequences
- Conversion facts metric to imperial measurements and vice versa
- Key circle, quadrilateral and triangle facts and formulae (e.g. angles on a straight line sum to 180 degrees)
- Rules and principles governing order of operations

Procedural knowledge

Early years: accurate counting, single digit addition and subtraction, halving doubling and sharing

Key Stage 1

Efficient and accurate methods:

- counting up and down in 1s, 2, 5s, 10s and 1/2s; addition; subtraction, equal sharing, division and multiplication
- reading, writing of the digits/symbols, vocabulary and phrases required for working with simple fractions, arithmetic expressions and equations
- measuring length, capacity, time and monetary value
- presentation and layout of calculations
- using a ruler
- spotting and making geometric and numerical patterns
- construction and interpretation of categorical data: pictograms, charts, tables

Lower Key Stage 2

Efficient and accurate methods:

- counting up and down in multiples of 3, 4, 6, 7, 8, 9, 11, 12, 25, 50, 100, 1000, in tenths, in ones through to negative numbers
- Column addition and subtraction
- Mental addition and subtraction using patterns and rules of number
- Short division and multiplication
- Mental multiplication using derived facts
- Fractions: finding unit and non-unit fractions of amounts, common equivalents, addition, subtraction and comparison of fractions with the same denominator
- measure, compare, add, subtract: lengths, mass, capacity (all units of measurement)
- read, write and compare roman numerals
- Draw 2D and 3D shapes
- Interpret and present data
- Estimation and rounding
- First quadrant grid construction, plotting and translation of points

Upper Key Stage 2

Efficient and accurate methods

- Scaling, coordinate geometry in all four quadrants
- Division with remainders as fractions, decimals and where rounding is needed
- Fractions: conversion mixed to improper and vice versa, add, subtract and multiply
- Finding percentages of amounts
- Converting units of measurement
- Measurement of length, angles, area, perimeter, volume
- Use of order of operations
- Convert between fractions, decimals and percentages
- Linear algebra, basic trigonometry
- Long multiplication and division

Conditional knowledge

Early years

Use combinations of number facts, shape facts, pattern facts, methods of counting, addition and subtraction to

- play games
- sing songs
- answer questions
- talk about everyday objects
- solve problems using objects within continuous provision

Key Stage 1

Use combinations of taught and rehearsed facts and methods to:

- Complete written exercises
- Solve missing number problems
- Solve simple word problems involving arithmetic, money, time and fractions
- Solve data and measurement problems

Lower Key Stage 2

Use combinations of taught and rehearsed facts and methods to:

- Complete written exercises
- Solve missing number, length problems
- Solve word problems involving arithmetic, fractions, data handling, shape, length, mass and capacity

Upper Key Stage 2

Use combinations of taught and rehearsed facts and methods to:

- Complete written exercises
- Find missing quantities, lengths, angles
- Solve one- and two-step word problems involving all the operations
- Abstract and solve linear equations from word problems