

Mathematics:

What have pupils covered by the end of KS2?



The National Curriculum for mathematics has three statutory aims which underpin all mathematical experiences in the primary phase. In brief, these are:

- become fluent in the fundamentals of mathematics
- reason mathematically
- solve problems by applying mathematical knowledge and skills

The primary mathematics curriculum is heavily weighted towards securing deep understanding of the number system and developing pupils' ability to think mathematically. The following content represents a summary of what, by the end of Key Stage 2, most pupils should have covered.

Pupils should be fully secure in their recall, knowledge and use of multiplication facts up to 12 x 12.

Number and place value:

- Read, write, order and compare numbers
- Know the value of any digit in a number up to 10 000 000
- Round any whole number to a required degree of accuracy
- Use negative numbers in context
- Solve number problems of increasing complexity
- Recognise square and cube numbers

Calculation:

- Use the four operations confidently to calculate, both in and out of context and as part of multi-step operations
- Use estimation to check answers
- Know when to use mental or written methods
- Identify common factors, common multiples and prime numbers
- Know the order of operations

Measurement:

- Use, read, write and convert between standard units of measurement for length, mass, volume and time
- Understand and use approximate equivalences between metric and imperial units of measure
- Calculate the area, perimeter and volume of a variety of shapes, including where formulae can be used

Fractions, decimals and percentages (FDP):

- Read, write, order and compare fractions with different denominators
- Recall and use equivalences between fractions with different denominators
- Add and subtract fractions with different denominators, including mixed numbers
- Calculate a percentage of a value
- Multiply simple pairs of fractions and divide proper fractions by whole numbers

Geometry:

- Identify, compare and draw a range of 2D and 3D shapes
- Recognise basic angle properties and use them to find missing angles
- Reason about shapes based on their properties
- Illustrate and name parts of a circle
- Use all four quadrants of a coordinate grid to describe, draw, reflect and translate shapes

Statistics:

- Complete, read, represent and interpret information in tables, line graphs, bar charts, pie charts and pictograms
- Calculate and interpret the mean as an average
- Solve comparison, sum and difference problems using information presented in different forms

Ratio and proportion: *First introduced in Year 6*

- Solve problems involving missing quantities where ratio is given
- Solve problems involving unequal sharing and grouping
- Solve problems involving similar shapes where the scale factor is known

Algebra: *First introduced in Year 6*

- Use simple formulae in mathematics and Science
- Express missing number problems algebraically
- Generate and describe linear number sequences
- Find pairs of numbers that satisfy an equation with two unknowns

Pupils should be able to apply all of the knowledge above flexibly, in a range of contexts, including:

word problems, logic puzzles, mathematical investigations, visualisation problems and across the curriculum. The above content is not exhaustive and pupils will have been introduced to other content in addition to these fundamentals, in line with the [National Curriculum programmes of study](#).

Mathematics:

What does Expected Standard look like?



The teaching of mathematics in Primary Schools is underpinned by the teaching of these essential mathematical attributes and a pupil who is securely working at Expected Standard will have begun to develop all these. We have summarised these as:

- ability to work systematically
- flexibility of thinking and deep understanding of mathematical vocabulary
- use of logic and clear reason including being able to interpret problems in different representations
- fluency in recall of fundamental mathematical knowledge

The end of Key Stage 2 test is made up of three papers: Arithmetic (40 marks) and two reasoning papers (35 marks each). To achieve Expected Standard, pupils should score in the region of 58/110 marks. Security and fluency in arithmetic is necessary for pupils to achieve Expected Standard.

Arithmetic:

Pupils should be able to select an efficient method to solve calculations. These are the sorts of questions that **most** pupils should be able to answer:

- $4.1 + 4.721 =$
- $471 \div 3 =$
- $\frac{\quad}{\quad} \div 100 = 2$
- $71 \div \frac{\quad}{\quad} = 0.071$
- $0.8 \times 50 =$
- $792 \times 37 =$
- $144 \div \frac{\quad}{\quad} = 12$
- $55\% \text{ of } 320 =$
- $\frac{4}{5} + \frac{2}{5} =$
- $\frac{2}{3} - \frac{1}{6} =$
- $80 + 48 \div 8 =$
- $\frac{\quad}{\quad} \times 100 = 6$
- $9 \div 1000 =$

Circle all the fractions that are greater than 25%.

$$\frac{1}{10} \quad \frac{1}{4} \quad \frac{2}{5} \quad \frac{1}{25} \quad \frac{1}{2}$$

Ben says 96 is the lowest common multiple of 7 and 8.

Is Ben correct?

Circle **Yes** or **No**

Explain how you know.

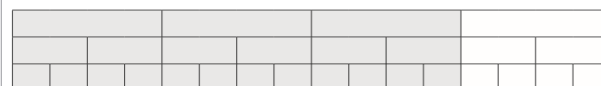
A film starts at 3:15pm and lasts 90 minutes.

What time does it end?

Reasoning problems can be presented in many different formats. **Most** pupils should have sufficient arithmetical fluency and reasoning skills to answer the following types of questions:

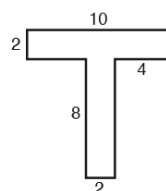
Mr Singh works five days a week.
His one-way trip from home to work is 76km.
Altogether, how far does he travel to work and back again in a week?

Use the diagram to help you write the missing numbers.



$$\frac{\boxed{4}}{\quad} = \frac{\boxed{6}}{\quad} = \frac{12}{\boxed{16}}$$

Calculate the perimeter of this shape. All units are in centimetres.



What might be different at Higher Standard?

All three papers are ordered broadly progressively, meaning that many of the questions towards the end of the papers will be targeted at pupils aiming for Higher Standard. To achieve Higher Standard, pupils should score in the region of 95/110 marks. These pupils are likely to have a very high degree of accuracy in arithmetic, the pace and stamina to complete all three papers and advanced reasoning skills, allowing them to quickly and efficiently work out what they need to do to solve a problem and do so accurately.

Mathematics:

Likely gaps and misconceptions



These are some of the common gaps and misconceptions that are often evident in national data.

Arithmetic:

- Subtracting decimals from whole numbers
- Finding simple percentages
- Addition and subtraction of fractions (including with mixed numbers)
- Placement of missing numbers in a problem
- **Selecting an efficient method**

Reasoning:

- Knowing decimal and fraction equivalents
- Reading measurement scales
- Solving problems in context using the four operations
- Using equivalences between fractions, decimals and percentages
- Quick recall of key facts
- **Approaching a problem systematically**

These are the types of questions that data shows us pupils commonly find challenging with some explanations of the potential challenges in each question:

$$0.9 \div 100 =$$

- **Not aligning digits correctly, place value misconceptions**

$$36\% \text{ of } 450 =$$

- **Percentages with no common equivalent fraction**

$$2\frac{1}{2} - \frac{3}{4} =$$

- **Finding a common denominator**

Tick the fractions that are equal to 20%.

$$\frac{1}{20} \quad \square \quad \frac{1}{5} \quad \square \quad \frac{2}{100} \quad \square$$
$$\frac{20}{40} \quad \square \quad \frac{3}{15} \quad \square$$

- **Calculation and comparison of percentages**

Mathematical experiences:

- Working under timed conditions
- Applying the same concept to different types of problems
- Persevering with a problem that they find challenging
- **Identifying errors in their own work**

Layla makes jewellery to sell at a school fair.

Each bracelet has 53 beads.

She makes 68 bracelets.



Each necklace has 105 beads.

She makes 34 necklaces.

How many beads does Layla use **altogether**?

- **Multi-step, lots of information to digest**

A machine pours 250 millilitres of juice every 4 seconds.

How many litres of juice does the machine pour every minute?

- **Early introduction to ratio, multiple possibilities, need for working systematically**

Questions and analysis taken from national ASP data and KS2 Mathematics papers 2019

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