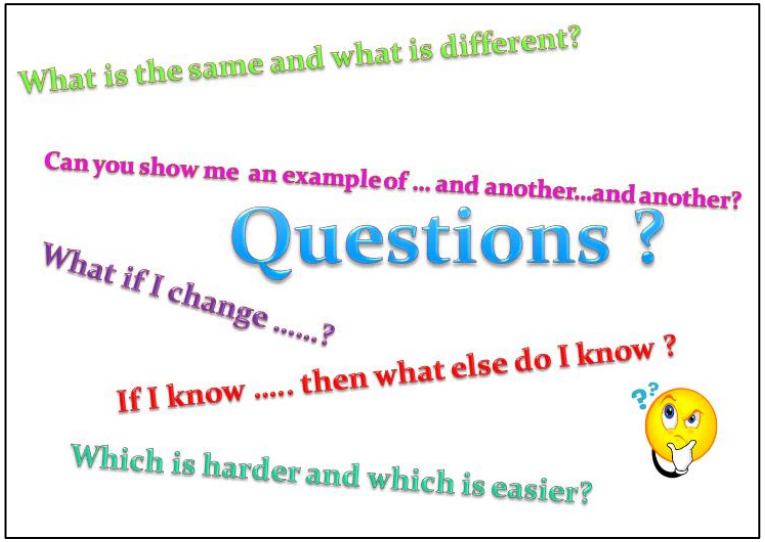
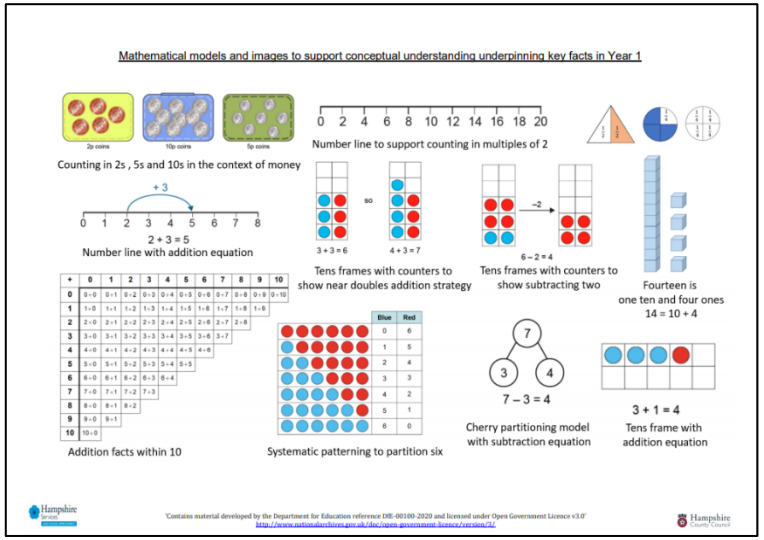
Supporting Primary Children with Learning Mathematics at Home

A Parent's Guide





The Hampshire Mathematics Team understands how challenging it can be for parents and schools during periods of blended and online learning at home or supporting pupils with homework . We have produced a guide to give parents some ideas about how they can support their children with the mathematics they are learning about with their school.

It is important that both children and parents enjoy this experience, whilst ensuring that the methods, models, and images the school are using for teaching and learning are understood and used well at home.

This document contains some guidance as to the sorts of questions parents might use when working with their children to help them think about the mathematics they are working on. For each year group in the national curriculum, an example problem shows parents how they could ask a question to engage the child and encourage them to think deeply. The examples are pitched at the sort of mathematics we would expect a child to know and understand at the end of each year, so the mathematics that schools will be asking children to think about and learn may be different. For some topics, children will be working towards the pitch in the question examples and for other topics, children may be feeling secure with these ideas and the school will be challenging them to look deeper.

Another important element of learning mathematics is knowing key number facts and using models, images, and verbal prompts to help recall of these facts. This document includes key number facts for each year group, including reception, together with some examples of the models and images that schools may be using. There is also a short glossary of some of the mathematical terms that children may need to know and understand when accessing their mathematical tasks. It is not an exhaustive list but provides a core of key words.

We hope that both schools and parents find this resource useful when supporting the children with learning mathematics at home.

Questions : Key Stage 1	Year 1	Year 2
If I know this, then what else do I know ?	**What else do you know?** If you know this: 12 – 9 = 3 what other facts do you know?	**What else do you know?** If you know this: 87 = 100 – 13 what other facts do you know?
What is the same and what is different?	**What do you notice?** 11 – 1 = 10 11 – 10 = 1 Can you make up some other number sentences like this involving 3 different numbers?	**Missing numbers** 91 + ☐ = 100 100 - ☐ = 89 What number goes in the missing box? **What is the same and what is different about the calculations?**
Which is harder and which is easier?	**Hard and easy questions** Which questions are easy / hard? 3 + 7 = 13 + 7 = 3 + 9 = 9 + 9 = Explain why you think the hard questions are hard?	**Hard and easy questions** Which questions are easy / hard? 23 + 10 = 93 + 10 = 54 + 9 = 54 + 1 = Explain why you think the hard questions are hard?
What if I change…?	**Spot the mistake:** 5, 6, 8, 9 What is wrong with this sequence of numbers? **What if change the sequence to:** 3, 4 , 6, 7 What is wrong with this sequence of numbers?	**Spot the mistake**: 45,40,35,25 What is wrong with this sequence of numbers? **What if change the sequence to:** 95, 105 , 110 , 115 What is wrong with this sequence of numbers?
Can you show me and example of…. and another ….?	**Can you show me an addition calculation with a sum of 10?** and another….? and another….?	**Can you show me an addition calculation with a sum of 100?** and another….? and another….?

Questions : Lower Key Stage 2	Year 3	Year 4
If I know this, then what else do I know ?	**Use a fact** 20 x 3 = 60. Use this fact to work out 21 x 3 = 22 x 3 = 23 x 3 = 24 x 3 =	**Use a fact** 63 ÷ 9 = 7 Use this fact to work out 126 ÷ 9 = 252 ÷ 7 =
What is the same and what is different?	**Making links** 4 × 6 = 24 How does this fact help you to solve these calculations? 40 x 6 = 20 x 6 = 44 x 6 =	**Making links** 8 × 7 = 56 How does this fact help you to solve these calculations? 80 x 7 = 40 x 7 = 48 x 6 =
Which is harder and which is easier?	**Hard and easy questions** Which questions are easy / hard? 323 + 10 = 393 + 10 = 454 - 100 = 954 - 120 = Explain why you think the hard questions are hard?	**Hard and easy questions** Which questions are easy / hard? 13323 - 70 = 12893 + 300 = 19354 - 500 = 19954 + 100 = Explain why you think the hard questions are hard?
What if I change…?	**Use the inverse** Use the inverse to check if the following calculation is correct: 12 ÷ 3 = 4 **What if I change 12 to 15 ?** How will the division calculation change? Use the inverse to check you are correct	**Use the inverse** Use the inverse to check if the following calculations are correct 117 ÷ 9 = 13 **What if I change 117 to 126 ?** How will the division calculation change? Use the inverse to check you are correct
Can you show me and example of…. and another ….?	**Can you show me a multiplication calculation with a product of 24?** and another….? and another….?	**Can you show me a multiplication calculation with a product of 100?** and another….? and another….?

Questions : Upper Key Stage 2	Year 5	Year 6
If I know this, then what else do I know ?	**What else do you know?** If you know this: 6.7 + 3.3 = 10 what other facts do you know? **Use a fact** 3 x 75 = 225 Use this fact to work out 450 ÷ 6 = 225 ÷ 0.6 =	**What else do you know?** If you know this: 86.7 + 13.3 = 100 what other facts do you know? **Use a fact** 12 x 1.1 = 13.2 Use this fact to work out 15.4 ÷ 1.1 = 27.5 ÷ 1.1 =
What is the same and what is different?	**Making links** 7 x 8 = 56 How can you use this fact to solve these calculations? 0.7 x 0.8 = 5.6 ÷ 8 =	**Making links** 0.7 x 8 = 5.6 How can you use this fact to solve these calculations? 0.7 x 0.08 = 0.56 ÷ 8 =
Which is harder and which is easier?	**Hard and easy questions** Which questions are easy / hard? 213323 - 70 = 512893 + 300 = 819354 - 500 = 319954 + 100 = Explain why you think the hard questions are hard?	**Hard and easy questions** Which questions are easy / hard? 213323 - 70 = 512893 + 37 = 8193.54 - 5.9 = Explain why you think the hard questions are hard?
What if I change…?	13 x 9 is the same as (10 x 9) + (3 x 9) {90 + 27 = 117} 13 x 9 is the same as (13 x 10) - (13 x 1) {130 - 13 = 117}	123 x 9 is the same as (100 x 9) + (20 x 9) + (3 x 9) {900 + 180 + 27 = 1107} 13 x 9 is the same as (13 x 10) - (13 x 1) {130 - 13 = 117}

<table>
<tr><td></td><td>What if I change one of the numbers?

Work out
14 x 9
23 x 9
13 x 11</td><td>What if I change one of the numbers?

Work out
14 x 9
23 x 9
13 x 11</td></tr>
<tr><td>Can you show me and example of…. and another ….?</td><td>Can you show me an example of a fraction that is the same as $\frac{1}{5}$?
…and another fraction that is the same as $\frac{1}{5}$?
…and another fraction that is the same as $\frac{1}{5}$?
$\{\frac{1}{5} = \frac{2}{10}, \frac{10}{50}, \frac{20}{100}, \ldots\ldots\}$
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$\{\frac{3}{5} = \frac{6}{10}, \frac{30}{50}, \frac{60}{100}, \ldots\ldots\}$
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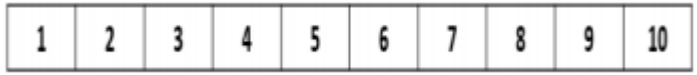
Key Mathematical Words and their meanings:

Word	Meaning
Acute angle	An angle between 0º and 90º
Decimal fraction	A number that has a zero or whole number part and a part that is less than 1 For example 1.75 is a decimal fraction with 1 as the whole number part and 0.75 as the part that is less than 1.
Denominator	The bottom number in a fraction. It tells us how many equal pieces the whole is divided into. For $\frac{5}{7}$ ~ the '7' is the denominator. It shows that the whole is divided into 7 equal pieces .
Digit	The numbers 0 to 9 in a number that is 10 or bigger. 23 has the digits two and three The two represents 2 tens and the three represents 3 ones.
Difference	When one number is taken away, or subtracted, from another number, the result is called the difference. The difference between 4 and 3 is 1 because 4 - 3 = 1
Equivalent	Has the same value. Is the same as… Two fractions are equivalent if the relationship between the numerator and the denominator is the same, so $\frac{1}{3}$ and $\frac{3}{9}$ and equivalent since the denominator is 3 x the numerator for both fractions.
Factor (pairs)	When two whole numbers are multiplied together to get a product, those two numbers are factors of the product. Also, a factor is a whole number that divides into another whole number exactly with no remainder 3 x 4 = 12 3 and 4 are factors of 12 12 ÷ 4 = 3 4 is a factor of 12
Grouping	Divide a quantity into equal groups for division . 20 ÷ 4 = 5 20 divided into 4 equal groups gives 5 in each group
Improper fractions	A fraction where the numerator is greater than the denominator Examples of improper fractions include $\frac{5}{3}$, $\frac{14}{3}$, $\frac{9}{8}$
Integer	A whole number 53 , 17 , 0 and -19 are all integers
Inverse	Inverse operations 'undo' each other. Addition and subtraction are inverses of each other. E.g. 3 + 4 = 7 and 7 - 4 = 3 Multiplication and division are inverses of each other. E.g. 70 ÷ 10 = 7 and 7 x 10 = 70
Mixed number	An improper fraction can be expressed in two parts, the whole number, and the remaining proper fractions Examples of mixed numbers include $1\frac{1}{3}$, $5\frac{2}{3}$, $2\frac{3}{8}$

Multiple	When multiplying two whole numbers together, the product is a multiple of each. 8 x 7 = 56 56 is a multiple of 7 and 56 is a multiple of 8 Other multiples of 8 are: 8 , 16 , 24 , 32 , 40 , 48 , 56 , 64 , …..
Number line	A line where numbers are represented by points upon it 
Number track	A sequence of connected cells where each cell represents a number 
Numerator	The top number in a fraction. It tells us how many equal pieces we have. For $\frac{5}{7}$ ~ the '5' is the numerator. It shows 5 equal pieces out of the whole 7 equal pieces.
Obtuse angle	An angle greater than 90º but less than 180º
Partition	To separate into subsets. To split a number into component parts The number 23 can be partitioned into 20 + 3 and also 19 + 4 and 10 + 13
Place value	The value of the digit that relates to its position or place in a number. In the number 36 the digits represent 3 tens, and 6 ones respectively
Prime number	A whole number greater than 1 that has exactly two factors, itself and 1 2 is a prime number (factors 2, 1) ; 41 is a prime number (factors 41, 1) ; 97 is a prime number (factors 97, 1)
Product	When two numbers are multiplied together, the result is called the product. The product of 3 and 4 is 12 because 3 x 4 = 12
Proper fraction	A fraction where the numerator is less than the denominator Examples of proper fractions include $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{8}$
Quotient	When one number is divided by another number, the result is called the quotient. The quotient of 20 and 10 is 2 because 20 ÷ 10 = 2
Reflex angle	An angle that is greater than 180º but less than 360º
Sharing	Share a quantity into equal groups for division 20 ÷ 4 = 5 20 shared between 4 gives 4 equal groups of 5
Sum	When two numbers are added together, the result is called the sum. The sum of 3 and 4 is 7 because 3 + 4 = 7
Unit fraction	A proper fraction where the numerator is 1 Examples of unit fractions include $\frac{1}{3}$, $\frac{1}{10}$, $\frac{1}{55}$

Primary Mathematics

Number facts, models, and images by year group

Number Facts: Overview

National Curriculum for Mathematics in England : Summary of Aims:

- Become **fluent** in the fundamentals of mathematics, developing conceptual understanding and the ability to recall knowledge and facts accurately and rapidly
- **Reason mathematically** by making connections, following a line of enquiry and developing a justified argument
- **Solve problems** by applying mathematical skills, knowledge and understanding to a variety of routine and non-routine problems, including in real-life contexts

Focus of number study in Key stage 1 (Year 1 and Year 2)	Focus of number study in Lower Key stage 2 (Year 3 and Year 4)	Focus of number study in Upper Key stage 2 (Year 5 and Year 6)
Develop confidence and mental fluency with whole numbers, counting and place value. Work with numerals, words and the four arithmetic operations (+, -, x, ÷) using visual prompts and practical resources. Use a range of measures such as length, mass, capacity, volume, time, and money	Become increasingly fluent with whole numbers and the four arithmetic operations (+, -, x, ÷), including known number facts and the concept of place value. Develop efficient written and mental methods Perform calculations accurately with increasingly large whole numbers Solve a range of problems including with simple fractions and decimals	Extend understanding of the number system and place value to include larger integers (whole numbers). Develop connections between multiplication, division, fractions, decimals, percentages, and ratio Begin to use algebraic techniques to solve simple arithmetic problems
By the end of Year 2: • Recall and use number bonds to 20 • Recall and use multiplication and division facts for the 2x, 5x and 10x tables. • Identify odd and even numbers • Use and understand place value, • Read and spell age appropriate mathematical vocabulary	**By the end of Year 4:** • Add and subtract numbers up to 4-digits using formal and informal methods • Recall and use all multiplication and division facts up to and including the 12x table. • Know and use common equivalences between fractions and decimals • Read and spell age appropriate mathematical vocabulary correctly.	**By the end of Year 6:** • Be fluent in written methods for the four arithmetic operations (+, -, x, ÷), including formal methods such as column addition and subtraction, long and short multiplication and division. • Calculate with integers and fractions • Read and spell age appropriate mathematical vocabulary correctly.

Number Facts: Reception Year

Early Learning Goal 11: 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.

Early Learning Goal 12: 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.

Number Facts: Number and place value

- Know the sequence of counting in ones from 1 to 20 (by rote)
- Recognise numerals 0 - 9
- Accurately count up to 20 objects
- Place numbers to 20 in order

Number Facts: Early Calculation

- Use the language of 'more' and 'fewer' to compare two sets of objects.
- Find the total number of items in two groups by counting all of them.
- Say the number that is one more than a given number to 20.
- Say the number that is one less than a given number to 20.
- Recognise when a quantity or items is reduced or increased by one.
- Subtract a quantity within 20. Say how many are left by counting (or counting back)
- Double small numbers (e.g. the amount shown on two dice)
- Share objects equally, or fairly, by putting them in equal sized groups

Number facts: Measure

- Develop an awareness of measure through practical experiences (e.g. length, weight/mass, capacity, distance, height) in readiness for more precise measuring in KS1
- Develop an awareness of time passing, in preparation for telling the time.
- Begin to use the language of time (next, before) to sequence personal events
- Develop their use and understanding of positional language.
- Explore 2-D and 3-D shape (e.g. through constructions and patterns)

Proposed Early Learning Goals 2021 *currently under consultation*

Number

- Have an understanding of numbers to 10, linking names of numbers, numerals, their value, and their position in the counting order.
- Subitise (recognise quantities without counting) up to 5.
- Automatically recall number bonds for numbers 0-5 and for 10, including corresponding partitioning facts.

Numerical Patterns

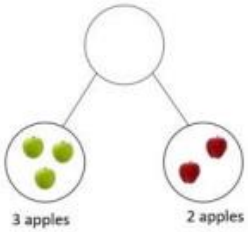
- Automatically recall double facts up to 5+5.
- Compare sets of objects up to 10 in different contexts, considering size and difference.
- Explore patterns of numbers within numbers up to 10, including evens and odds.

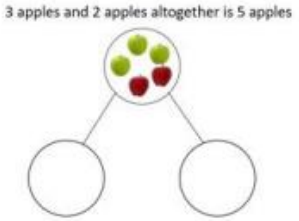
Number Facts: Fractions

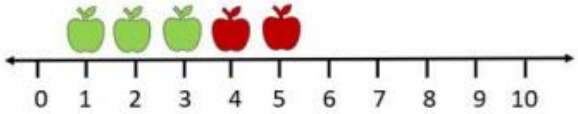
- Develop an awareness of halving through practical experiences.

Mathematical models and images to support conceptual understanding underpinning key facts in Reception

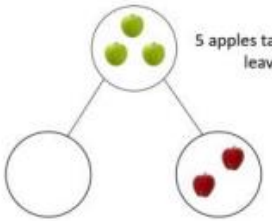
Early representations of structure

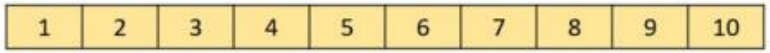


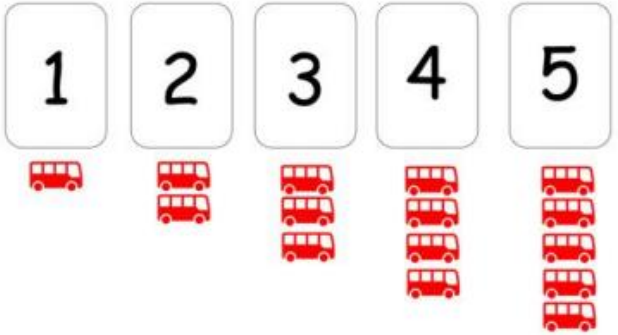




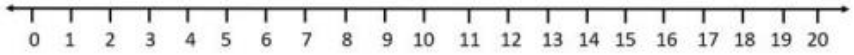
'part-part-whole' language







number tracks and number lines



HIAS Maths Team: Number Facts: Year 1

Number and place value

Pupils should be taught to:

- 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
- given a number, identify one more and one less

Addition and subtraction

Pupils should be taught to:

- read, write, and interpret mathematical statements involving addition (+) and subtraction (-) and equals (=) signs
- represent and use number bonds and related subtractions 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 = □ - 9.

Fractions

Pupils should be taught to:

- 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

Measure

Pupils should be taught to:

- recognise and know the value of different denominations of coins and notes
- sequence events in chronological order using language such as 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

Number Facts: Number and place value

- Know the sequence of counting in multiples of 2.
- Know the sequence of counting in multiples of 10.
- Know the sequence of counting in multiples of 5.
- Say one more or one less than any number up to 20.

Number Facts: Addition and subtraction

- Know the number bonds and related subtraction facts for all numbers to 5

For example:

4 + 0 = 4	4 – 0 = 4
3 + 1 = 4	4 – 1 = 3
2 + 2 = 4	4 – 2 = 2
1 + 3 = 4	4 – 3 = 1
0 + 4 = 4	4 – 4 = 0

- Know the number bonds for all numbers to 10 and the related subtraction facts.
- Know the number bonds for all numbers to 20 and the related subtraction facts.

For example

10 + 2 = 12	12 – 2 = 10
9 + 3 = 12	12 – 3 = 9
8 + 4 = 12	12 – 4 = 8

- Recognise that 'teens' numbers comprise one ten and some ones.

Number facts: Measure

- Say the days of the week and the months of the year in the correct order.
- Recognise the coins and notes of the realm and starting with 1p, 2p, 5p, 10p, 20p.
- Apply number bond knowledge to coins
  10p + 1p = 11p
  10p +2p = 12p

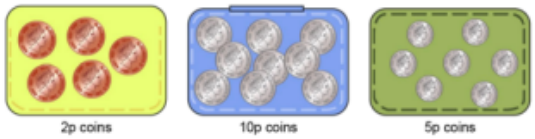
Number Facts: Fractions

Know that.....

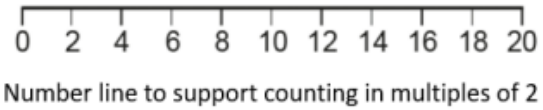
½ + ½ = 1 whole

¼ + ¼ + ¼ + ¼ = 1 whole

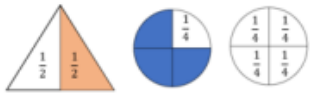
Mathematical models and images to support conceptual understanding underpinning key facts in Year 1

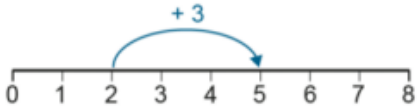


Counting in 2s , 5s and 10s in the context of money



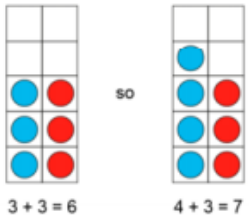
Number line to support counting in multiples of 2



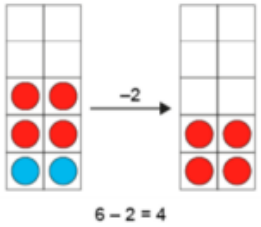


2 + 3 = 5

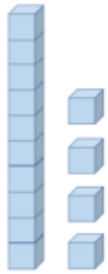
Number line with addition equation



Tens frames with counters to show near doubles addition strategy



Tens frames with counters to show subtracting two

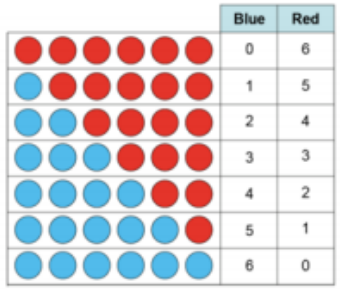


Fourteen is one ten and four ones

14 = 10 + 4

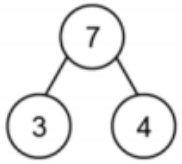
+	0	1	2	3	4	5	6	7	8	9	10
0	0+0	0+1	0+2	0+3	0+4	0+5	0+6	0+7	0+8	0+9	0+10
1	1+0	1+1	1+2	1+3	1+4	1+5	1+6	1+7	1+8	1+9	
2	2+0	2+1	2+2	2+3	2+4	2+5	2+6	2+7	2+8		
3	3+0	3+1	3+2	3+3	3+4	3+5	3+6	3+7			
4	4+0	4+1	4+2	4+3	4+4	4+5	4+6				
5	5+0	5+1	5+2	5+3	5+4	5+5					
6	6+0	6+1	6+2	6+3	6+4						
7	7+0	7+1	7+2	7+3							
8	8+0	8+1	8+2								
9	9+0	9+1									
10	10+0										

Addition facts within 10



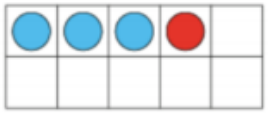
Blue	Red
0	6
1	5
2	4
3	3
4	2
5	1
6	0

Systematic patterning to partition six



7 – 3 = 4

Cherry partitioning model with subtraction equation



3 + 1 = 4

Tens frame with addition equation

Number Facts: Year 2

Number and place value

Pupils should be taught to:
- count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward

Addition and subtraction

Pupils should be taught to:
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and missing number problems.

Multiplication and division

Pupils should be taught to:
- 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

Fractions

Pupils should be taught to:
- 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 e.g. $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$

Measurement

Pupils should be taught to:
- compare and sequence intervals of time .
- know the number of minutes in an hour and the number of hours in a day

Number Facts: Number and place value

- Know the sequence of counting in multiples of 3.
- Count in steps of 10 from any number.

Number Facts: Addition and subtraction

- Know number bonds and related subtraction facts to 20
- Derive number bonds to 100 using multiples of 10, relating this to known number bonds to 10 (from Y1)
- Add and subtract numbers to 100 using informal methods, manipulative resources and visual representations,

Number facts: Multiplication and division

- Know the 2x, 5x and 10x times table and the related division facts.
- Recognise odd and even numbers.

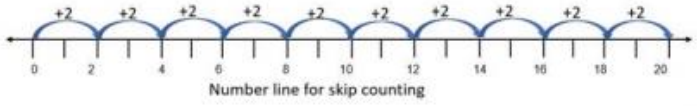
Number Facts: Measure

- 100p = £1 50p+50p= £1
- 100 cm = 1metre
- One hour = 60 minutes
- $\frac{1}{2}$ an hour = 30 minutes
  $\frac{1}{4}$ of an hour = 15 minutes
  $\frac{3}{4}$ of an hour = 45 minutes
- There are 24 hours in a day
- Recite the months of the year in the correct order

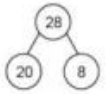
Number Facts: Fractions

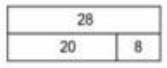
- $\frac{1}{3}+\frac{1}{3}+\frac{1}{3}$ = 1 whole
  $\frac{1}{4}+\frac{1}{4}+\frac{1}{4}=\frac{3}{4}$
- 1 whole $-\frac{1}{4}=\frac{3}{4}$
- $\frac{2}{4}=\frac{1}{2}$
- Halve all even numbers to 20

Mathematical models and images to support conceptual understanding underpinning key facts in Year 2



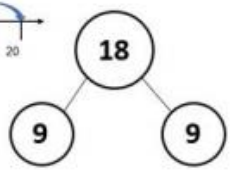
Number line for skip counting

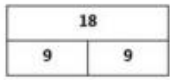




Partitioning 28 into 20 and 8

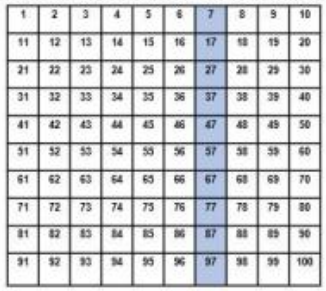
9 + 9 = 18

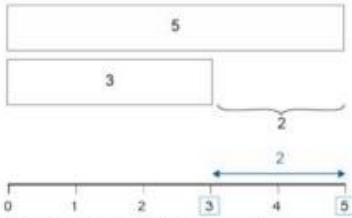




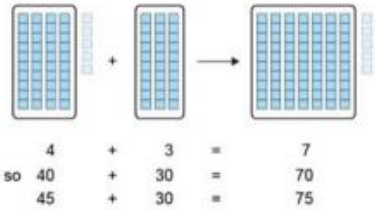
Half of 18 is 9

100-square for skip counting in tens from any number

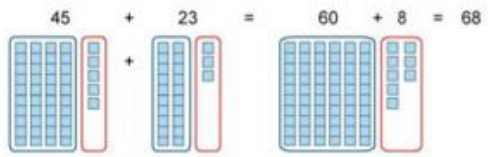




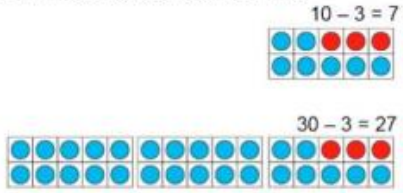
Finding the difference using a bar model and a number line



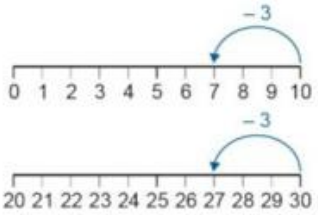
Base 10 material and equations to support adding a multiple of 10

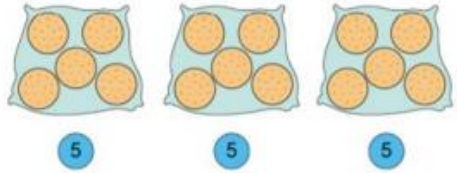


Base 10 material and equations to support adding 2 two-digit numbers



Tens frames with counters and number lines to support subtracting ones from a multiple of 10





Three bags of five biscuits with three 5-value counters to support skip counting for 3 x 5 = 15

Number Facts: Year 3

Number and place value
Pupils should be taught to:
- count from 0 in multiples of 4, 8, 50 and 100
- find 10 or 100 more or less than a given number up to 1000

Addition and subtraction
Pupils should be taught to:
- derive complements to 100
- add and subtract numbers mentally, including:
  - a three-digit number and ones
  - a three-digit number and tens
  - a three-digit number and hundreds

Multiplication and division
Pupils should be taught to:
- 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

Fractions
Pupils should be taught to:
- 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 and show, using diagrams, equivalent fractions with small denominators
- add and subtract fractions with the same denominator within one whole (e.g. $\frac{5}{7} + \frac{1}{7} = \frac{6}{7}$)

Measurement
Pupils should be taught to:
- measure, compare, add and subtract lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- know the number of seconds in a minute and the number of days in each month, year, and leap year

Number Facts: Number and place value
- Know the sequence of counting in 50's.
- Know the sequence of counting in 100's

Number Facts: Measure
- 60 seconds = 1 minute
- How many days in each month / year / leap year.
- Find complements to 60.
- 50p x 2 = £1.00 £50 x 2 = £100
  25 p x 4 = £1.00 £25 x 4 = £100
  20p x 5 = £1.00 £20 x 5 = £100
- 1000 g = 1kg 1000ml = 1l
  1000 m = 1km
- 1000 ÷ 2 = 500 1000 ÷ 4 = 250
  $\frac{1}{2}$ l/kg/km = 500
  $\frac{1}{4}$ l/kg/km = 250
  $\frac{3}{4}$ l/kg/km = 750

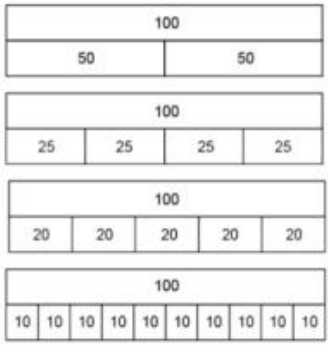
Number Facts: Fractions
- $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$
- $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{5}{5}$ = 1 whole
- $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{6}{6}$ = 1 whole
- $\frac{1}{7} + \frac{1}{7} + \frac{1}{7} + \frac{1}{7} + \frac{1}{7} + \frac{1}{7} + \frac{1}{7} = \frac{7}{7}$ = 1 whole
- $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{8}{8}$ = 1 whole
- $\frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} + \frac{1}{9} = \frac{9}{9}$ = 1 whole
- $\frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} = \frac{10}{10}$ = 1 whole
- Understand fraction facts related to whole number facts

1 + 5 = 6 (Year1) linked to $\frac{1}{6} + \frac{5}{6} = \frac{6}{6}$ (Year 3)

Number facts: Addition and subtraction
- Know or derive all the complements to 100
  $x + y = 100$; $x = ?$ and $y = ?$
- Know pairs of multiples of 100 that total 1000
  1 + 9 = 10 (Year 1)
  10 + 90 = 100 (Year 2)
  100 + 900 = 1000 (Year 3)
- Add and subtract numbers with up to 3 digits (e.g. 253 + 75 = 328)

Number Facts: Multiplication and division
- Know the 3x, 4x and 8x table and the related division facts
- Understand that doubling means x 2
- Understand that halving means ÷ 2
- Know that…
  50 x 2 = 100 ; 25 x 4 = 100 ; 20 x 5 = 100

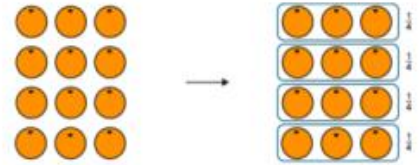
Mathematical models and images to support conceptual understanding underpinning key facts in Year 3



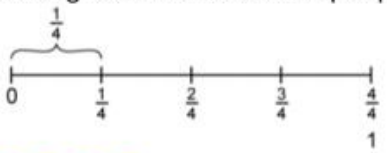
Bar models showing 100 partitioned into 2, 4, 5 and 10 equal parts.

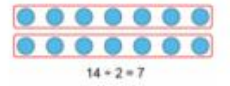
Number line to identify previous and next multiples of 100

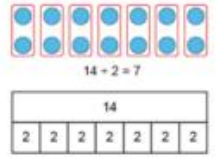
previous multiple of 100		next multiple of 100
600	< 681 <	700



12 oranges divided into four equal parts

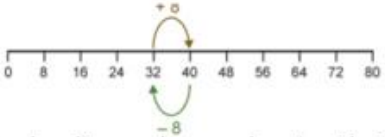




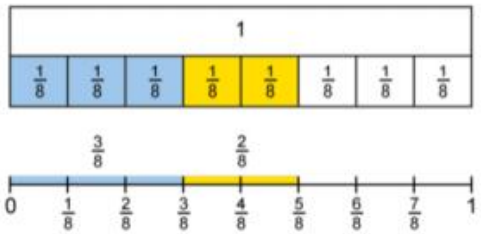


7 x 2 = 2 x 7

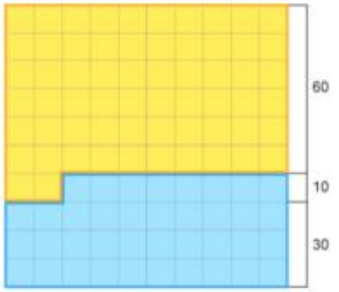
10-value place value counters in a 3-by-5 array to show 3 x 50 = 30 x 5 = 150



Number line and array showing that adjacent multiples of 8 (32 and 40) have a difference of 8



$\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$ $\frac{5}{8} - \frac{2}{8} = \frac{3}{8}$



100-grid to show the complement 62+38=100

Number Facts: Year 4

Number and place value
Pupils should be taught to:
- count from 0 in multiples of 6, 7, 9, 25 and 1000
- find 100 or 1000 more or less than a given number up to 10,000

Addition and subtraction
Pupils should be taught to:
- order and compare numbers beyond 1000
- add and subtract numbers with up to 4 digits

Multiplication and division
Pupils should be taught to:
- recall and use multiplication and division facts for multiplication tables up to 12 x 12
- multiply two-digit and three-digit numbers by a one-digit number

Fractions
Pupils should be taught to:
- count up and down in hundredths; recognise that hundredths arise from dividing an object into 100 equal parts and in dividing tenths by 10
- recognise and write decimal equivalents of $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$

Measurement
Pupils should be taught to:
- convert between different units of measure (e.g. kilometres to metres, hours to minutes)

Number Facts: Number and place value

- Know the sequence of counting in multiples of 25.

Number Facts: Measure

- £5.00 x 2 = £10.00
  £50 x 2 = £100
  £500 x 2 = £1000
  £2.50 x 4 = £10.00
  £25 x 4 = £100
  £250 x 4 = £1000
  £2.00 x 5 = £10.00
  £20 x 5 = £100
  £200 x 5 = £1000
- 10cm = $\frac{1}{10}$m 1cm = $\frac{1}{100}$m
- 100g = $\frac{1}{10}$kg
  1.1 kg = 1kg 100g = 1kg + $\frac{1}{10}$kg
- 48 hours = 2 days
  120 minutes = 2 hours
  90 minutes = 1 $\frac{1}{2}$ hours

Number Facts: Fractions

- 100 ÷ 10 = 10 1000 ÷ 10 = 100
  10 ÷ 10 = 1 1 ÷ 10 = $\frac{1}{10}$
- 1 ÷ 10 = $\frac{1}{10}$ = 0.1 2 ÷ 10 = $\frac{2}{10}$ = 0.2
  3 ÷ 10 = $\frac{3}{10}$ = 0.3 4 ÷ 10 = $\frac{4}{10}$ = 0.4
  5 ÷ 10 = $\frac{5}{10}$ = 0.5 6 ÷ 10 = $\frac{6}{10}$ = 0.6
  7 ÷ 10 = $\frac{7}{10}$ = 0.7 8 ÷ 10 = $\frac{8}{10}$ = 0.8
  9 ÷ 10 = $\frac{9}{10}$ = 0.9 10 ÷ 10 = $\frac{10}{10}$ = 1.0
- $\frac{1}{4}$ = 0.25 $\frac{1}{2}$ = 0.5
  $\frac{3}{4}$ = 0.75

Number facts: Addition and subtraction

- Know or derive all the complements to 10,000 using multiples of 1000 and related subtraction facts
  $x + y = 10{,}000$; x =? and y = ?

  1 + 9 = 10 (Year 1)
  10 + 90 = 100 (Year 2)
  100 + 900 = 1000 (Year 3)
  1000 + 9000 = 10,000 (Year 4)
- Mentally add and subtract numbers with up to 2 digits reliably

Number Facts: Multiplication and division

- Know the 6x, 7x, 9x, 11x, and 12x tables and the related division facts
- Know that…
  500 x 2 = 1000 1000 ÷ 2 = 500
  250 x 4 = 1000 1000 ÷ 4 = 250
  200 x 5 = 1000 1000 ÷ 5 = 200

Mathematical models and images to support conceptual understanding underpinning key facts in Year 4

eighteen 100-value place-value counters in two tens frames to show 1800

1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9

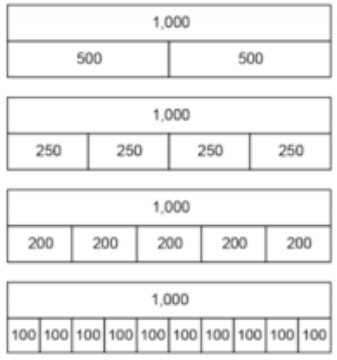
× 10 ÷ 10

80 × 10 = 800 80 ÷ 10 = 8

Gattegno chart to multiply and divide by 10

Representations of the place value composition of 5,342

number-line to identify the previous and next multiple of 1,000



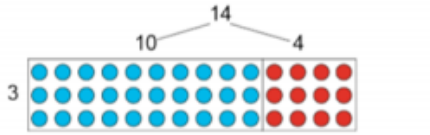
bar models showing 1,000 partitioned into 2, 4, 5, and 10 equal parts and

1000 ÷ 2 = 500 and $\frac{1}{2}$ of 1000 = 500

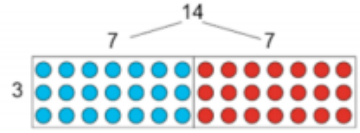
1000 ÷ 4 = 250 and $\frac{1}{4}$ of 1000 = 250

1000 ÷ 5 = 200 and $\frac{1}{5}$ of 1000 = 200

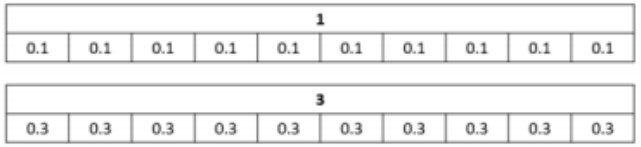
1000 ÷ 10=100 and $\frac{1}{10}$ of 1000 = 100



array to show that 14 x 3 = 10 x 3 + 4 x 3



array to show that 14 x 3 = 2 x 7 x 3



bar models showing 1 ÷ 10 = 0.1 and 3 ÷ 10 = 0.3

Number Facts: Year 5

Addition and subtraction
Multiplication and division

Pupils should be taught to:

- add and subtract with more than four digits and with decimals (informal and formal methods)
- recall prime numbers to19
- multiply and divide mentally using known facts
- multiply and divide whole and decimal numbers by 10, 100 and 1000
- recognise and use square numbers

Fractions, decimals and percentages

Pupils should be taught to:

- read and write decimal numbers as fractions (e.g. 0.8= $\frac{8}{10}$)
- recognise and use thousandths, relating them to tenths, hundredths, and decimal equivalents
- recognise the per cent symbol (%) and know that per cent relate to the number of parts per hundred
- write percentages as a fractions with a denominator of 100 and as a decimal fraction (e.g. 0.71= $\frac{71}{100}$= 71%)

Measurement

Pupils should be taught to:

- convert between different units of metric measure such as kilometre to metre, centimetre to metre, centimetre and millimetre, gram and kilogram, litre and millilitre
- know and use equivalences between metric units and common imperial units such as inches, pounds and pints

Geometry

Pupils should be taught to:

- identify angles at a point (one whole turn) as 360º
- identify angles at a point on a straight line (half a turn) as 180º
- identify angles in a right angle (quarter of a turn) as 90º
- recognise multiples of 90º
- know the sum of the angles in any triangle is 180º
- know the sum of the angles in any quadrilateral is 360º

Number facts: Addition and subtraction; multiplication and division

- Derive new facts from known facts:
  For example:
  12 x 5 = 60 — 60 ÷ 5 = 12
  5.2 x 5 = 6.0 — 6 ÷ 5 = 1.2
  5 x 7 = 35 — 5 x 0.7 = 3.5
  5 x 0.07 = 0.35
- Square numbers:
  1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144
- Prime numbers:
  2, 3, 5, 7, 11, 13, 17, 19
- Associated facts
  10,000 = 9500 = 500
  10,000 = 5000 + 5000
  10,000 = 2500 + 2500 + 2500 + 2500
  10,000 ÷ 2 = 5000
  10,000 ÷ 4 = 2500
  10,000 ÷ 5 = 2000
  10,000 ÷ 10 = 1000
  10,000 ÷ 100 = 100

Number Facts: Fractions

- $1 \div 100 = \frac{1}{100} = 0.01$ — $2 \div 100 = \frac{2}{100} = 0.02$
  $3 \div 100 = \frac{3}{100} = 0.03$ — $4 \div 100 = \frac{4}{100} = 0.04$
  $5 \div 100 = \frac{5}{100} = 0.05$ — $6 \div 100 = \frac{6}{100} = 0.06$
  $7 \div 100 = \frac{7}{100} = 0.07$ — $8 \div 100 = \frac{8}{100} = 0.08$
  $9 \div 100 = \frac{9}{100} = 0.09$ — $10 \div 100 = \frac{10}{100} = \frac{1}{10} = 0.1$
- $10\% = 0.1 = \frac{1}{10} = \frac{10}{100} = \frac{100}{1000}$
  $50\% = 0.5 = \frac{1}{2} = \frac{5}{10} = \frac{50}{100}$
  $25\% = 0.25 = \frac{1}{4} = \frac{25}{100}$
  $75\% = 0.75 = \frac{3}{4} = \frac{75}{100}$
  $20\% = 0.2 = \frac{1}{5} = \frac{2}{10} = \frac{20}{100}$
  $40\% = 0.4 = \frac{2}{5} = \frac{4}{10} = \frac{40}{100}$

Number Facts: Measure

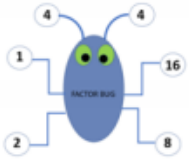
- 1mm = $\frac{1}{10}$ cm
- 1mm = $\frac{1}{1000}$ m
- 1 kg ≈ 2.2 lbs
- 1 L ≈ 1.76 pints
- 1m ≈ 39.4 inches
- 1cm ≈ 2.54 inches

≈ means 'approximately equal to'

Number Facts: Geometry

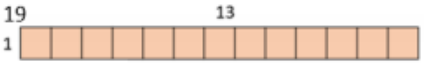
- 360 ÷ 4 = 90 — $\frac{1}{4}$ of 360 = 90
- 360 ÷ 2 = 180 — $\frac{1}{2}$ of 360 = 180
- $\frac{3}{4}$ of 360 = 270
- complements such as
  70 + 110 = 180
  95 + 85 = 180
- multiples: 90 , 180 , 270 , 360 , 450 , 540

Mathematical models and images to support conceptual understanding underpinning key facts in Year 5

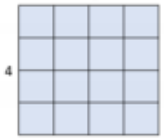


1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Using a number track to generate multiples of primes to identify primes: 2, 3, 5, 7, 11, 13, 17, 19

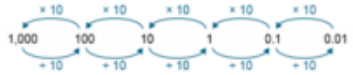


Square numbers have an odd number of factors

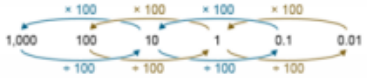


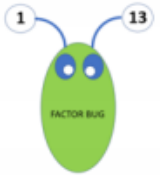
1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

Gattegno chart showing thousands, hundreds, tens, ones, tenths and hundredths

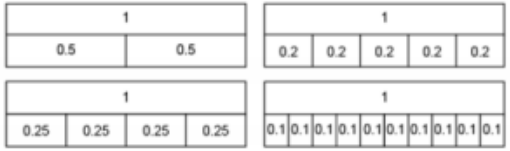


Multiplicative relationships between powers of ten





Prime numbers have exactly two factors



Bar models showing 1 partitioned into 2, 4, 5 and 10 equal parts

$1 \div 2 = 0.5$ and $\frac{1}{2}$ of $1 = 0.5$

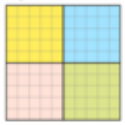
$1 \div 4 = 0.25$ and $\frac{1}{4}$ of $1 = 0.25$

$1 \div 5 = 0.2$ and $\frac{1}{5}$ of $1 = 0.2$

$1 \div 10 = 0.1$ and $\frac{1}{10}$ of $1 = 0.1$

A hundred grid divided into four equal parts.

$\frac{1}{4} = 25\%$



Ratio tables for conversion

1m	100cm	1,000ml	1 litre	100p	£1
$\frac{3}{4}$m	75cm	3,700ml	3.7 litres	52p	£0.52

Key multiplication facts to support place value calculations, fractions and ratio

$2\times2=4$ $3\times2=6$ $4\times2=8$ $5\times2=10$ $6\times2=12$ $7\times2=14$ $8\times2=16$ $9\times2=18$	$3\times3=9$ $4\times3=12$ $5\times3=15$ $6\times3=18$ $7\times3=21$ $8\times3=24$ $9\times3=27$	$4\times4=16$ $5\times4=20$ $6\times4=24$ $7\times4=28$ $8\times4=32$ $9\times4=36$	$5\times5=25$ $6\times5=30$ $7\times5=35$ $8\times5=40$ $9\times5=45$	$6\times6=36$ $7\times6=42$ $8\times6=48$ $9\times6=54$	$7\times7=49$ $8\times7=56$ $9\times7=63$	$8\times8=64$ $9\times8=72$	$9\times9=81$

Number Facts: Year 6

Ratio and proportion

Pupils should be taught to:

- solve problems involving the calculation of percentages of quantities such as 15% of 360 and then use their solutions for comparison
- represent fractions sums such as $\frac{1}{4} + \frac{3}{4}$ in ratio form (a:b) as 1:3
- simplify ratios such as 2:6 to their simplest form (1:3 in this case) using common factors

Fractions, decimals, and percentages

Pupils should be taught to:

- associate a fraction with division and calculate decimal fraction equivalents for a vulgar fraction (e.g. 0.375= $\frac{3}{8}$)
- recall and use equivalences between vulgar fractions, decimals, and percentages
- use common factors to simplify fractions
- add and subtract fractions with different denominators and mixed numbers
- multiply simple pair of proper fractions
- multiply one-digit numbers with up to two decimals places by whole numbers (e.g. 1.37 x 5)
- divide numbers where the quotient has up to two decimal places (e.g. 145 ÷ 4 = 3.75)

Measurement

Pupils should be taught to:

- convert between common imperial and metric units of measure. (e.g. miles and kilometres)
- recognise when it is possible to use formulae for the area and volume of shapes.
- know and use formulae for the area of a triangle, the area of a rectangle, the area of a parallelogram, the volume of a cuboid and the diameter of a circle (diameter = 2 x radius)

Geometry

Pupils should be taught to:

- illustrate and name parts of circles, including the radius, diameter, and circumference.
- know and use the relationship between the diameter and the radius (diameter = 2 x radius)
- know that vertically opposite angles are equal and use this to calculate missing angles around a point

Number facts: Ratio and proportion

- Derive new % facts from known facts:
  For example:
  1% doubled will give 2% of a quantity
  10% halved will give 5% of a quantity
  100% is the whole amount, so twice as much is the same as 200%
- Fluency with multiplication and division facts up to 12 x 12 and derive others beyond known facts.
- For example:
  24 : 48 simplifies to 1:2 with a common factor of 24
  (24 x 1 and 24 x 2)

Number Facts: Fractions

- 12.5% = 0.125 = $\frac{1}{8}$
  25% = 0.25 = $\frac{2}{8} = \frac{1}{4}$
  37.5% = 0.375 = $\frac{3}{8}$
  50% = 0.5 = $\frac{4}{8} = \frac{1}{2}$
  62.5% = 0.625 = $\frac{5}{8}$
  75% = 0.75 = $\frac{6}{8} = \frac{3}{4}$
  82.5% = 0.825 = $\frac{7}{8}$
  100% = 1.0 = $\frac{8}{8}$
  112.5% = 1.125 = $\frac{9}{8}$
  125% = 1.25 = $\frac{10}{8}$
- $33.\dot{3}\%$ = 0.333... = $\frac{1}{3}$
  $66.\dot{6}\%$ = 0.666... = $\frac{2}{3}$
  100 % = 1.0 = $\frac{3}{3}$
  $133.\dot{3}\%$ = 1.333... = $\frac{4}{3}$
  $266.\dot{6}\%$ = 2.666... = $\frac{8}{3}$

$0.\dot{3}$ = 0.3333333..... a recurring decimal continually repeats and does not terminate

Number Facts: Measure

- 1 km ≈ $\frac{5}{8}$ mile
- 1 mile ≈ $\frac{8}{5}$ km (or 1.6 km)
- Area of a triangle = $\frac{1}{2}$ x base x height
- Area of a rectangle = length x width
- Area of a parallelogram
  = length x perpendicular height
- Volume of a cuboid
  = length x width x height

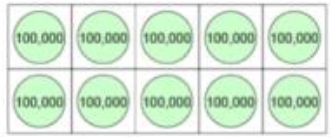
≈ means 'approximately equal to'

Number Facts: Geometry

- Diameter = 2 x radius
- Radius = $\frac{1}{2}$ x diameter

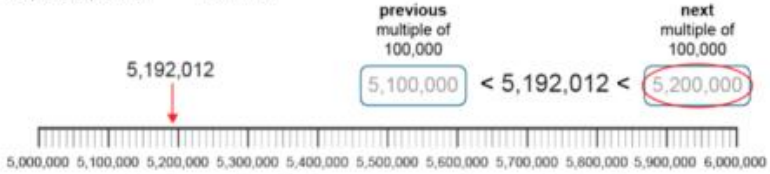
Mathematical models and images to support conceptual understanding underpinning key facts in Year 6

0 . 0 1	one hundredth
0 . 1	one tenth
1	one
1 0	ten
1 0 0	one hundred
1 , 0 0 0	one thousand
1 0 , 0 0 0	ten thousand
1 0 0 , 0 0 0	one hundred thousand
1 , 0 0 0 , 0 0 0	one million
1 0 , 0 0 0 , 0 0 0	ten million



One million represented as ten 100,000-value place-value counters in a tens frame

Gattegno chart to multiply and divide by 100



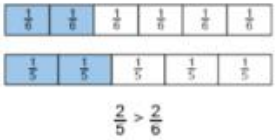
number line to identify the previous and next multiple of 100,000

bead strings to show 'for every 1 red bead, there are 3 blue beads'

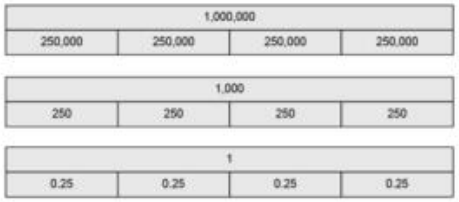
r : b = 1 : 3

table to show total quantities in proportion

number of red beads	1	2	3	4
number of blue beads	3	6	9	12
total number of beads	**4**	**8**	**12**	**16**



compare and simplify fractions

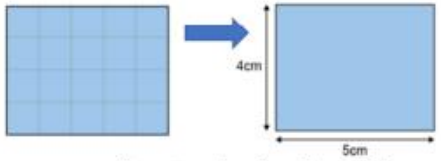


Bar models showing 1 million, 1,000 and 1 partitioned into 4 equal parts

1,000,000 ÷ 4 = 250, 000 and $\frac{1}{4}$ of 1,000,000 = 250, 000

1,000 ÷ 4 = 250 and $\frac{1}{4}$ of 1,000 = 250

1 ÷ 4 = 0.25 and $\frac{1}{4}$ of 1 = 0.25



area of a rectangle = length x width

4 x 5 = 5 x 4 = 20 cm²