National Centre for Excellence in the Teaching of Mathematics

MathsHUBS

Teaching for Mastery

Questions, tasks and activities to support assessment

Year 2

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Contents

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Introduction

In line with the curricula of many high performing jurisdictions, the National curriculum emphasises the importance of all pupils mastering the content taught each year and discourages the acceleration of pupils into content from subsequent years.

The current National curriculum document[1] says:

'The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.' (National curriculum page 3)

Progress in mathematics learning each year should be assessed according to the extent to which pupils are gaining a deep understanding of the content taught for that year, resulting in sustainable knowledge and skills. Key measures of this are the abilities to reason mathematically and to solve increasingly complex problems, doing so with fluency, as described in the aims of the National curriculum:

'The national curriculum for mathematics aims to ensure that all pupils:

- *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*
- ***reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language*
- *can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.'* (National curriculum page 3)

1. Mathematics programmes of study: key stages 1 and 2, National curriculum in England, September 2013, p3

Assessment arrangements must complement the curriculum and so need to mirror these principles and offer a structure for assessing pupils' progress in developing mastery of the content laid out for each year. Schools, however, are only '*required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study*' (National curriculum page 4). Schools should identify when they will teach the programmes of study and set out their school curriculum for mathematics on a year-by-year basis. The materials in this document reflect the arrangement of content as laid out in the National curriculum document (September 2013).

These *Teaching for Mastery: Questions, tasks and activities to support assessment* outline the key mathematical skills and concepts within each yearly programme and give examples of questions, tasks and practical classroom activities which support teaching, learning and assessment. The activities offered are not intended to address each and every programme of study statement in the National curriculum. Rather, they aim to highlight the key themes and big ideas for each year.

Ongoing assessment as an integral part of teaching

The questions, tasks, and activities that are offered in the materials are intended to be a useful vehicle for assessing whether pupils have mastered the mathematics taught.

However, the best forms of ongoing, formative assessment arise from well-structured classroom activities involving interaction and dialogue (between teacher and pupils, and between pupils themselves). The materials are not intended to be used as a set of written test questions which the pupils answer in silence. They are offered to indicate valuable learning activities to be used as an integral part of teaching, providing rich and meaningful assessment information concerning what pupils know, understand and can do.

The tasks and activities need not necessarily be offered to pupils in written form. They may be presented orally, using equipment and/or as part of a group activity. The encouragement of discussion, debate and the sharing of ideas and strategies will often add to both the quality of the assessment information gained and the richness of the teaching and learning situation.

What do we mean by mastery?

The essential idea behind mastery is that ***all children***[2] need a ***deep*** understanding of the mathematics they are learning so that:

- future mathematical learning is built on solid foundations which do not need to be re-taught;
- there is no need for separate catch-up programmes due to some children falling behind;
- children who, under other teaching approaches, can often fall a long way behind, are better able to keep up with their peers, so that gaps in attainment are narrowed whilst the attainment of all is raised.

There are generally four ways in which the term mastery is being used in the current debate about raising standards in mathematics:

1. **A mastery approach**: a set of principles and beliefs. This includes a belief that all pupils are capable of understanding and doing mathematics, given sufficient time. Pupils are neither 'born with the maths gene' nor 'just no good at maths'. With good teaching, appropriate resources, effort and a 'can do' attitude all children can achieve in and enjoy mathematics.
2. **A mastery curriculum**: one set of mathematical concepts and big ideas for all. All pupils need access to these concepts and ideas and to the rich connections between them. There is no such thing as 'special needs mathematics' or 'gifted and talented mathematics'. Mathematics is mathematics and the key ideas and building blocks are important for everyone.
3. **Teaching for mastery**: a set of pedagogic practices that keep the class working together on the same topic, whilst at the same time addressing the need for all pupils to master the curriculum and for some to gain greater depth of proficiency and understanding. Challenge is provided by going deeper rather than accelerating into new

2. Schools in England are required to adhere to the 0-25 years SEND Code of Practice 2015 when considering the provision for children with special educational needs and/or disability. Some of these pupils may have particular medical conditions that prevent them from reaching national expectations and will typically have a statement of Special Educational Needs/ Education Health Care Plan. Wherever possible children with special educational needs and/or a disability should work on the same curriculum content as their peers; however, it is recognised that a few children may need to work on earlier curriculum content than that designated for their age. The principle, however, of developing deep and sustainable learning of the content they are working on should be applied.

mathematical content. Teaching is focused, rigorous and thorough, to ensure that learning is sufficiently embedded and sustainable over time. Long term gaps in learning are prevented through speedy teacher intervention. More time is spent on teaching topics to allow for the development of depth and sufficient practice to embed learning. Carefully crafted lesson design provides a scaffolded, conceptual journey through the mathematics, engaging pupils in reasoning and the development of mathematical thinking.

4. **Achieving mastery of particular topics and areas of mathematics**. Mastery is not just being able to memorise key facts and procedures and answer test questions accurately and quickly. It involves knowing 'why' as well as knowing 'that' and knowing 'how'. It means being able to use one's knowledge appropriately, flexibly and creatively and to apply it in new and unfamiliar situations.[3] The materials provided seek to exemplify the types of skills, knowledge and understanding necessary for pupils to make good and sustainable progress in mastering the primary mathematics curriculum.

Mastery and the learning journey

Mastery of mathematics is not a fixed state but a continuum. At each stage of learning, pupils should acquire and demonstrate sufficient grasp of the mathematics relevant to their year group, so that their learning is sustainable over time and can be built upon in subsequent years. This requires development of depth through looking at concepts in detail using a variety of representations and contexts and committing key facts, such as number bonds and times tables, to memory.

Mastery of facts, procedures and concepts needs time: time to explore the concept in detail and time to allow for sufficient practice to develop fluency.

Practice is most effective when it is intelligent practice,[4] i.e. where *the teacher is advised to avoid mechanical repetition and to create an appropriate path for practising the thinking process with increasing creativity.* (Gu 2004[5]) The examples provided in the materials seek to exemplify this type of practice.

Mastery and mastery with greater depth

Integral to mastery of the curriculum is the development of deep rather than superficial conceptual understanding. '*The research for the review of the National Curriculum showed that it should focus on "fewer things in greater depth", in secure learning which persists, rather than relentless, over-rapid progression.*'[6] It is inevitable that some pupils will grasp concepts more rapidly than others and will need to be stimulated and challenged to ensure continued progression. However, research indicates that these pupils benefit more from enrichment and deepening of content, rather than acceleration into new content. Acceleration is likely to promote superficial understanding, rather than the true depth and rigour of knowledge that is a foundation for higher mathematics.[7]

Within the materials the terms *mastery* and *mastery with greater depth* are used to acknowledge that all pupils require depth in their learning, but some pupils will go deeper still in their learning and understanding.

Mastery of the curriculum requires that all pupils:

- use mathematical concepts, facts and procedures appropriately, flexibly and fluently;
- recall key number facts with speed and accuracy and use them to calculate and work out unknown facts;
- have sufficient depth of knowledge and understanding to reason and explain mathematical concepts and procedures and use them to solve a variety of problems.

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3. Helen Drury asserts in 'Mastering Mathematics' (Oxford University Press, 2014, page 9) that: 'A mathematical concept or skill has been mastered when, through exploration, clarification, practice and application over time, a person can represent it in multiple ways, has the mathematical language to be able to communicate related ideas, and can think mathematically with the concept so that they can independently apply it to a totally new problem in an unfamiliar situation.'

4. Intelligent practice is a term used to describe practice exercises that integrate the development of fluency with the deepening of conceptual understanding. Attention is drawn to the mathematical structures and relationships to assist in the deepening of conceptual understanding, whilst at the same time developing fluency through practice.
5. Gu, L., Huang, R., & Marton, F. (2004). Teaching with variation: A Chinese way of promoting effective mathematics learning. In Lianghuo, F., Ngai-Ying, W., Jinfa, C., & Shiqi, L. (Eds.) How Chinese learn mathematics: Perspectives from insiders. Singapore: World Scientific Publishing Co. Pte. Ltd. page 315.
6. Living in a Levels-Free World, Tim Oates, published by the Department for Education https://www.tes.co.uk/teaching-resource/living-in-a-levels-free-world-by-tim-oates-6445426
7. This argument was advanced by the Advisory Committee for Mathematics Education on page 1 of its report: Raising the bar: developing able young mathematicians, December 2012.

A useful checklist for what to look out for when assessing a pupil's understanding might be:

A pupil really understands a mathematical concept, idea or technique if he or she can:

- describe it in his or her own words;
- represent it in a variety of ways (e.g. using concrete materials, pictures and symbols – the CPA approach)[8]
- explain it to someone else;
- make up his or her own examples (and non-examples) of it;
- see connections between it and other facts or ideas;
- recognise it in new situations and contexts;
- make use of it in various ways, including in new situations.[9]

Developing mastery with greater depth is characterised by pupils' ability to:

- solve problems of greater complexity (i.e. where the approach is not immediately obvious), demonstrating creativity and imagination;
- independently explore and investigate mathematical contexts and structures, communicate results clearly and systematically explain and generalise the mathematics.

The materials seek to exemplify what these two categories of *mastery* and *mastery with greater depth* might look like in terms of the type of tasks and activities pupils are able to tackle successfully. It should, however, be noted that the two categories are not intended to exemplify differentiation of activities/tasks. Teaching for mastery requires that all pupils are taught together and all access the same content as exemplified in the first column of questions, tasks and activities. The questions, tasks and activities exemplified in the second column might be used as deepening tasks for pupils who grasp concepts rapidly, but can also be used with the whole class where appropriate, giving all children the opportunity to think and reason more deeply.

National curriculum assessments

National assessment at the end of Key Stages 1 and 2 aims to assess pupils' mastery of both the content of the curriculum and the depth of their understanding and application of mathematics. This is exemplified through the content and cognitive domains of the test frameworks.[10] The content domain exemplifies the minimum content pupils are required to evidence in order to show mastery of the curriculum. The cognitive domain aims to measure the complexity of application and depth of pupils' understanding. The questions, tasks and activities provided in these materials seek to reflect this requirement to master content in terms of both skills and depth of understanding.

Final remarks

These resources are intended to assist teachers in teaching and assessing for mastery of the curriculum. In particular they seek to exemplify what depth looks like in terms of the types of mathematical tasks pupils are able to successfully complete and how some pupils can achieve even greater depth. A key aim is to encourage teachers to keep the class working together, spend more time on teaching topics and provide opportunities for all pupils to develop the depth and rigour they need to make secure and sustained progress over time.

8. The Concrete-Pictorial-Abstract (CPA) approach, based on Bruner's conception of the enactive, iconic and symbolic modes of representation, is a well-known instructional heuristic advocated by the Singapore Ministry of Education since the early 1980s. See https://www.ncetm.org.uk/resources/44565 (free registration required) for an introduction to this approach.

9. Adapted from a list in 'How Children Fail', John Holt, 1964.

10. 2016 Key stage 1 and 2 Mathematics test frameworks, Standards and Assessments Agency www.gov.uk/government/collections/national-curriculum-assessments-test-frameworks

The structure of the materials

The materials consist of PDF documents for each year group from Y1 to Y6. Each document adopts the same framework as outlined below.

The examples provided in the materials are only indicative and are designed to provide an insight into:

- How mastery of the curriculum might be developed and assessed;
- How to teach the same curriculum content to the whole class, challenging the rapid graspers by supporting them to go deeper rather than accelerating some pupils into new content.

The assessment activities presented in both columns are suitable for use with the whole class. Pupils who successfully answer the questions in the left-hand column (Mastery) show evidence of sufficient depth of knowledge and understanding. This indicates that learning is likely to be sustainable over time. Pupils who are also successful with answering questions in the right-hand column (Mastery with Greater Depth) show evidence of greater depth of understanding and progress in learning.

This section lists a selection of key National Curriculum programme of study statements. The development and assessment of these is supported through the questions, tasks and activities set out in the two columns below.

This section lists a selection of key ideas relevant to the selected programme of study statements.

Number and Place Value

Selected National Curriculum Programme of Study Statements

Pupils should be taught to:

- compare and order numbers from 0 up to 100
- use place value and number facts to solve problems
- use < > and = signs correctly
- count in steps of two, three, and five from 0, and in tens from any number, forward and backward

The Big Idea

The position (place) of a digit in a number determines its value. Hence the term *place value.*

Mastery Check

Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

Mastery	Mastery with Greater Depth
Put a circle around the larger number. 1) 50 48 2) 77 81 3) 78 87	Write all the 2-digit numbers greater than 40 using these digits. 2 4 6 6 How do you know you have them all? Prove it.
Use coins to make the amount. 196p 100s | 10s | 1s 	Jo has £2.29. She only has £1 coins, 10p coins and 1p coins. How many of each coin does she have? Can you suggest a different answer?

This section reminds teachers to check pupils' understanding by asking questions such as 'Why', 'What happens if …', and checking that pupils can use the procedures or skills to solve a variety of problems.

This section contains examples of assessment questions, tasks and teaching activities that might support a teacher in assessing and evidencing progress of those pupils who have developed a sufficient grasp and depth of understanding so that learning is likely to be sustained over time.

This section contains examples of assessment questions, tasks and teaching activities that might support a teacher in assessing and evidencing progress of those pupils who have developed a stronger grasp and greater depth of understanding than that outlined in the first column.

Number and Place Value

Selected National Curriculum Programme of Study Statements

Pupils should be taught to:

- compare and order numbers from 0 up to 100
- use place value and number facts to solve problems
- use < > and = signs correctly
- count in steps of two, three, and five from 0, and in tens from any number, forward and backward

The Big Idea

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Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

Mastery

Put a circle around the larger number.

1) 50 48   2) 77 81   3) 78 87

Use coins to make the amount.

196p

100s	10s	1s

Mastery with Greater Depth

Write all the 2-digit numbers greater than 40 using these digits.

2 4 6 6

How do you know you have them all? Prove it.

Jo has £2·29.

She only has £1 coins, 10p coins and 1p coins.

How many of each coin does she have?

Can you suggest a different answer?

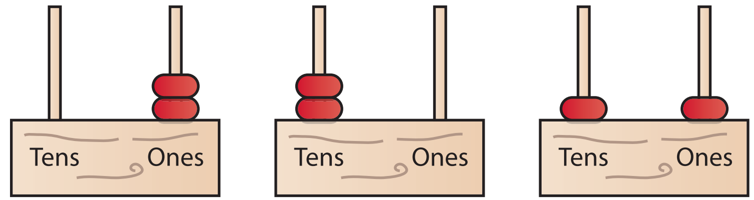
Mastery

Write the missing numbers in the boxes.

1) In the number 47, there are ☐ groups of 10 and ☐ ones.
2) The number that is ten groups of 10 is ☐ .
3) The number 75 shows ☐ in the tens place, and ☐ in the ones place.

Mastery with Greater Depth

If you put 2 beads onto a tens/ones abacus you can make the numbers 2, 20 and 11.



Do the same with 3 beads. How many different numbers can you make?

How many different numbers can you make using 4 beads?

Mastery

Here is part of a number square.
What is the largest number on the whole square?

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16		
19	20	21			
25	26				
31	32				

Mastery with Greater Depth

Here is part of a number square.
What is the largest number on the whole square?

3	6	9	12	15
18	21	24	27	
33	36	39		
48	51	5		
63	66			

Mastery	Mastery with Greater Depth
Think of an even number that is more than 30 and less than 50. And another. Can you find them all? How many are there? Explain your reasoning.	Amy thinks of a number. Her number: ■ is an even number ■ is between 20 and 25 ■ has two different digits. What is her number? Explain your reasoning.
Steve says, 'My number has two tens and five ones.' What is Steve's number? Amy has two more tens than Steve. What is her number? Sam says, 'My number has five tens.' What numbers **can** it be? What numbers **can't** it be?	Captain Conjecture says, 'When I count in tens from any number the units digit stays the same.' Do you agree? Explain your reasoning. 
Place these numbers on the number line: 10, 48, 30 	Place 47 on each of these empty number lines. 0 100 40 60 33 50
Use < > and = signs to make these number sentences correct. 3 tens ☐ 30 ones 2 tens ☐ 9 ones 4 tens ☐ 33 ones	Use < > and = signs to make these number sentences correct. 3 tens and 2 ones ☐ 2 tens 12 ones 4 tens and 3 ones ☐ 3 tens 14 ones 5 tens and 4 ones ☐ 4 tens 11 ones

Addition and Subtraction

Selected National Curriculum Programme of Study Statements

Pupils should be taught to:

- solve problems with addition and subtraction:
  - using concrete objects and pictorial representations, including those involving numbers, quantities and measures
  - applying an increasing knowledge of mental and written methods
- recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a 2-digit number and ones
  - a 2-digit number and tens
  - two 2-digit numbers
  - adding three 1-digit numbers
- show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot

The Big Ideas

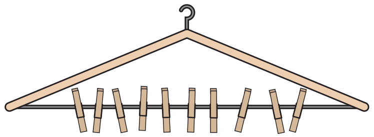
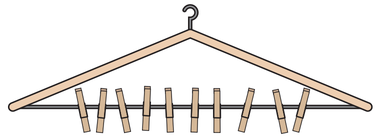
Understanding that addition of two or more numbers can be done in any order is important to support children's fluency. When adding two numbers it can be more efficient to put the larger number first. For example, given 3 + 8 it is easier to calculate 8 + 3.

When adding three or more numbers it is helpful to look for pairs of numbers that are easy to add. For example, given 5 + 8 + 2 it is easier to add 8 + 2 first than to begin with 5 + 8.

Understanding the importance of the equals sign meaning 'equivalent to' (i.e. that 6 + 4 = 10, 10 = 6 + 4 and 5 + 5 = 6 + 4 are all valid uses of the equals sign) is crucial for later work in algebra. Empty box problems can support the development of this key idea. Correct use of the equals sign should be reinforced at all times. Altering where the equals sign is placed develops fluency and flexibility.

Mastery Check

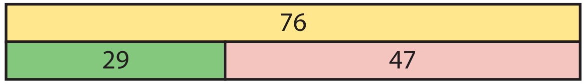
Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

Mastery	Mastery with Greater Depth
Fill in the missing numbers and explain what you notice. $23 + \square = 30$ $33 - \square = 30$ $43 + \square = 50$ $53 - 3 = \square$	Find different possibilities. $\square + \square = 50$ $50 - \square = \square$
If each peg on the coat hanger has a value of 10, find three ways to partition the pegs to make the number sentences complete.  $\square + \square = \square$ $\square + \square = \square$ $\square + \square = \square$ What is the total of each addition sentence? Will the total always be the same? Explain your reasoning.	If each peg on the coat hanger has a value of 10, find three ways to partition the pegs to make the number sentences complete.  $\square + \square + \square = \square$ $\square + \square + \square = \square$ $\square + \square + \square = \square$ What is the total of each addition sentence? Will the total always be the same? Explain your reasoning.
Captain Conjecture says, 'An odd number + an odd number = an even number'. Is this sometimes, always or never true? Explain your reasoning. *Concrete resources might help pupils to explain their reasoning.* 	Captain Conjecture says, 'An odd number + an odd number + an odd number = an even number'. Is this sometimes, always or never true? Explain your reasoning. *Concrete resources might help pupils to explain their reasoning.* 

Mastery	Mastery with Greater Depth
What do you notice about each set of calculations? What's the same and what's different about the three sets of calculations? 10 – 9 = 10 – 8 = 10 – 7 = 10 – 6 = 10 – 5 = 10 – 4 = 10 – 3 = 10 – 2 = 20 – 19 = 20 – 18 = 20 – 17 = 20 – 16 = 20 – 15 = 20 – 14 = 20 – 13 = 20 – 12 = 100 – 90 = 100 – 80 = 100 – 70 = 100 – 60 = 100 – 50 = 100 – 40 = 100 – 30 = 100 – 20 =	Complete the calculations. 30 + 40 + □ = 100 40 + □ + 20 = 100 36 + 44 + □ = 100 36 + 54 + □ = 100 47 + □ + 20 = 100 47 + □ + 30 = 100
What do I need to add to or subtract from each of these numbers to total 60? 40, 44, 66, 69, 76, 86, 99, 89, 79.	I think of a number and I add 2. The answer is 17. What was my number? I think of a number and I subtract 5. The answer is 24. What was my number?
Insert <, > or = to make these number sentences correct. 7 + 8 ◯ 8 + 7 3 + 6 ◯ 2 + 7 3 + 6 ◯ 4 + 7 4 + 7 ◯ 2 + 6	Insert numbers to make these number sentences correct. 13 – ___ < 6 13 – ___ < 6 13 – ___ < 6 13 – ___ < 6 13 – ___ < 6 13 – ___ < 6 13 – ___ < 6

Mastery

Pupils use a bar model to explore addition and subtraction facts and the relationship between them.



Using the bar model complete the four number sentences.

□ + □ =

□ + □ =

□ − □ =

□ − □ =

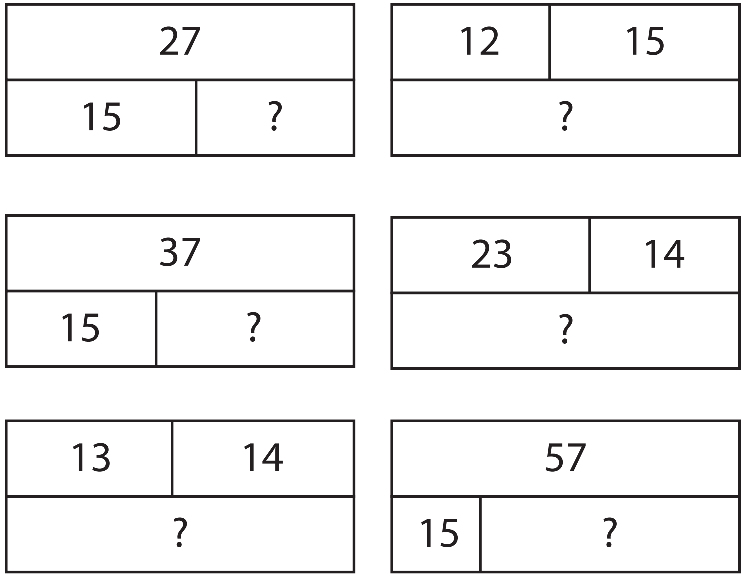
Dan needs 80 g of sugar for his recipe. There are 45 g left in the bag. How much more does he need to get?

The temperature was 26 degrees in the morning and 11 degrees colder in the evening. What was the temperature in the evening?

A tub contains 24 coins. Saj takes 5 coins. Joss takes 10 coins. How many coins are left in the tub?

Mastery with Greater Depth

Fill in the missing numbers. What do you notice?

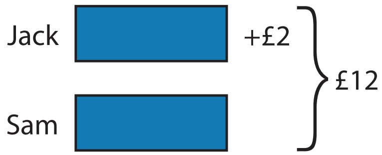


Together Jack and Sam have £12.

Jack has £2 more than Sam.

How much money does Sam have?

A bar model can be very helpful in solving these types of problems.



£12 – £2 = £10
£10 ÷ 2 = £5
Sam has £5

Multiplication and Division

Selected National Curriculum Programme of Study Statements

Pupils should be taught to:

- recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

The Big Ideas

It is important that pupils both commit multiplication facts to memory and also develop an understanding of conceptual relationships. This will aid them in using known facts to work out unknown facts and in solving problems.

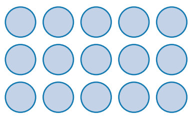
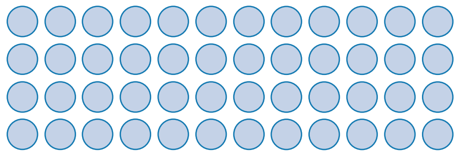
Pupils should look for and recognise patterns within tables and connections between them (e.g. 5× is half of 10×).

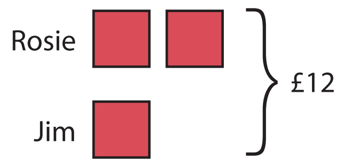
Pupils should recognise multiplication and division as inverse operations and use this knowledge to solve problems. They should also recognise division as both grouping and sharing.

The recognition of pattern in multiplication helps pupils commit facts to memory, for example doubling twice is the same as multiplying by four, or halving a multiple of ten gives you the related multiple of five.

Mastery Check

Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

Mastery	Mastery with Greater Depth
What is 5×4? (5 times table) What is 10×6? (10 times table) *Being able to answer such questions is, of course, important, but check pupils understand the meaning of them. For example, ask them to make 5 x 4 and 10 x 6 using concrete apparatus.*	Which has the most biscuits: 4 packets of biscuits with 5 in each packet, or 3 packets of biscuits with 10 in each packet? Explain your reasoning.
Write these addition sentences as multiplication sentences. The first one has been completed. $5 + 5 + 5 + 5 + 5 = 5 \times 5$ $2 + 2 + 2 + 2 + 2 =$ $2 + 2 + 2 =$ $10 + 10 + 10 + 10 =$	Write these addition sentences as multiplication sentences. $10 + 10 + 10 + 5 + 5 =$ $2 + 2 + 2 + 4 =$ $2 + 2 + 4 + 4 =$ $5 + 5 + 5 + 2 + 3=$
This array represents $5 \times 3 = 15$.  Write three other multiplication or addition facts that this array shows. Write one division fact that this array shows.	Find different ways to find the answer to 12×4.  *Children are expected to use their 2, 5 and 10 times tables to answer this question.*

Mastery	Mastery with Greater Depth
Complete and compare the 5 and 10 times tables. What do you notice? $5 \times 1 =$ $10 \times 1 =$ $5 \times 2 =$ $10 \times 2 =$ $5 \times 3 =$ $10 \times 3 =$ $5 \times 4 =$ $10 \times 4 =$	True or false? $5 \times 4 = 4 \times 5$ $5 \times 4 = 10 \times 2$ $5 \times 4 = 2 \times 10$ Explain your reasoning. What do you notice?
Sally buys 3 cinema tickets costing £5 each. How much does she spend? Write the multiplication number sentence and calculate the cost. If Sally paid with a £20 note, how much change would she get?	Together Rosie and Jim have £12. Rosie has twice as much as Jim. How much does Jim have? *The bar model can be helpful in solving these types of problems.*  $12 \div 3 = 4$ Jim has £4
Two friends share 12 sweets equally between them. How many do they each get? Write this as a division number sentence. Make up two more sharing stories like this one. Chocolate biscuits come in packs (groups) of 5. Sally wants to buy 20 biscuits in total. How many packs will she need to buy? Write this as a division number sentence. Make up two more grouping stories like this one.	Two friends want to buy some marbles and then share them out equally between them. They could buy a bag of 13 marbles, a bag of 14 marbles or a bag of 19 marbles. What size bag should they buy so that they can share them equally? What other numbers of marbles could be shared equally? Explain your reasoning.

Fractions

Selected National Curriculum Programme of Study Statements

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, for example $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$

The Big Ideas

Fractions involve a relationship between a whole and parts of a whole. Ensure children express this relationship when talking about fractions. For example, *'If the bag of 12 sweets is the whole, then 4 sweets are one third of the whole.'*

Partitioning or 'fair share' problems when each share is less than one gives rise to fractions.

Measuring where the unit is longer than the item being measured gives rise to fractions.

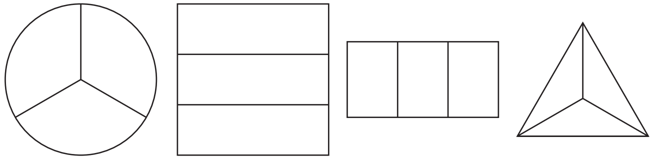
Mastery Check

Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

Mastery	Mastery with Greater Depth
Complete: Half of 12 is $\square$ $\frac{2}{4}$ of 12 is $\square$ $\frac{1}{4}$ of 20 = $\frac{3}{4}$ of 20 =	Complete: Half of $\square$ is 6 $\frac{2}{4}$ of $\square$ is 6 $\frac{1}{4}$ of $\square$ = 5 $\frac{3}{4}$ of $\square$ = 15 20 children are in a class and $\frac{1}{4}$ are girls. How many are boys?

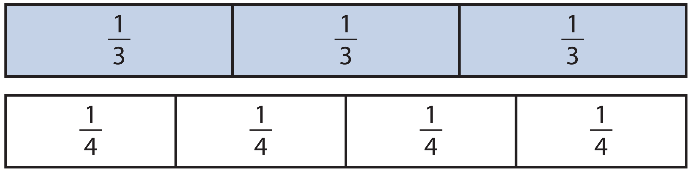
<table>
<tr><th>Mastery</th><th>Mastery with Greater Depth</th></tr>
<tr><td>

Shade $\frac{1}{3}$ of each shape.



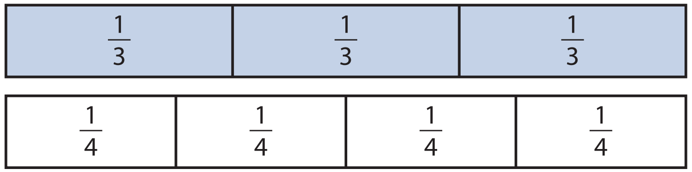
</td><td>

Use the pictures to complete the number sentences.



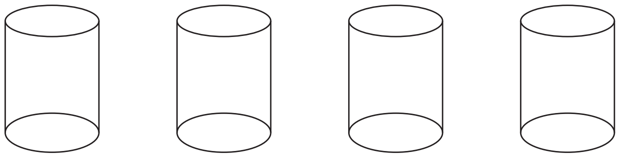
$\square$ is less than $\square$ $\square < \square$

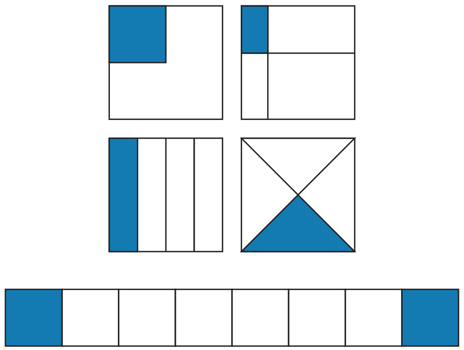
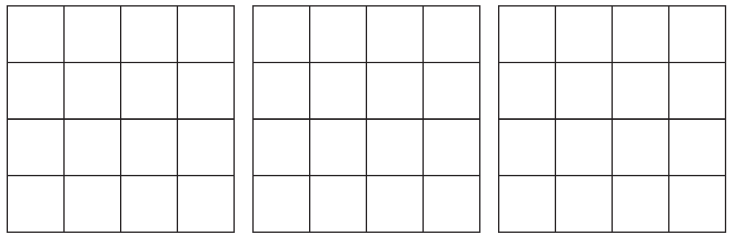
$\square$ is greater than $\square$ $\square > \square$

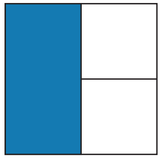
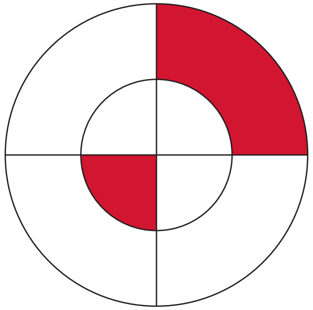


$\frac{3}{\square}$ is greater than $\frac{2}{\square}$ $\frac{3}{\square}$ is less than $\frac{3}{\square}$

</td></tr>
<tr><td>Jo bought a bag of 12 cherries.
Jo ate half the number of cherries in the bag.
How many cherries did Jo eat?</td><td>Jo bought a bag of cherries.
Jo ate half the number of cherries in the bag.
Jo had 7 cherries left. How many cherries did Jo buy?</td></tr>
<tr><td>Sam bought a bag of 18 cherries.
Sam ate 6 cherries.
What fraction of the bag of cherries did Sam eat?</td><td>Sam bought a bag of cherries.
Sam ate 9 cherries and had 3 left over.
What fraction of the bag of cherries did Sam eat?</td></tr>
</table>

<table>
<tr><th>Mastery</th><th>Mastery with Greater Depth</th></tr>
<tr><td>If you count in steps of $\frac{1}{2}$ starting from 0, how many steps will it take to reach:
2, 4 or 6
What do you notice?</td><td>$\frac{1}{3}$ of 3 = 1
$\frac{1}{3}$ of 6 = 2
$\frac{1}{3}$ of 9 = 3
$\frac{1}{3}$ of 12 =
Continue the pattern.
What do you notice?</td></tr>
<tr><td>Shade the cylinders.

$\frac{1}{3}$ full $\frac{2}{3}$ full $\frac{3}{3}$ full $\frac{1}{4}$ full
This may first be carried out as a practical activity.</td><td>Mark another fraction on this line.
And another, and another.

0   $\frac{3}{4}$</td></tr>
<tr><td>Which of these diagrams have $\frac{1}{4}$ of the whole shaded?

Explain your reasoning.</td><td>Colour in $\frac{1}{4}$ of each of these grids in a different way. Try to think of an unusual way.

How many squares did you colour each time?</td></tr>
</table>

Mastery	Mastery with Greater Depth
Jayne says that the shaded part of the whole square below does not show a half because there are three pieces, not two. Do you agree? Explain your reasoning. 	What fraction is the red part of the whole circle? Explain your reasoning. 

Measurement

Selected National Curriculum Programme of Study Statements

Pupils should be taught to:

- choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels
- solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change

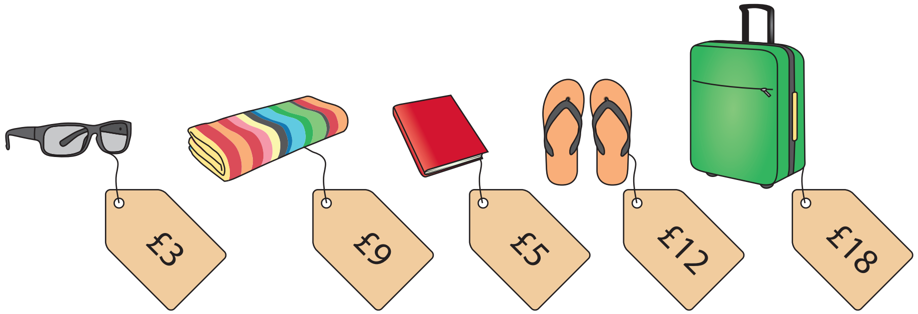
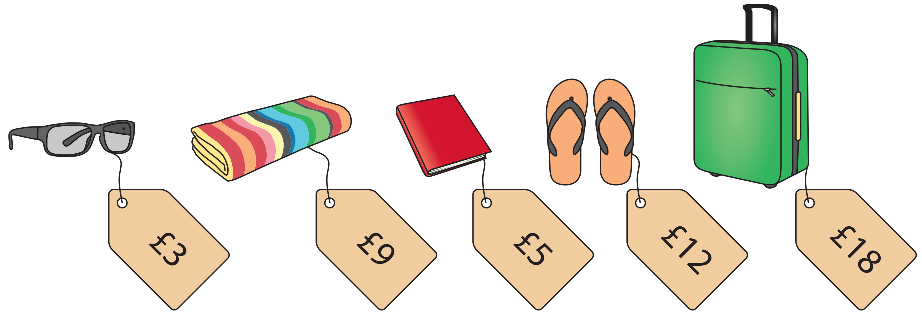
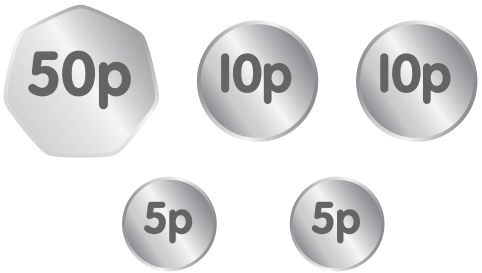
The Big Idea

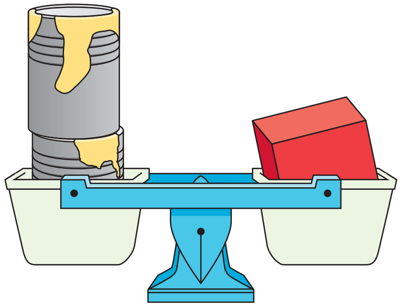
We need standard units of measure in order to compare things more accurately and consistently.

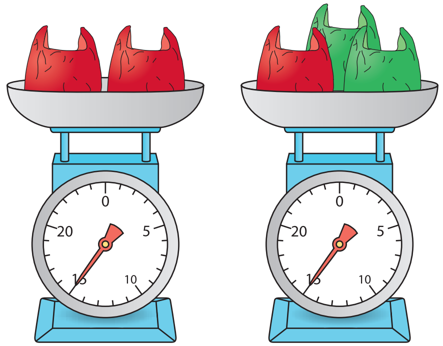
Mastery Check

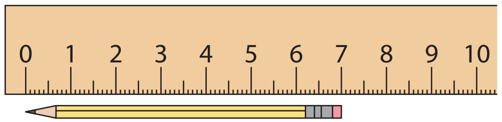
Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

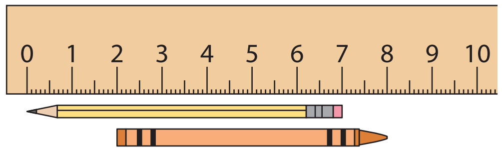
Mastery	Mastery with Greater Depth
Holly uses a £1 coin to buy a pack of stickers. Here is the change she was given.  How much did the pack of stickers cost?	I spend £2 on a drink and sandwich. The sandwich costs 80p more than the drink. How much does the sandwich cost?
Grace uses a £1 coin to buy a can of drink which costs 80p. She is given three coins in change. What coins could she have been given?	Grace uses a £2 coin to buy a can of drink which costs 85p. She is given four coins in change. Find all the possible combinations of coins she could have been given.

Mastery	Mastery with Greater Depth
Sid says, 'I have bought 2 items for my holiday. One item cost £9 more than the other.' What might Sid have bought? The _______ and the _______ .  	Sid says, 'I have bought 2 items for my holiday. One item cost £9 more than the other. I spent over £15.' What two items did Sid buy? The _______ and the _______ .  Make up your own problems using the holiday items.
Look at these coins. How could you make up the same total amount using just one type of coin?  	Sam says I can make 97p using just four coins. Is he correct? Explain your reasoning.

<table>
<tr><th>Mastery</th><th>Mastery with Greater Depth</th></tr>
<tr><td>
This box weighs 10 kg.
How much does each tin of paint weigh?

</td><td>
What is the mass of two red bags?
Which is heavier, the red bag or the green bag?

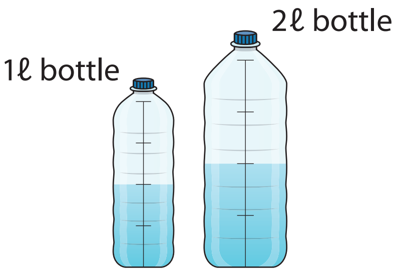
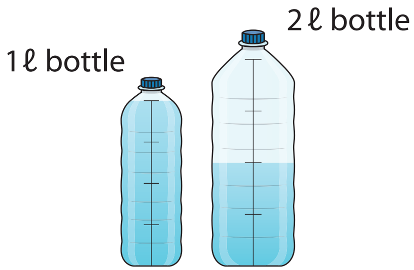
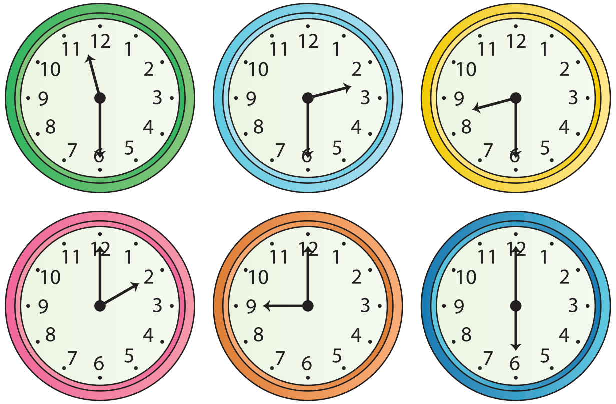
Explain your reasoning.


</td></tr>
<tr><td>
How long is the pencil?


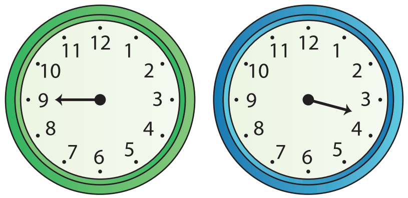
The pencil is ______ cm long.
</td><td>
How long is the crayon?


The crayon is ______ cm long.

How much longer is the crayon than the pencil?
</td></tr>
</table>

<table>
<tr><th>Mastery</th><th>Mastery with Greater Depth</th></tr>
<tr><td>Here is a picture of a 1 litre bottle and a 2 litre bottle both with some water in them.
What's the same? What's different?

</td><td>Here is a picture of a 1 litre bottle and a 2 litre bottle with some water in them.
What's the same? What's different?

</td></tr>
<tr><td>Which of these clock faces shows a time between 5 o'clock and 7 o'clock?
</td><td>Jack says, 'There isn't any point in having a minute hand on a clock because I can still tell the time without it.'

Do you agree with him?

Explain your answer.
</td></tr>
</table>

Geometry

Selected National Curriculum Programme of Study Statements

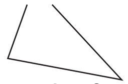
Pupils should be taught to:

- identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line
- identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces
- identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid]
- compare and sort common 2-D and 3-D shapes and everyday objects
- order and arrange combinations of mathematical objects in patterns and sequences

The Big Ideas

It is not uncommon for pupils to say that this  is a square and this  is not, or that something like this  is a triangle.

It is important for pupils to know what the properties are that make up certain shapes, and for them not to just learn the names of typical proto looking shapes.

It is helpful to think about non examples of shapes. For example, why this is not a triangle: 

Recognising pattern and generalising structures and relationships are key elements for laying the foundations for later work in algebra.

Mastery Check

Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

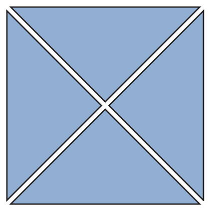
Mastery

Carry out activities that direct pupils' attention to properties and do not just ask them to state the name of shapes in order to allow them to demonstrate mastery.

Asking questions like 'How do you know the shape is a triangle?' can also support pupils to develop mastery of this topic.

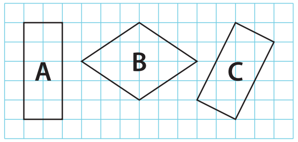
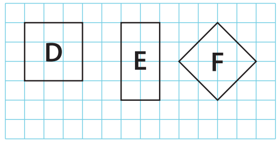
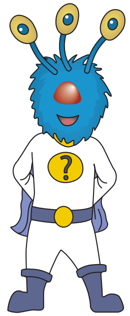
Mastery with Greater Depth

Cut a square piece of paper as shown. Rearrange the pieces to make different shapes. What different shapes can you make?

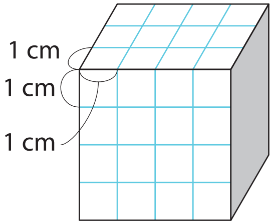


Describe the properties of the shapes you make.

Can you make some shapes which have at least one line of symmetry?

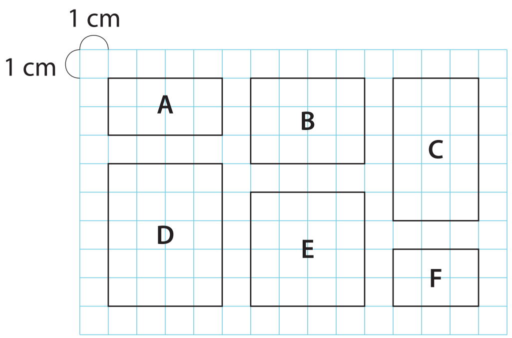
Mastery	Mastery with Greater Depth
Captain Conjecture says, 'All of these shapes are rectangles because they have four sides.' Do you agree?   Explain your reasoning.	Captain Conjecture says, 'All of these shapes are rectangles because they have four sides.' Do you agree?   Explain your reasoning. *Children should appreciate that a square is a rectangle because it has 4 right angles and opposite sides are of equal length.*

<table>
<tr><th>Mastery</th><th>Mastery with Greater Depth</th></tr>
<tr><td>
We are going to make a box as shown.

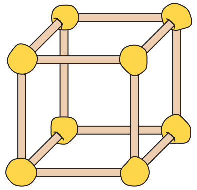


Which quadrilaterals shown below do we need?

How many of each do we need?



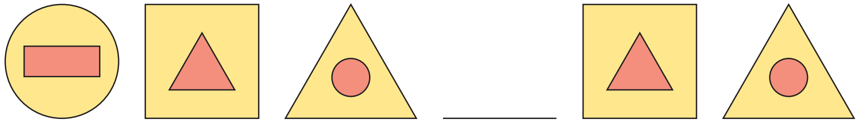
</td><td>
Jack has made a cube using 12 sticks and 8 balls of modelling clay.



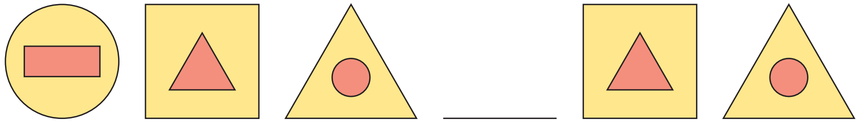
What shape could he make with:

6 sticks and 4 balls of clay?

4 long sticks, 8 short sticks 8 balls of clay?
</td></tr>
<tr><td>
Fill in the missing shape to complete the pattern.



Explain your reasoning.
</td><td>
Fill in the missing shape to complete the pattern.



If the pattern continued what would the tenth shape be?

Explain your reasoning.
</td></tr>
</table>

www.mathshubs.org.uk
www.ncetm.org.uk
www.oxfordowl.co.uk

Statistics

Selected National Curriculum Programme of Study Statements

Pupils should be taught to:

- 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

The Big Ideas

Data need to be collected with a question or purpose in mind.

Tally charts are used to collect data over time (cars passing the school, birds on the bird table).

Mastery Check

Please note that the following columns provide indicative examples of the sorts of tasks and questions that provide evidence for mastery and mastery with greater depth of the selected programme of study statements. Pupils may be able to carry out certain procedures and answer questions like the ones outlined, but the teacher will need to check that pupils really understand the idea by asking questions such as 'Why?', 'What happens if …?', and checking that pupils can use the procedures or skills to solve a variety of problems.

Mastery

Generate data with the children on a daily basis. For example, use an IWB to identify who is having school dinner or a packed lunch.

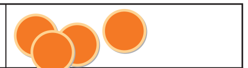
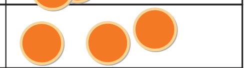
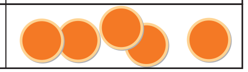
Present data in different ways: pictograms, tally charts, block diagrams and simple tables.

Check whether children can answer questions about the data. For example: which is most popular? Which is least popular?

Children may be able to answer simple retrieval questions, but can they extend to finding the total number or finding a difference?

Mastery with Greater Depth

Four children played racing games at break time. Each time they won a game they took a counter.

Sam	
Tom	
Sally	
Ally	

Present the information in a different way to make it clearer and answer the following questions:

Who won the most races?

How many more races did Ally win than Sally?

Does the information answer the question:

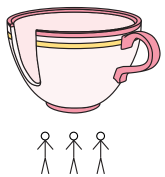
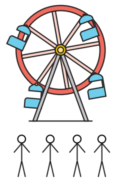
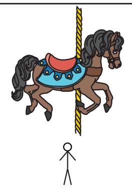
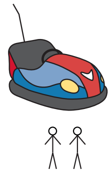
Who is the fastest runner?

Mastery with Greater Depth	Mastery with Greater Depth

Mastery with Greater Depth

Ten friends went to the fair.
The picture below shows each friend's favourite activity.
Fill in the number of children under each picture.

Challenge children to compare different ways of representing the same information.

				
Number of children				

Mastery with Greater Depth

What's the same? What's different?

Ice creams sold in one week	
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Cars in the car park on Monday at 10 o'clock	
Red	
Blue	
Black	
Silver	
White	
Other