Planning Overview
Year 6 Decimals and Percentages

Identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places
Multiply one-digit numbers with up to two decimal places by whole numbers
Use written division methods in cases where the answer has up to two decimal places
Solve problems which require answers to be rounded to specified degrees of accuracy
Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

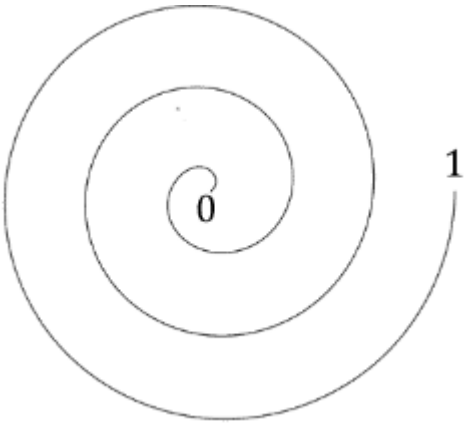
6NPV–1 Understand the relationship between powers of 10 from 1 hundredth to 10 million, and use this to make a given number 10, 100, 1,000, 1 tenth, 1 hundredth or 1 thousandth times the size (multiply and divide by 10, 100 and 1,000).
6NPV–2 Recognise the place value of each digit in numbers up to 10 million, including decimal fractions, and compose and decompose numbers up to 10 million using standard and non-standard partitioning.
6NPV–3 Reason about the location of any number up to 10 million, including decimal fractions, in the linear number system, and round numbers, as appropriate, including in contexts.
6NPV–4 Divide powers of 10, from 1 hundredth to 10 million, into 2, 4, 5 and 10 equal parts, and read scales/number lines with labelled intervals divided into 2, 4, 5 and 10 equal parts.

<table>
<tr><th></th><th>Teaching and Learning</th></tr>
<tr><td>Recap Introduction</td><td>In Year 5, children will have explored tenths, hundredths and thousandths. The ready to progress statements in Year 5 only require the children to complete decimals up to hundredths. Use the following activity to identify how well the children have retained their knowledge from Year 5.

Pair the children to play the following game. They will need a different coloured pencil each. Ask them to decide who goes first.
They will take turns to place the numbers below on a 0-1 number line.
The aim of the game is to position 3 numbers next to each other.

<table><tr><td>0.5</td><td>0.25</td><td>0.75</td><td>0.3</td></tr><tr><td>0.35</td><td>0.9</td><td>0.99</td><td>0.999</td></tr><tr><td>0.1</td><td>0.01</td><td>0.05</td><td>0.79</td></tr><tr><td>0.64</td><td>0.32</td><td>0.54</td><td>0.865</td></tr></table>
Make the game progressively harder by giving children a range of number lines to play each round on.

The first number line could be between 0 and 1 and have tenths marked on.</td></tr>
</table>

	The second number line could be between 0 and 1 with no markings. The number line for the final round could be a spiral number line.  Spiralling Decimals – NRICH Ensure the children are able to complete this activity without the common misconception that that 0.35 is larger than 0.5 for example. Can the children complete the following sentence stems? 0.3 is _tenths 0.3 is _ hundredths 0.3 is _ thousandths Model to the children how to partition the following number in a standard way. 0.875 Eight tenths, seven hundredths and five thousandths 0.8 + 0.07 + 0.05 Then progress to a variety of non-standard ways. 0.875 875 thousandths 8 tenths and 75 thousandths 87 hundredths and 5 thousandths 805 thousands and 7 hundredths 86 hundredths and 15 thousandths 5 tenths and 375 thousandths Can they now do the same with 0.657? If the children are struggling to understand the relationship between tenths, hundredths or thousandths, consider tracking back to the Year 4 or 5 planning units.

Ensure that the children can answer the following sample SATs questions before moving on.

Look at this number.

23,451.96

Write the **digit** that is in the hundreds place.

[ ] 1 mark

Write the **digit** that is in the hundredths place.

[ ] 1 mark

Write these masses in order, starting with the **lightest**.

1.25 kg 0.99 kg 1.025 kg 0.009 kg

[ ] kg [ ] kg [ ] kg [ ] kg

lightest

1 mark

Write these numbers in order of size, starting with the **smallest**.

1.9 0.96 1.253 0.328

[ ] [ ] [ ] [ ]

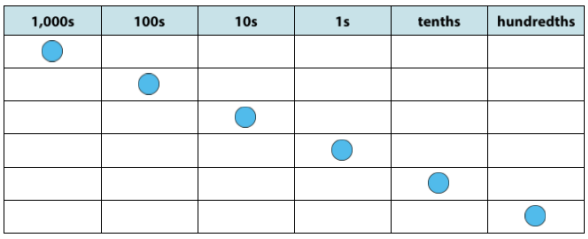
smallest

1 mark

Mastery

Put these numbers in order, from smallest to largest.

- 3·3, 3·03, 3·33, 3·303, 3·033
- 5834, 61·8 multiplied by 100, one tenth of 45813
- 0·034, 3·6 divided by 100, ten times 0·0033
- –4·4, –4·44, –4·04, –4·404

<table>
<tr>
<td>x10, 100 and 1000</td>
<td>
Show the children the chart below which they should have seen in Year 5 (taken from the NCETM Professional Development Materials). Ask them if they can use the sentence stems to discuss relationships.


'___ is ten times bigger than ___.'
'___ is ten times smaller than/one tenth the size of ___.'
'___ is one hundred times bigger than ___.'
'___ is one hundred times smaller than/one hundredth the size of ___.'

Provide the children with a number that involves a decimal.
e.g. 3.45

Using a place value chart, ask them to complete the following questions. Some children may need place value cards to physically move on the chart others may not.

3.45 x 10 =
3.45 x 1000 =
3.45 ÷ 10 =

What happens to the digits? Why?

Provide the children with a range of fluency questions where they are asked to multiply and divide by 10, 100 and 1000 involving decimals numbers.
<table>
<tr><th>In</th><th>Function</th><th>Out</th></tr>
<tr><td>3.5</td><td>x100</td><td></td></tr>
<tr><td>345.6</td><td></td><td>34,560</td></tr>
<tr><td></td><td>÷ 10</td><td>22.3</td></tr>
<tr><td>43.05</td><td>x1,000</td><td></td></tr>
</table>
Encourage the children to be able to convert between measures, applying this skill.

Can the children find their way through the grid to make the highest possible product? What about the lowest possible product?
</td>
</tr>
</table>

Start 0.4	X 10	X 1000	÷ 100
X 100	÷ 100	X 1000	÷ 100
÷ 1000	X 100	X 10	X 10
÷ 100	÷ 10	÷ 1000	÷ 1000
X 1000	÷ 10	X 10	End

Example of SATs style questions.

Write the missing number to make this **division** correct.

0.3 ÷ ☐ = 0.03

1 mark

One tonne is 1,000 kilograms.

A truck can carry a load of 2.3 tonnes.

How many **kilograms** can the truck carry?

☐ kg

1 mark

Here are six cards.

× 10	× 100	× 1000
÷ 10	÷ 100	÷ 1000

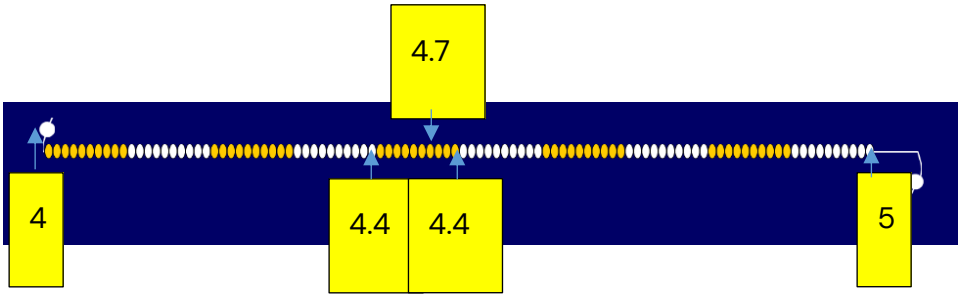
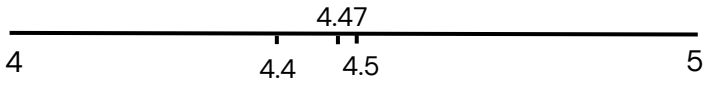
Use a card to complete each calculation.

5.3 ☐ = 0.53

5.3 ☐ = 5300

5.3 ☐ = 0.053

2 marks

	Ask the children to explore the following reasoning questions. Why is 2.34 ÷ 10 the same as 23.4 ÷ 100? Can they write any of their own examples? Provide children with more difficult conversions to apply their knowledge to. a) Convert 0.402 kg into g. b) Convert 70.06 cm into m. c) Convert 7.36 litres into centilitres. d) Convert 1.056 kilometres into mm
Rounding decimals	Use a hundred bead string where the range is from 4 to 5. Where would 4.47 be? What is this rounded to the nearest tenth? What is this rounded to the nearest whole number? Ensure that children know that this means rounding to the nearest one.  Ask the children how they could show this on a number line. This is something they should have done in Year 5. Model how to use a number line to round to the nearest tenth and whole number.  The children should be able to use their knowledge of rounding from the place value unit and from previous years to know that you will round up to 4.5 when rounding to the nearest ten and round down to 4 when rounding to the nearest whole number.

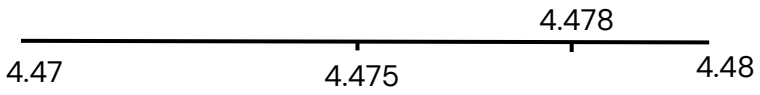
Sample SATs style question

Tick the numbers that round to 28.7

- 28.07 ☐
- 28.65 ☐
- 28.71 ☐
- 28.75 ☐
- 28.97 ☐

Use the same numbers to now see how to round a number to the nearest hundredth.
E.g 4.478

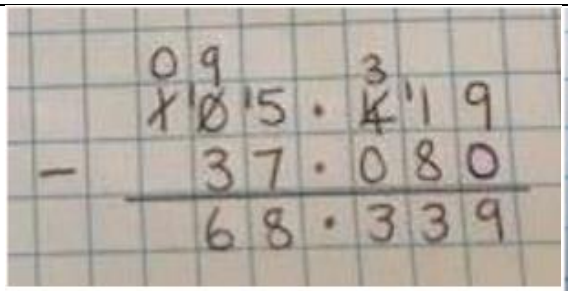
Ask the children to place the number on a number line as below.

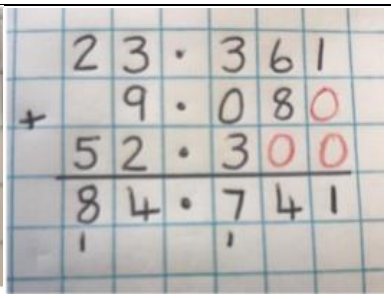


Provide the children with number lines to practise rounding to the nearest whole number, tenth and hundredth.

8,997.405	
Rounded to the nearest hundred.	
Rounded to the nearest tenth.	
Rounded to the nearest hundredth.	
Rounded to the nearest whole number.	

	What mistakes have these children made? 1645.456 a) Jack rounds this number to the nearest hundred. His answer is 1645.46 b) Annie rounds this number to the nearest tenth. Her answer is 1650 c) Ezra rounds this number to the nearest whole number. His answer is 1645.056
Link decimals to calculation - Adding and subtracting	In Year 5, children will have learnt how to add and subtract decimals using mental strategies. Ensure that these strategies have been retained. They should be able to answer questions such as the sample SATs questions below. Circle two numbers that add together to equal **0.25** 0.05 0.23 0.2 0.5 1 mark Two decimal numbers add together to equal 1 One of the numbers is 0.007 What is the other number? 1 mark Complete the second part of this question. **Mastery** Choose digits to go in the empty boxes to make these number sentences true. 14 781 – 6 ☐ 53 = 8528 23·12 + 22· ☐ = 45·23 In Year 6, they will need to be able to add and subtract decimals using the formal written methods of column addition and column subtraction. This should include addition several numbers with different numbers of decimal places (including in the context of measures and money). Tenths, hundredths and thousandths should be correctly aligned, with the decimal place lined up vertically, including in the answer row. Zeros should be added into empty decimals places to show there is no value to add.





Provide chidlren with a range of fluency questions to practise these skills ensuring that money and measure are included in these examples.

a) £52.64 + £9.70 =

b) 8.06cm + 4cm =

c) 658.34L – 1.78L =

d) £352 – £6.91 =

Mastery

Calculate 36·2 + 19·8

- with a formal written column method
- with a mental method, explaining your reasoning.

Fill in the missing digits to make this addition correct.

	5	3	2 .		9
+	7	4	.	2	
	0	6	.	7	6

Now allow the chidlren to explore problems realted to adding and subtracting decimas.

What number is six tenths less than 9.072?

The numbers in this sequence **decrease** by 4.57 each time.

Write the missing numbers.

	21			11.86	

A bottle contains 1.245l of milk. Alice pours out three quarters of a litre. How much milk is left?

'The table shows how far some children jumped in a long-jump competition.'

Name	Distance jumped (m)
Jamal	3.04
Reyna	3.4
Faisal	2.85
Ilaria	3.19
Charlie	3.09
Kagendo	2.9

- *'Who came third in the competition?'*
- *'How much further did the winner jump compared to the child who came second?'*
- *'What was difference between the longest and shortest jumps?'*
- *'How much further did Ilaria jump than Faisal?'*

Taken from the NCETM PD materials

At the start of 2020, there were £1.793 million in a charity fund. During that year,

- £8.728 million more was donated
- £9.4 million was used to buy medical equipment

To reach their target of having £9 million by the end of 2020, how much more will they need to raise?

Sample SATs questions

The children at Farmfield School are collecting money for charity.

Their target is to collect £360

So far they have collected £57.73

How much **more** money do they need to reach their target?

£ _____

1 mark

Jacob cuts **4** metres of ribbon into **three** pieces.

The length of the first piece is **1.28** metres.

The length of the second piece is **1.65** metres.

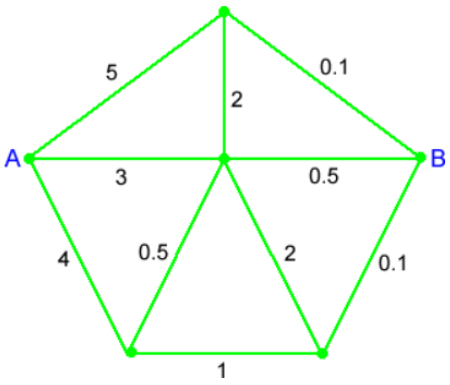
Work out the length of the third piece.

<table>
<tr><td></td><td>
<table>
<tr><th>Mastery with Greater Depth</th></tr>
<tr><td>Can you use five of the digits 1 to 9 to make this number sentence true?
□ □ · □ + □ · □ = 31·7

Can you find other sets of five of the digits 1 to 9 that make the sentence true?</td></tr>
<tr><td>Two numbers have a difference of 2·38. What could the numbers be if:
■ the two numbers add up to 6?
■ one of the numbers is three times as big as the other number?

Two numbers have a difference of 2·3. To the nearest 10, they are both 10.
What could the numbers be?</td></tr>
</table>
</td></tr>
<tr><td>Link decimals to calculation – Multiplying</td><td>
In Year 5, children will have used their known facts to complete multiplication questions involving decimals. Ensure that the children have retained this knowledge so they are able to answer the questions below.

0.5 × 28 = 3.1 × 30 = 0.9 x 600 = 0.6 × 200 =

The children can build on this knowledge by completing ‘Route Product’ from NRICH.
There are lots of different routes from A to B in this diagram:


The idea is to work out the product of the numbers on these different routes from A to B. Let's say that in a route you are not allowed to visit a point more than once.

For example, we could have 3×0.5 but we couldn't have $3 \times 2 \times 5 \times 4 \times 1 \times 0.1$ because that route passes through A twice.

Which route or routes give the largest product?

Which route or routes give the smallest product?

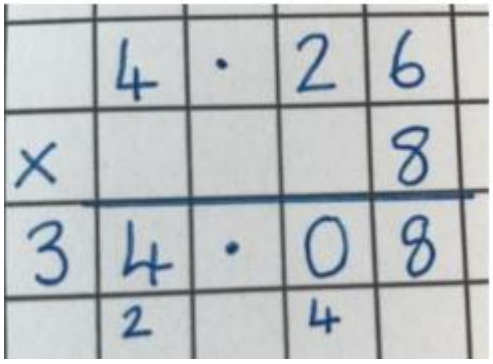
Do you have any quick ways of working out the products each time?

Children will now need to apply their knowledge of short multiplication to multiply numbers with more than 4 digits by a one-digit number, to multiply money and measures and to multiply decimals with up to 2 decimal places by a single digit.
</td></tr>
</table>

First begin by showing this method with money so that they have a better conceptual understanding of what they are doing particularly with the number that they are multiplying by (it won't be in the correct place value column).

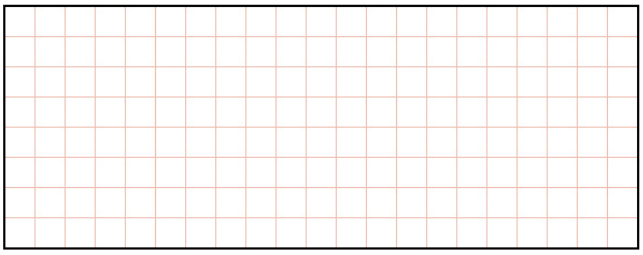
Show the children the calculation 4.26 x 8 =
Ask them how they would solve this problem.

Model how to use short multiplication to support them with this.



Provide the children with fluency questions to practise. You could find these from the arithmetic SATs papers e.g.

34.9 × 5 = ☐



Always/Sometimes/Never
When you multiply a number with two decimal places by a one-digit number, the answer will always have at least 2 decimal places. Is this always, sometimes or never true?

Sample SATs questions

The mass of a 10p coin is 6.5g.

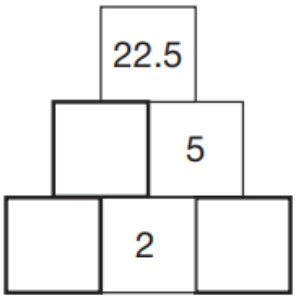
The mass of a 5p coin is half the mass of a 10p coin.

What is the mass of these six coins **altogether**?

Here is a number pyramid.

The number in a box is the **product** of the two numbers below it.

Write the missing numbers.



2 marks

One gram of gold costs £32.94

What is the cost of **half a kilogram** of gold?

Mastery

Work out:

- $8{\cdot}4 \times 3 + 8{\cdot}4 \times 7$
- $6{\cdot}7 \times 5 - 0{\cdot}67 \times 50$
- $93 \times 0{\cdot}2 + 0{\cdot}8 \times 93$
- $7{\cdot}2 \times 4 + 3{\cdot}6 \times 8$

Complete the first 2 examples below.

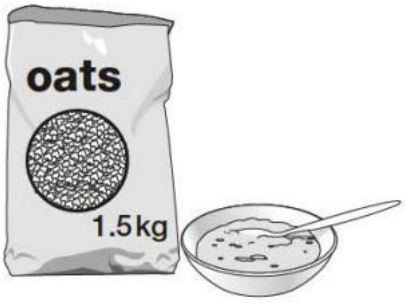
Mastery with Greater Depth

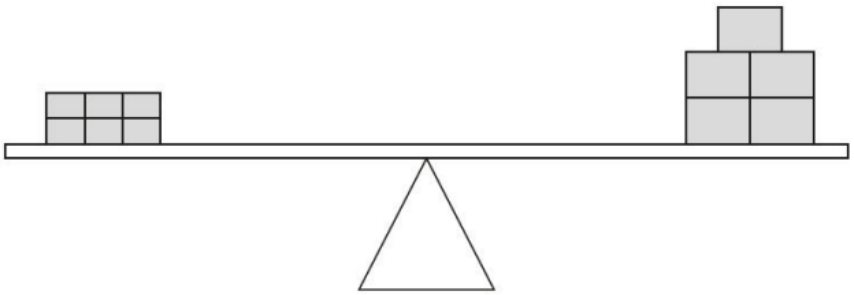
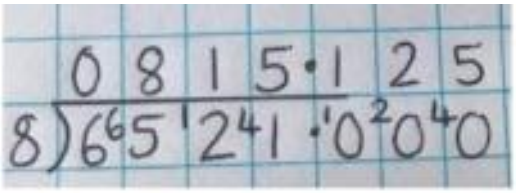
In each pair of calculations, which one would you prefer to work out?

- (a) $35 \times 0{\cdot}3 + 35 \times 0{\cdot}7$ **or** (b) $3{\cdot}5 \times 0{\cdot}3 + 35 \times 7$
- (c) $6{\cdot}4 \times 1{\cdot}27 - 64 \times 0{\cdot}1$ **or** (d) $6{\cdot}4 \times 1{\cdot}27 - 64 \times 0{\cdot}027$
- (e) $52{\cdot}4 \div 0{\cdot}7 + 524 \div 7$ **or** (f) $52{\cdot}4 \div 0{\cdot}7 - 524 \div 7$
- (g) $31{\cdot}2 \div 3 - 2{\cdot}4 \div 6$ **or** (h) $31{\cdot}2 \div 3 - 1{\cdot}2 \div 0{\cdot}3$

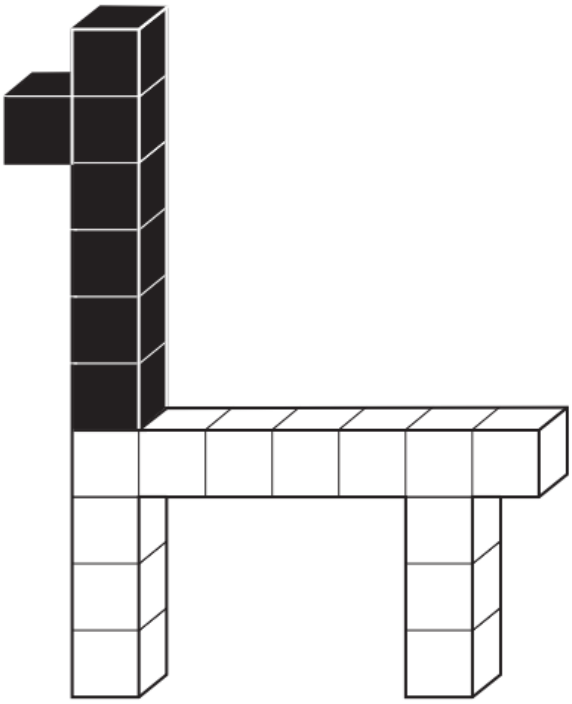
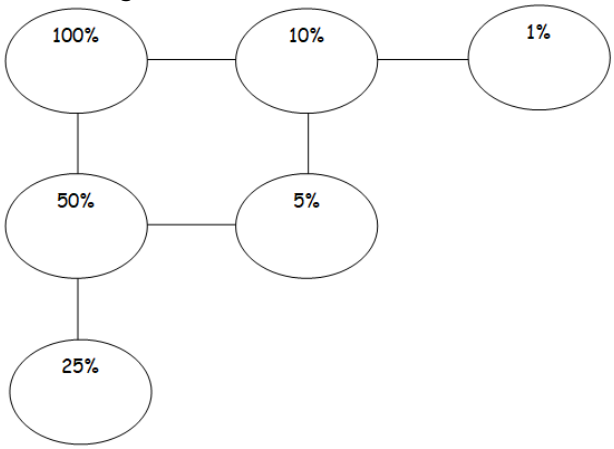
Explain your choices.

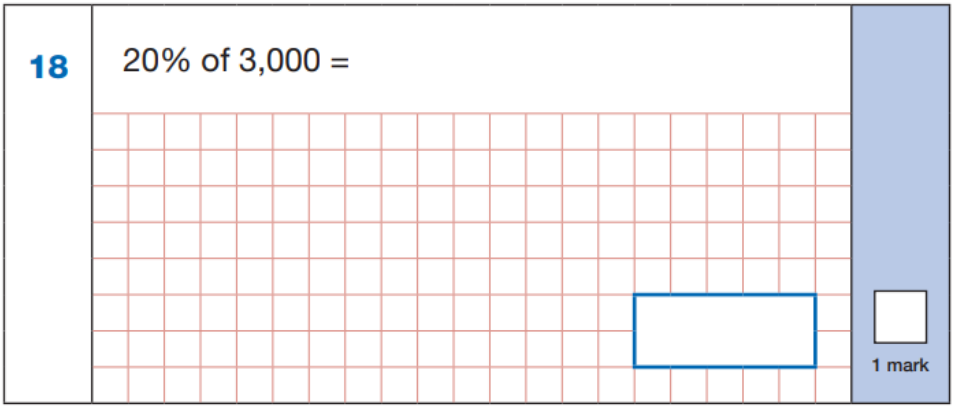
On my calculator I divided one whole number by another whole number and got the answer 3.125. I know that both numbers were less than 50, but can't remember what they were. Using your knowledge of multiplication and fractions, can you work out what they were?

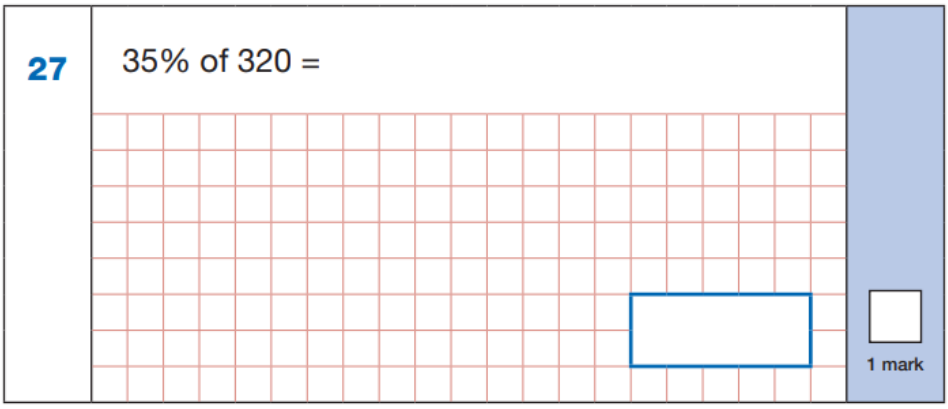
Link decimals to calculation - dividing	In Year 5, children will have used their knowledge of known facts to divide mentally. Ensure that children have retained this knowledge before moving on. Children will build on their use of short division and learn how to divide decimals by one-digit numbers. Provide the children with fluency questions to practise this skill. e.g. a) 5.64 ÷ 3 = b) 96.75 ÷ 5 = c) 32.64 ÷ 8 = d) 109.17 ÷ 9 = Encourage the children to apply this skill to solving problems, involving measure and money. e.g. A carpenter cuts up a piece of wood in to 6 equal sections. The original length of the wood is 14.34m. What is the length of each of the pieces once the wood has been cut? 4 watermelons cost £3.40. Calculate the cost of **1** watermelon. Sample SATs questions A packet contains 1.5 kg of oats.  Every day Maria uses 50 g of oats to make porridge. How many days does the packet of oats last?

	6 small bricks have the same mass as 5 large bricks.  The mass of one small brick is 2.5 kg. What is the mass of one large brick? Large pizzas cost £8.50 each. Small pizzas cost £6.75 each. Five children together buy one large pizza and three small pizzas. They share the cost equally. How much does each child pay? Children continue to develop their use of short division and how to express remainders as decimals. 
Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts	Recall fraction, decimal and percentages equivalents using a bead string. Ask children to partner up. One child puts a peg on a bead string, the second child gives the value of that bead as a fraction, a decimal and a percentage. Ask children to use this understanding and their bead string to sort statements like these into true or false piles 52 % is more than 0.5 $\frac{2}{5}$ is the same as 40% 90% is the same as $\frac{90}{100}$

	Consider how the skills taught above are applied to the problems. Examples from NCETM PD Materials True/false style problems: *'Are the following statements true or false? Why? Challenge yourself to do this without calculating the exact percentages.'* • 25% of 379 is a bit less than 100. • 90% of 520 is around 400. • 45% of 210 is more than 105. Ensure that children are tackling these questions by using their reasoning around fractions, decimals and percentages equivalents. *'I know that 25% of 379 is going to be more than just a bit less than 100 because 25 % is a quarter. 379 is almost 380 and a quarter of that is 90'* Children apply this to SATs questions requiring an understanding of fractions, decimals and percentages relationships **18** A cat sleeps for **12 hours** each day. **50%** of its life is spent asleep.  Write the missing percentage. A koala sleeps for **18 hours** each day. ____ % of its life is spent asleep.  1 mark **20** Adam says, 0.25 is **smaller** than $\frac{2}{5}$ 

	17 This model is made with 20 cubes.  What **percentage** of the cubes in the model is black?
Exploring percentages	Recap from year 5 how to find 50% of a number by halving, 25% of a number by halving and halving again (to find a quarter), 10% of a number by dividing by 10 and 1% of a number by dividing by 100. As children to find various percentages of numbers using the percentages chains model if needed.  Find 50% of 400 Find 10% of 450 Find 5% of £4.60 Find 54% of 600



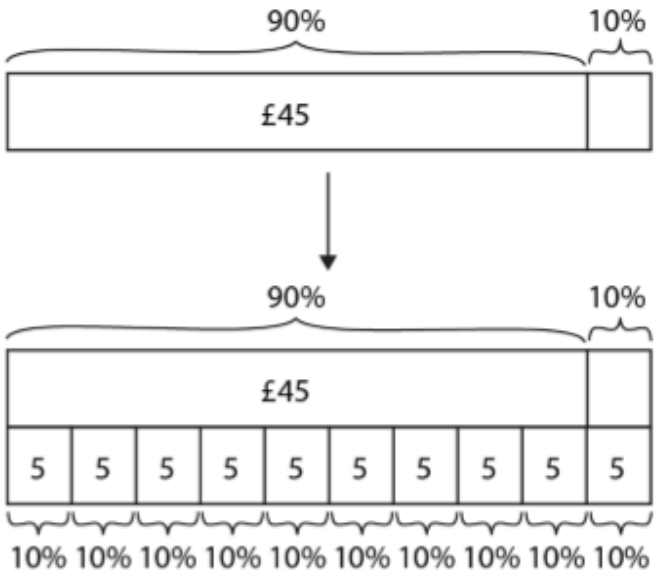


Look at how the bar model can help solve problems involving percentages e.g.

A coat has a 10% off in the sale. The coat is now £45. What was its original cost?

Examples from NCETM PD Materials

Bar model

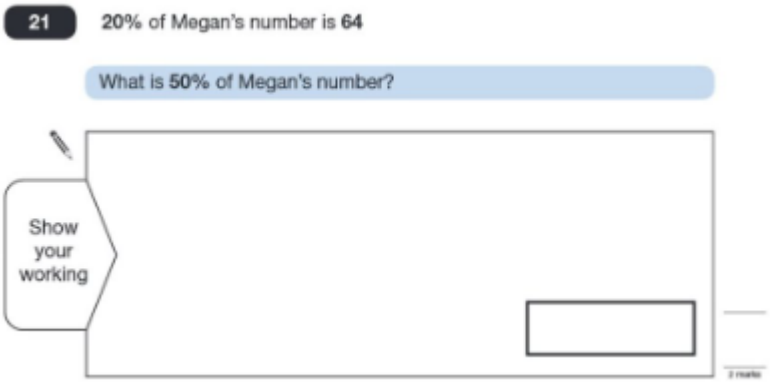


Complete more real-life contexts. How can the bar model help the children to solve the problems below?

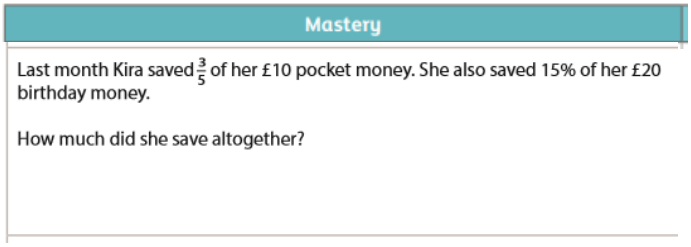
Real-life contexts:

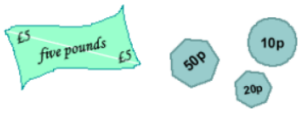
- *'30% of the seats at a cricket match are taken. So far, there are 750 people present. How many people will be there when all of the seats are filled?'*
- *'So far, Adam has read 180 pages, or 60%, of his book. How many pages are in Adam's book in total?'*
- *'A pair of trainers is reduced by 25% in a sale. They now cost £36. What did they cost at full price?'*
- *'90% of the runners in a race have crossed the finish line. There are still 12 runners on the course. How many runners took part altogether?'*

Look at SATs questions involving problem solving with percentages



Include problems where children are required to also use their understanding of decimals and percentages alongside fractions.



Link finding percentages to measure	Complete problems involving finding fractions of measures in context. **Would You Rather?** **Age 7 to 11** ★ If you are working in the USA units then go to Would you rather..... Have 10% of £5 or 75% of 80p?  Be given 60% of 2 pizzas or 26% of 5 pizzas? Be bitten by 15% of 120 mosquitoes or 8% of 250 mosquitoes?  Skip using a rope which is 54% of 105cm long, or 88% of 2.75m long? Sit in a traffic jam for 33% of 2 hours or 44% of 1hr 40mins?