Planning Overview
Year 5 Decimals and Percentages

Read and write decimal numbers as fractions
Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
Round decimals with two decimal places to the nearest whole number and to one decimal place
Read, write, order and compare numbers with up to three decimal places
Solve problems involving number up to three decimal places
Recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal
Solve problems which require knowing percentage and decimal equivalents of $\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{2}{5}$ and $\frac{4}{5}$ and those fractions with a denominator of a multiple of 10 or 25.

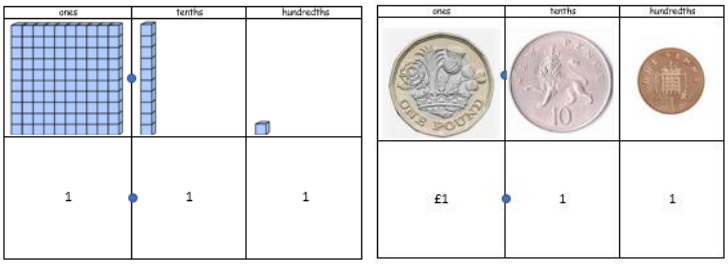
5F–3 Recall decimal fraction equivalents for $\frac{1}{2}, \frac{1}{4}, \frac{1}{5}$ and $\frac{1}{10}$ and for multiples of these proper fractions.
5NPV–1 Know that 10 tenths are equivalent to 1 one, and that 1 is 10 times the size of 0.1. Know that 100 hundredths are equivalent to 1 one, and that 1 is 100 times the size of 0.01. Know that 10 hundredths are equivalent to 1 tenth, and that 0.1 is 10 times the size of 0.01.
5NPV–3 Reason about the location of any number with up to 2 decimals places in the linear number system, including identifying the previous and next multiple of 1 and 0.1 and rounding to the nearest of each.
5NPV–2 Recognise the place value of each digit in numbers with up to 2 decimal places, and compose and decompose numbers with up to 2 decimal places using standard and non-standard partitioning.
5NPV–4 Divide 1 into 2, 4, 5 and 10 equal parts, and read scales/number lines marked in units of 1 with 2, 4, 5 and 10 equal parts

	Teaching and Learning
Understand tenths and hundredths and the relationship between tenths and hundredths	Introduce place value of decimals using concrete resources.  Use a bead string to reinforce the relationship with decimal numbers: If the bead string represents one whole, what is each coloured section of 10 beads? (One tenth) What would that look like as a fraction? ($\frac{1}{10}$) What would this look like as a decimal? (0.1) We have no wholes and one in the tenth column.

Each individual bead is now one hundredth. Ask children to represent 5 hundredths on the bead string. What would this look like as a fraction ($\frac{5}{100}$) and as a decimal (0.05) because we have 5 in the hundredths column, no tenths and no wholes. What would 45 hundredths look like?

Ask how many hundredths are the same as 2 tenths? How does the bead string show this?

Use the bead string to help us with questions such as:
Which is more? 0.4 or 0.04?
Which number is closer to one whole? 0.9 or 0.09?
Transfer understanding onto a Place Value chart using Dienes and money to support.



10 tenths make a whole or 10 x 10p coins = £1.00

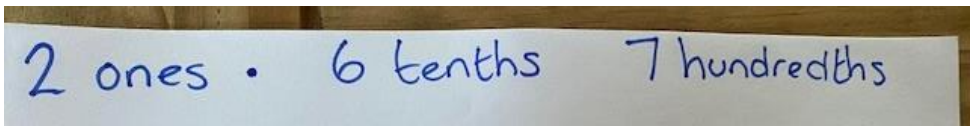
10 hundredths make a tenth or 10 x 1p coins = 10p = £0.10

100 hundredths make a whole or 100 x 1p coins = £1.00

How many different ways could you use £1, 10p and 1p coins to make £1.67?

Can children link this to how many hundredths and tenths there are in 2.67?

Use folded paper to support understanding.



	Ready to Progress Fill in the missing numbers. ☐ tenths = 3.9 ☐ hundredths = 0.22 ☐ hundredths = 8 Circle all of the numbers that are equal to a whole number of tenths. 0.2 4.8 1 0.01 10 0.83
If children are fully secure with the conceptual understanding of tenths and hundredths you may wish to introduce them to thousandths at this point. This plan introduces thousandths later in the unit of work. **Teaching thousandths at this stage would allow you to tackle the following objectives around adding and subtracting, ordering and comparing, positioning on a number line and multiplying and dividing by 10, 100 and 1000 to 3 decimal places.** ***The Ready to Progress materials prioritise children's understanding of hundredths in Year 5 - ensure that the children are fully secure with hundredths before moving on to thousandths.**	
Partitioning and recombining decimal numbers	Build decimal numbers using place value counters. Children to use this to help them to partition their decimal using standard then non-standard partitioning. 3.56 = 3 and 5 tenths and 6 hundredths 3.56 = 2 and 1.5 and 0.06 3.56 = 3 and 0.4 and 1.6 3.56 = 2.9 and 0.6 and 0.06 Can children recombine numbers and understand the place holders when a value does not appear in a column. Ready to Progress Complete the calculations. $4 + 0.07 + 0.2 =$ ☐ $0.4 + 0.02 + 70 =$ ☐ $20 + 0.07 + 4 =$ ☐ $0.4 + 20 + 700 =$ ☐

<table>
<tr><td></td><td>Extend to addition and subtraction by using Place Value where exchange may be necessary
e.g. examples below from Ready to Progress.

$3.87 - 0.8 = \square$ $25.14 - 0.04 = \square$ $19.7 - 9 = \square$
$99.99 - 90 = \square$ $84.51 = 50 + \square$ $0.3 + 5.61 = \square$
$95.75 - 0.5 = \square$ $6.14 = 5 + \square + 0.04$ $2 + 1.43 + 0.05 = \square$</td></tr>
<tr><td>Compare decimals</td><td>Compare two decimal numbers using < > and =

Build decimals using place value counters if necessary.

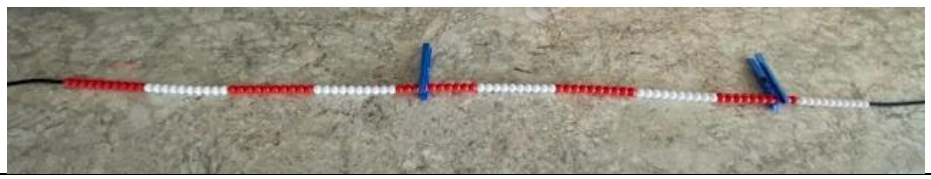
Begin with decimal numbers with the same number of place value columns
Compare 4.5 and 4.8
Compare 6.6 and 6.5
Compare 3.45 and 3.48

Model the language that children will be required to use
‘To compare 4.5 and 4.8 I can see that both numbers have 4 in the ones column but one number has 5 tenths and one has 8 tenths. 8 tenths is bigger than 5 tenths’

Extend to numbers that may appear larger e.g. 0.56 and 0.8, do children understand that 0.8 is larger due to the value of the tenths column.

Ready to progress
Fill in the missing symbols (<, > or =).
0.3 ☐ 0.5 0.03 ☐ 0.05 0.50 ☐ 0.5
9 ☐ 9.00 0.2 ☐ 0.15 0.11 ☐ 0.09
1.01 ☐ 1.1 3 ☐ 2.99 140 ☐ 1.40</td></tr>
<tr><td>Position decimal numbers on a number line</td><td>Use a bead string and pegs to position numbers with 2 dp on a number line from 0 -1, ask the children to identify where 0.1, 0.5 and 0.9 would be.

Ask them to place a peg on 0.54, and 0.87 and explain reasoning about where they would be.

  </td></tr>
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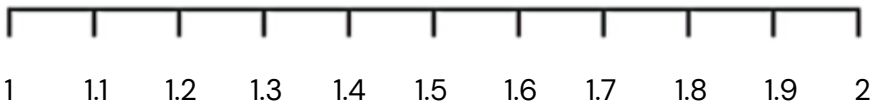
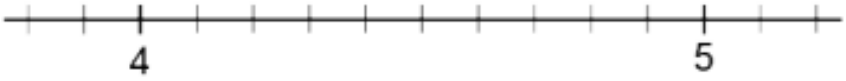
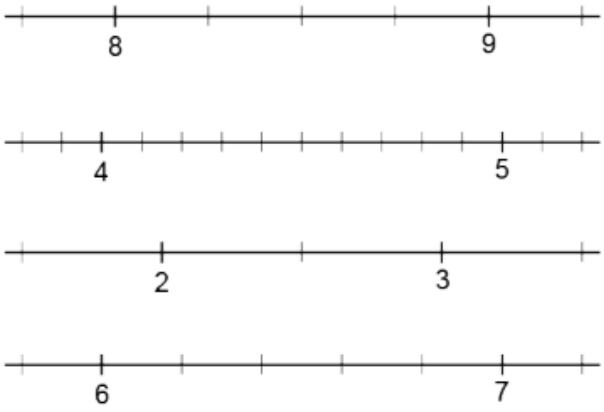
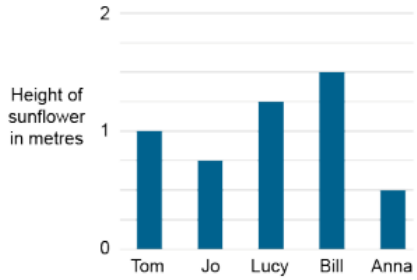
	Move children from a concrete bead string to a number line with 10 increments. Model how to label the start of the number line with a whole number and the end of the number line with a whole number. What will each of the increments be?  Where would 1.25 go on this number line? 1.62? 1.97? Relate this to number lines between other whole numbers with 10 increments. Ready to progress guidance  Look at positioning decimals on number lines with varying increments and scales – encourage children to continue the count once they have placed their numbers as a way of checking their answer. Relate this number line work to the work that they did in place value. How many increments has the line been split into? Can we use the strategy of a mid point? Of quarter point? If the number line is in 10 increments can we use our understanding of a number line in 10 increments to help us? Ready to progress guidance 5. Complete the labelling of these scales. 

Relate to measures and statistics questions.

Ready to progress guidance

3. 5 children have been growing sunflowers. The bar chart shows how tall each child's sunfower has grown. How tall is each flower?'



Play Limits game from BEAM and discuss position of decimals and relationships between the numbers placed.

Roll the dice four times to get four digits.

Arrange those digits in these boxes, to make decimal numbers between 0 and 1.

0.□□ and 0.□□

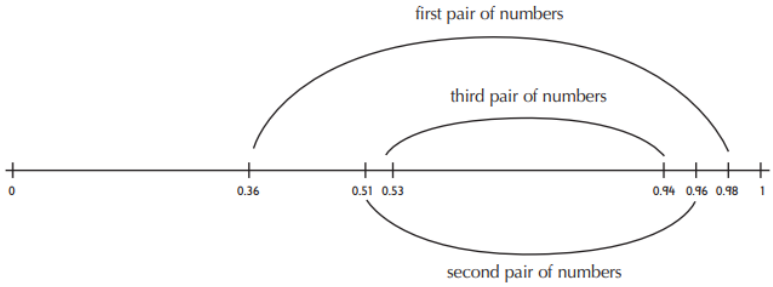
Sketch those numbers on a 0 to 1 number line. These are your limits.

Now roll the dice four more times and make two more numbers. Try to make numbers that fit between the two limits. If you succeed, these are your new limits.

Continue like this until you can't go on.

How many times can you fit a new pair of numbers between the previous limits?

Sample game

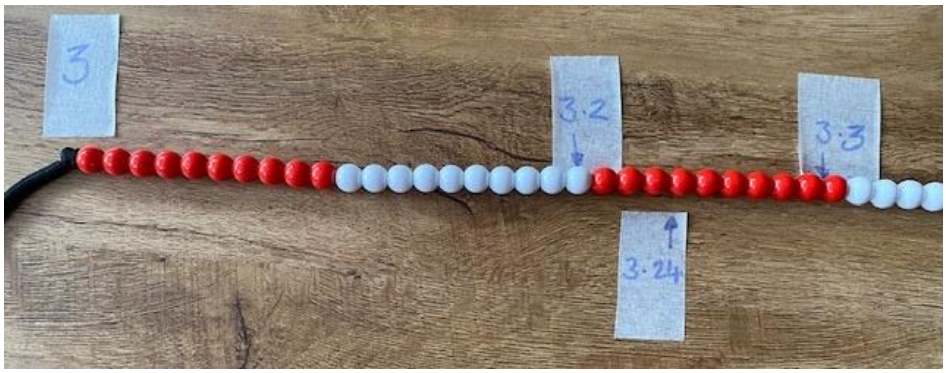
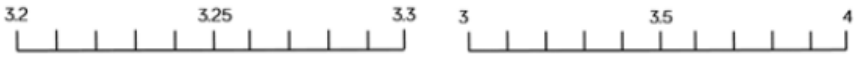


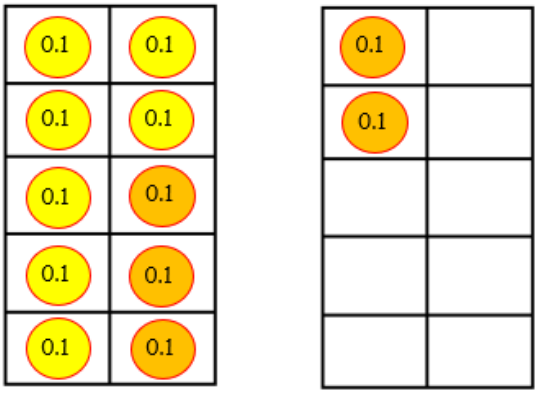
First four digits: 3, 6, 8, 9 → 0.36 and 0.98

Next four digits: 1, 5, 6, 9 → 0.51 and 0.96 (both between 0.36 and 0.98)

Next four digits: 3, 4, 5, 9 → 0.53 and 0.94 (both between 0.51 and 0.96)

Next four digits: 1, 2, 5, 8 → can't make two numbers between previous limits

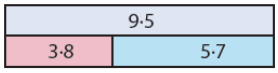
Rounding decimals	Look at rounding decimals to the nearest tenth and whole number. Use a bead string where the range is from 3 to 4. Where is 3.2 and 3.3. How would we record halfway? 3.25 Where would 3.24 be? Is it closer to 3 or 4? Now look at the nearest tenth. Is it closer to 3.2 or 3.3?  Reinforce the rules of rounding. To round to the nearest whole number the determiner is the tenth column. To round to the nearest tenth the determiner is the hundredth column. 1,2,3 and 4 would round down 5,6,7,8 and 9 would round up Look at the same concept but on a number line. Can children describe why 3.24 would round to 3.2 and not 3.3? Can they say a number that would round to 3.3?  Discuss which whole number it would round to and why. Link to money. Is £3.24 closer to £3.20 or £3.30? Is £3.24 closer to £3 or £4 Circle each decimal which when rounded to one decimals place is 7.2. Explain your reasoning 7.32 7.23 7.27 7.17

	NRICH – Round the Dice Decimals 2 **Round the Dice Decimals 2** **Age 7 to 11** **Challenge Level** ★  There are three dice, each of them with faces labelled from 1 to 6. When the dice are rolled they can be combined in six different ways to make a number less than 10 with two decimal places. For example, if I roll a 2, a 3 and a 6, I can combine them to make 2.36, 2.63, 3.26, 3.62, 6.23 or 6.32. Now round each of these numbers to the nearest whole number: 2.36 rounds to 2, 2.63 rounds to 3, 3.26 rounds to 3, 3.62 rounds to 4, 6.23 rounds to 6 and 6.32 rounds to 6. Repeat for other rolls of the dice. Can each of the six numbers round to the same whole number? Can each of the six numbers round to a different whole number? There are some interactive dice here that you can use for this problem.
Add and subtract decimals	Recap on the mental methods that were used in the Addition and Subtraction unit of work. How can these be applied to decimals? e.g. bridging 0.7 + 0.5 (0.7 + 0.3 + 0.2 = 1.2)  How would children tackle 2.7 + 1.5 = *'I would do 2.7 + 1 = 3.7 first and then I would do 3.7 + 0.5 = 4.2'* Finding the difference 5.6 – 4.9 (a blank number line may support children to bridge through 5) Compensating 3.4 + 0.9 (a blank number line may support children to see which way they need to compensate) Reordering 4.3 + 2.5 + 0.7 = (reminding children to look for bonds or known facts)

Recap how to use a bar model. The parts can be added together to make the whole. If we know the whole and one part then we are going to need to subtract to work out the other part.

Mastery

Write four number facts that this bar diagram shows.



□ + □ = □

□ + □ = □

□ − □ = □

□ − □ = □

Encourage children to compete missing box calculations that involve a selection of strategies.
e.g. 3.4 + ? = 5

5	
3.4	?

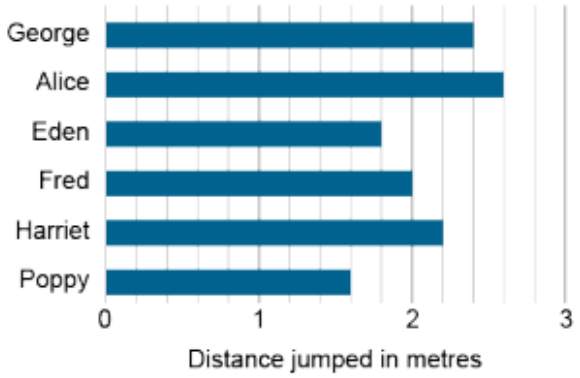
Mastery with Greater Depth

Use this number sentence to write down three more pairs of decimal numbers that sum to 3:

1·6 + 1·4 = 3

Application to word problems

4. The bar chart below shows long-jump distances for 6 children.



a. How far did the winning child jump?

b. What was the difference between the two longest jumps?

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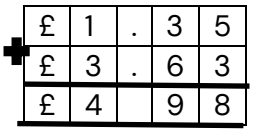
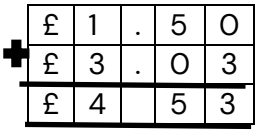
Written Methods with Decimals

Ensure that children are confident with lining up their place value columns. Give children calculations with the same number of decimal places. Build money or measure into this skill.



Move on to looking at how to line up column addition calculations where the amounts have different number of decimal places



Relate this to calculations just using decimal amounts. Can children consistently line columns up correctly?
3.5 + 2.04 =

Repeat for decimals and column subtraction.

Mastery

The table shows the cost of train tickets from different cities.

What is the total cost for a return journey to York for one adult and two children?
How much more does it cost for two adults to make a single journey to Hull than to Leeds?

		York	Hull	Leeds
Adult	Single	£13·50	£16·60	£11·00
	Return	£24·50	£30·00	£20·00
Child	Single	£9·75	£11·00	£8·00
	Return	£15·00	£18·50	£13·50

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<tr>
<td>Multiply & divide by 10, 100 and 1000</td>
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Human Moving Digits

Give children large digits to hold and create a “human number” by standing in a line. Where should they move if multiplying by 10? 100? Dividing by 1000? How many places? Emphasise that all children stick together – only the decimal point can come between you and we never separate two digits with a zero, but we may add a place holder at the beginning or end of a number (One or more children can be Zero the hero)

Patterns

Look at patterns to help children notice things about number.
2 x 10 = 20
2 x 100 = 200
2 x 1000 = 2000
Can children continue the pattern?

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What would the division pattern look like?
2÷10 = 0.2 …

Look at the chart below (taken from NCETM Professional Development Materials) and discuss relationships.
<table>
<tr><th>1,000s</th><th>100s</th><th>10s</th><th>1s</th><th>tenths</th><th>hundredths</th></tr>
<tr><td>●</td><td></td><td></td><td></td><td></td><td></td></tr>
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• '___ 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 ___.'

Use this to help solve missing box problems
e.g. 0.3 ÷ ? = 0.03
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<td>Multiply and divide numbers mentally drawing upon known facts</td>
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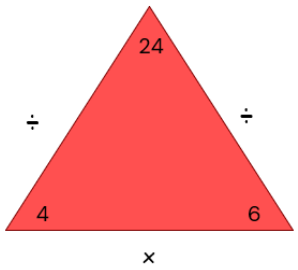
This objective may have been covered in the multiplication and division unit of work – if not revisit here


4 x 6 = 24
6 x 4 = 24
24 ÷ 4 = 6
24 ÷ 6 = 4
Remind children of the multiplication and division triangle and the related facts.

Extend to decimals e.g. what if 2.4 was at the top of the triangle what could be on the bottom?

Discuss how we have scaled 24 to 2.4 by making it 10 times smaller. How can we use our understanding of scaling from our multiplication and division unit to solve this question?
24 ÷ 6 = 4 becomes 2.4 ÷ 0.6 = 4

Solve missing number questions

? x 6 = 2.4
Use the known fact ? X 6 = 24 to support.

8 x ? = 2.4
Use the known fact 8 x ? = 24 to support.
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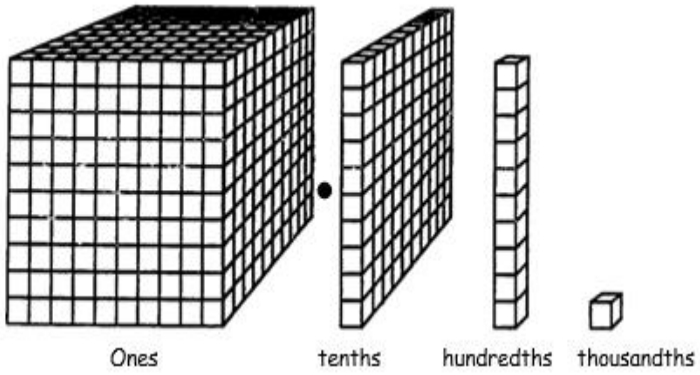
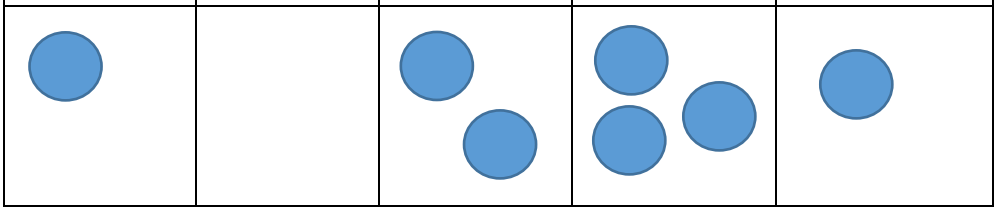
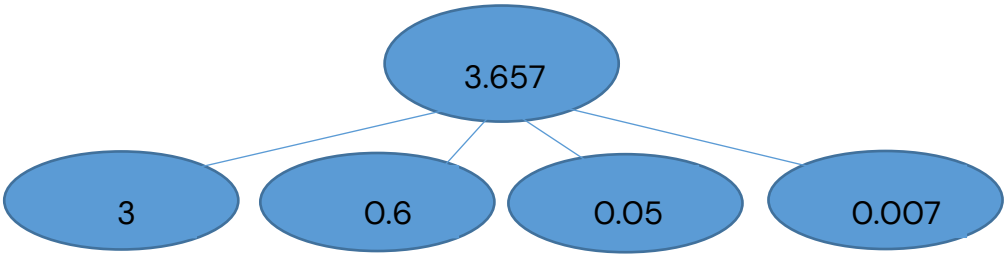
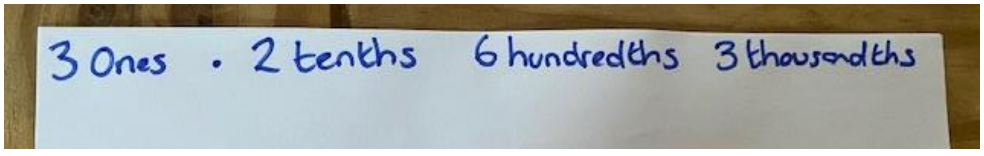
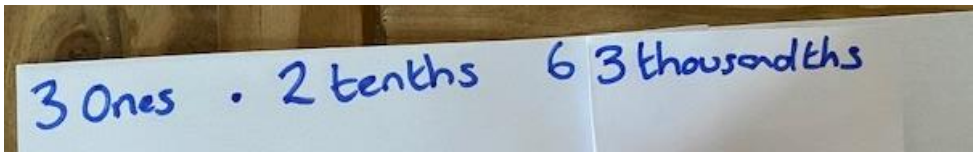
Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents	Reintroduce Dienes and ask children to recall how the pieces relate to each other. Emphasise the relationship of 10: 10 ones in a ten, 10 tens in a hundred, 10 hundreds in a thousand. Ask children to imagine the "thousand" block is now an enlarged "one" If we split this into 10 pieces, it is now part of a whole called a tenth. If we split the tenth into 10 pieces it is now a hundredth and if we split the hundredth, it is now a thousandth. Introduce the decimal point as a separator of whole numbers and fractional parts.  How many thousands are in one whole? How many thousands are in one hundredth? How thousands are in one tenth? Ask children to identify numbers represented by combinations of equipment and use place holders where necessary. **Ones** | **.** | **Tenth** | **Hundredths** | **Thousandths**  Play Cover the board to reinforce parts to a decimal. Children roll a dice 4 times to generate a decimal to 3 decimal places. Children can use their digits to create a number that they like. Children cover their number using counters on the board below. Their partner does the same thing but with a different colour of counter. Children are aiming to have 3 of their colour counters in a row. children will need to start thinking carefully about what decimal number they create from their dice roll in order to be strategic.

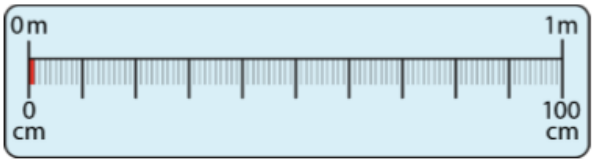
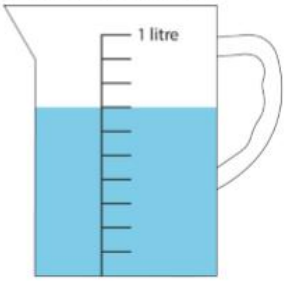
Link to part part whole model if appropriate.



Can children confidently identify how many tenths, hundredths or thousands a number has and express this in all of the different ways? Use paper folding to support if necessary.





	If children have only worked with 2dp up to now then repeat activities from working with Decimals to 2dp e.g. comparing and ordering a range of decimals, multiplying and dividing by 10, 100 and 1000 but this time including thousandths. Can children create related multiplication and division facts including thousandths.
Solve problems involving number up to three decimal places – link to measure	Application to measures can take place as part of this unit and then be further consolidated during the Measures unit of work. Images from NCETM PD Materials  More than one tenth - measures:  *'The litre jug is divided into ten equal parts and there is water up to the seventh mark; this is seven tenths of a litre.'* Consider ways to apply the skills to problem solving. *'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?'*

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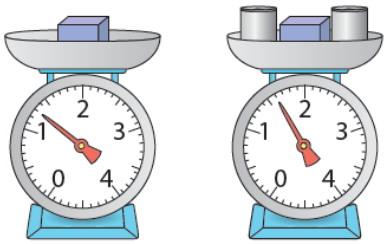
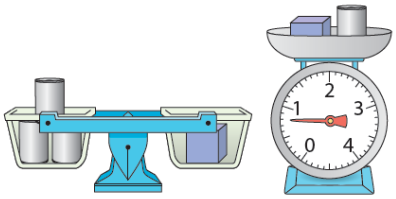
Mastery
A box weighs 1·3 kg. A box and two tins weigh 1·6 kg.

How much does one tin weigh in grams?


Mastery with Greater Depth
True or false?
1·5 kg + 600 g = 2·1 kg + 300 g
32 cm + 1·05 m = 150 cm – 0·13 m
$\frac{3}{4}$ ℓ + 0.05 ℓ = half of 1·6 ℓ

Explain your reasoning.

Mastery with Greater Depth
Here are some tins and boxes on two different scales.

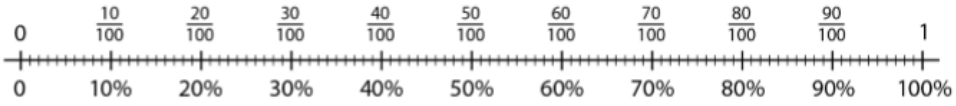
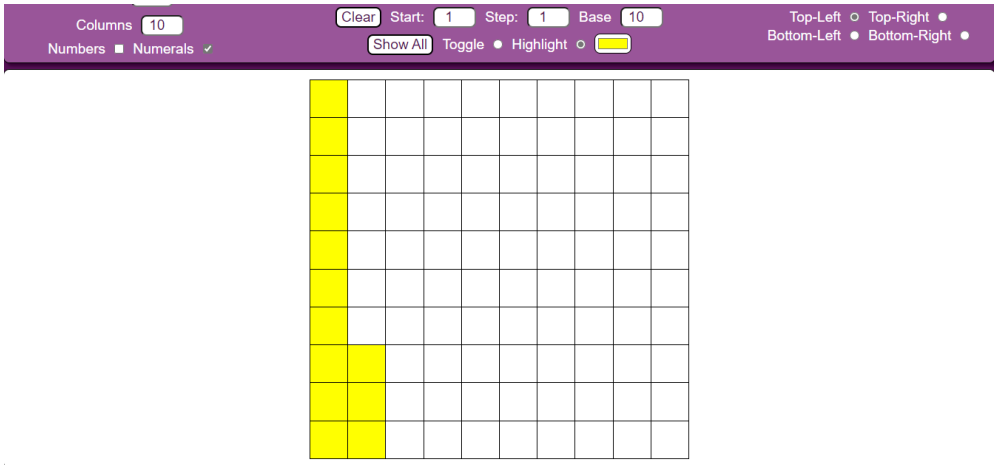
How many grams does a tin weigh? How many grams does the box weigh?

</td>
</tr>
<tr>
<td>Read and write decimal numbers as fractions [for example, 0.71 = 71/100].</td>
<td>
Take a bead string and split the beads into halves, how many beads are on one of these halves? 50 beads out of 100 – how do we record this as a decimal? 0.5.
So $\frac{1}{2}$ of our bead string is the same as 0.5 of our bead string.

Repeat with a quarter of the bead string – how many beads? 25 out of 100. How do we record this as a decimal? 0.25

Repeat with $\frac{3}{4}$ of the bead string. How many beads is this? 75 out of 100 beads. How do we record this as a decimal? 0.75

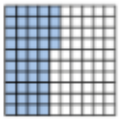
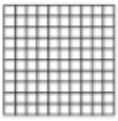
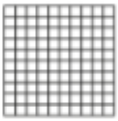
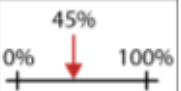
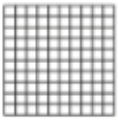
Children use what they already know about fractions and decimals to convert other fractions.

E.g. $\frac{20}{50}$ would be equivalent to $\frac{40}{100}$ which is 0.4
If we know that $\frac{1}{5}$ is equivalent to 0.2 what else do we know? $\frac{2}{5}$ is the same as 0.4.
</td>
</tr>
</table>

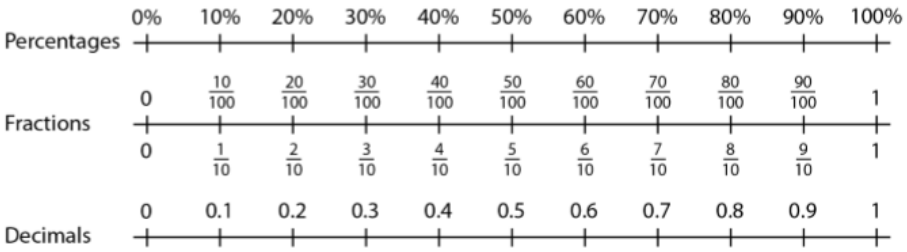
	Display the Fraction/Decimal equivalents for when we move onto Percentages. Solve comparison problems similar to those found in the SATs e.g. Tick the **two** numbers that are equivalent to $\frac{1}{4}$ Tick **two**. 0.25 ☐ 0.75 ☐ $\frac{25}{100}$ ☐ 0.5 ☐ $\frac{2}{5}$ ☐
Recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal	Consider how percentages are out of 100 so the whole is 100. Link to number line being 100 parts. NCETM PD Materials  Link to completing parts of a 100 square. How can we identify the percentage? What Percentage of the square is yellow? What percentage is white? What do these totals add up to and why?  *Maths Bot*

Tackle 100 square percentage investigation questions.
What percentage of the 100 square are prime numbers, square numbers, multiples of 7, multiples of 3 and 4?

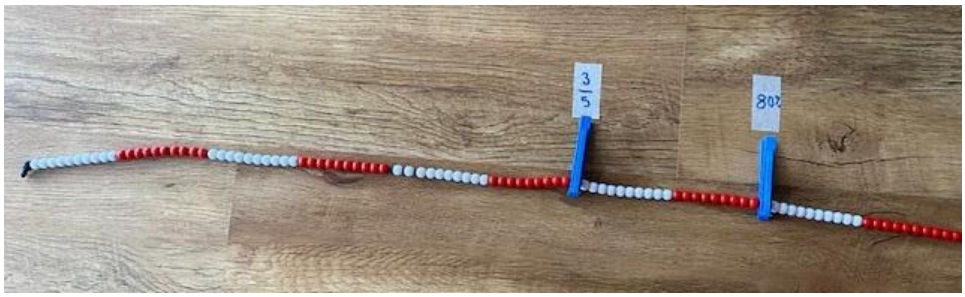
Complete charts that show fraction, decimal and percentage relationships such as this one from NCETM

Percentage	Fraction	Hundred square	Number line
	$\frac{\square}{100}$		
	$\frac{10}{100}$		
	$\frac{\square}{100}$		
6%	$\frac{\square}{100}$		

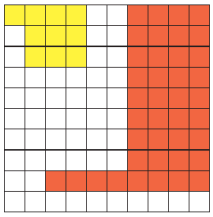
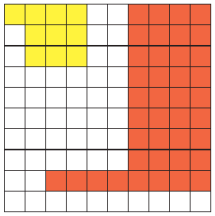
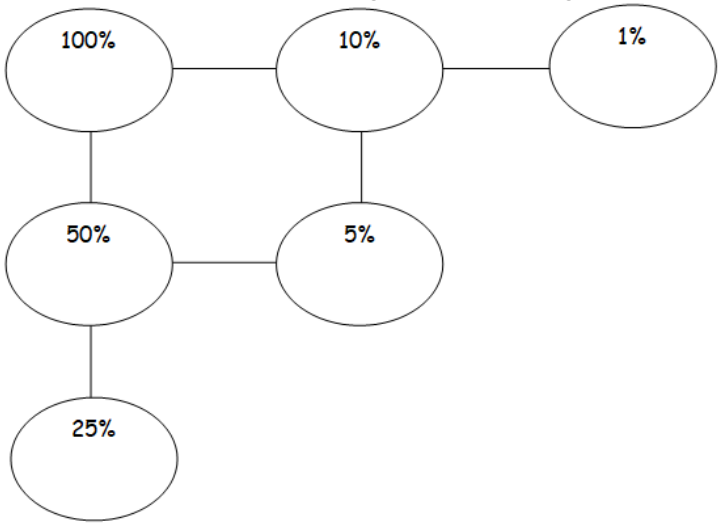
Show the links to Fractions and Decimals on a number line.



Would you rather have $\frac{3}{5}$ of a bar of chocolate or 80%?



Which is bigger $\frac{6}{10}$ or 50%

	Mastery Express the yellow section of the grid in hundredths, tenths, as a decimal and as a percentage of the whole grid. Do the same for the red section.  Greater Depth Suggest another way to colour the grid to show clearly each fraction that is shaded. What fraction of the grid is shaded in total? How many different ways can you express the fraction of the grid that is shaded? 
Finding percentages of amounts	Are children able to systematically find percentages of amounts? Show children the Percentage Chains image.  Remind children that 50% is a half and 25% is a quarter. If we knew that 100% of a number was 40 then what would 50% of that number be? We could half 40 because half is the same as 50. We could then say that 50% of 40 is 20.

<table>
<tr>
<td></td>
<td>
Repeat with 25% modelling the language and connections that children will need to use.

Discuss with the children that 10% is the same as $\frac{1}{10}$
When we were calculating fractions of a quantity to find $\frac{1}{10}$ of a number we divided it by 10. Because of this to find 10% of a number we can also divide it by 10.
If 100% of our number was 40 then 10% of 40 would be 4 because we divided it by 10.

How would you use what you know to find 5% - would you half then divide by 10 or divide by 10 then half?

How could we find 1% of a number?

What else can you work out now that you have these key facts?
'To find 52% of 200 I can first find 50% which is 100 and then I can find 1% which is 2. I would need to multiply my 1% by 2 to make that 2% which would be 4. I would then add my 50% and my 2% together to know that 52% of 200 is 104.'

Use the bar model to support with solving problems such as, a jumper was £30 but has 20% off in the sale. What is its new price?

<table>
<tr><td colspan="5">Whole = £30</td></tr>
<tr><td>20% = 6</td><td>20% = 6</td><td>20% = 6</td><td>20% = 6</td><td>20% = 6</td></tr>
<tr><td></td><td colspan="4">New Price 80% = £24</td></tr>
</table>

Extend to problem such as, a jumper has 30% off in the sale, the new price is £21. What was the original price?

<table>
<tr><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td><td>10%
£3</td></tr>
<tr><td colspan="3">Discount</td><td colspan="7">New Price = £21</td></tr>
<tr><td colspan="10">Original price at 100% = 30</td></tr>
</table>
</td>
</tr>
<tr>
<td>Solve problems which require knowing percentage and decimal equivalents</td>
<td>
Children to use their understanding of equivalent fractions to work our decimal and percentage equivalents that they don't already know

Children can apply what they know to unknown percentage/fractions/decimals equivelants
e.g $\frac{2}{5}$ would be equivelent to $\frac{4}{10}$ which is 0.4 and 40%

Can you put these numbers in order starting with the smallest?
$\frac{7}{10}$, 0.73, $\frac{7}{100}$, 0.073, 72%
</td>
</tr>
</table>

NRICH

Doughnut Percents

Age 7 to 14
Challenge Level ★★

This is one of a series of problems designed to develop students' team working skills. Other tasks in the series can be found by going to this article.

0·3	20%	$\frac{9}{10}$	30%	$0.\dot{6}$	$\frac{1}{4}$	0·8	$33\frac{1}{3}\%$
0·8	25%	$\frac{1}{2}$	40%	$\frac{1}{3}$	50%	$\frac{1}{10}$	$\frac{3}{4}$
$\frac{1}{5}$	$66\frac{2}{3}\%$	$\frac{1}{4}$	0·5	75%	90%	$\frac{3}{5}$	80%
0·4	$\frac{4}{5}$	$\frac{3}{10}$	10%	50%	0·6	0·25	30%

What are you aiming to do?

Every member of the team must end up with a set of four dominoes which join together to form a "doughnut" where touching ends have equal value. For example:

0·8	40%	$\frac{2}{5}$
80%		$\frac{1}{4}$
0.3	30%	25%