Summer Block 3

Decimals

Small steps

Step 1	Use known facts to add and subtract decimals within 1
Step 2	Complements to 1
Step 3	Add and subtract decimals across 1
Step 4	Add decimals with the same number of decimal places
Step 5	Subtract decimals with the same number of decimal places
Step 6	Add decimals with different numbers of decimal places
Step 7	Subtract decimals with different numbers of decimal places
Step 8	Efficient strategies for adding and subtracting decimals

Small steps

Step 9	Decimal sequences
Step 10	Multiply by 10, 100 and 1,000
Step 11	Divide by 10, 100 and 1,000
Step 12	Multiply and divide decimals – missing values

Use known facts to add and subtract decimals within 1

Notes and guidance

In this small step, children add and subtract decimals within 1 whole using known facts. They will move on to using a formal method to add and subtract decimals later in this block.

Through unitising, children are able to make connections between whole numbers and decimals. For example, 7 ones + 9 ones = 16 ones, therefore 7 hundredths + 9 hundredths = 16 hundredths. Ensure that children have a good understanding of place value, as a common error is to ignore the place value of decimals, leading to incorrect calculations such as 0.48 + 0.3 = 0.51. Using a stem sentence allows children to recognise that the unit they are adding or subtracting must be the same, so in this example 48 hundredths + 30 hundredths = 78 hundredths. Hundred squares and place value charts are useful representations to support children when adding and subtracting decimals within 1 whole.

Things to look out for

- Children may add digits together irrespective of which place value column they are in, e.g. 0.45 + 0.3 = 0.48
- Children may rely on using formal written methods to add/subtract decimals within 1 instead of using known facts.

Key questions

- How can you use the hundred square to help you with the addition/subtraction?
- What whole number calculation can you compare this calculation to?
- How can you convert between tenths and hundredths?
- Which known facts can help you with this calculation?
- What is 1 hundredth more than your number?
- What is 2 tenths less than your number?

Possible sentence stems

- ______ tenths = ______ hundredths
- ______ ones + ______ ones = ______ ones,

  so ______ tenths + ______ tenths = ______ tenths
- ______ hundredths − ______ hundredths = ______ hundredths

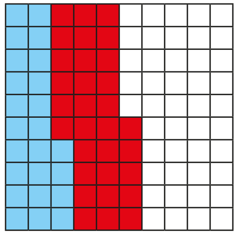
National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

Use known facts to add and subtract decimals within 1

Key learning

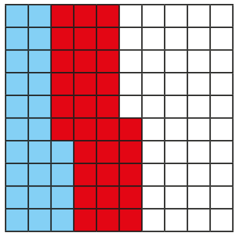
- Complete the sentences.
  - Each square in this hundred square represents 1 whole.



______ ones + ______ ones = ______ ones

______ + ______ = ______

  - Each square in this hundred square represents one-hundredth of the whole.



______ hundredths + ______ hundredths = ______ hundredths

______ + ______ = ______

What is the same and what is different about the hundred squares?

- Use a hundred square to work out the calculations.

0.72 + 0.13 | 0.16 + 0.08 | 0.28 + 0.49 | 0.62 + 0.19

- Here is a number.

Ones	Tenths	Hundredths
	0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01 0.01 0.01 0.01

  - What is 3 tenths less than this number?
  - What is 0.02 more than this number?

- Max uses known facts to complete the subtraction.

86 – 24 = 62, so 0.86 – 0.24 = 0.62

Use known facts to work out the calculations.

  - 0.89 – 0.41
  - £0.45 – £0.27
  - 37 hundredths more than 14 hundredths
  - 72 hundredths – 19 hundredths

- Mo and Dora are working out 0.76 – 0.3

Mo 0.76 – 0.3 = 0.73

Dora 0.76 – 0.3 = 0.46

Who is correct?

How do you know?

Use known facts to add and subtract decimals within 1

Reasoning and problem solving

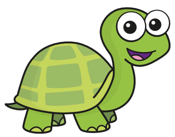
Is the statement true or false?

21 hundredths – 10 hundredths = 0.21 – 0.1

Explain your answer.

True

Tiny is working out 0.57 + 0.4



57 + 4 = 61
So 0.57 + 0.4 = 0.61

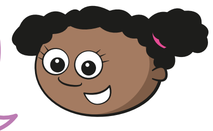
What mistake has Tiny made?

What is the correct answer?

0.97

Whitney is working out 0.4 – 0.07

I cannot work out 0.4 – 0.07, because 7 is greater than 4



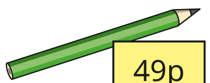
Do you agree with Whitney?

Explain your answer.

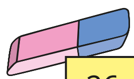
No

Brett has £0.89

He buys a pencil and a rubber.



49p



26p

How much money does Brett have left?

Give your answer in pounds and pence.

£0.14

Complements to 1

Notes and guidance

In this small step, children find complements to 1 for numbers with up to 3 decimal places.

It is important for children to see the links with number bonds to 10, 100 and 1,000, and it may be useful to revise these first. The use of ten frames and hundred squares can support children to see the number bonds to 10 and 100 and the corresponding number bonds to 1 for numbers with 1 or 2 decimal places respectively. The number bonds to 1,000 and corresponding 3-decimal place bonds to 1 can be more challenging, but children should be encouraged to apply the same principles as for numbers with fewer decimal places.

Things to look out for

- When finding a complement to 1, children may assume that they need to find the bond to 10 in each place value column, for example 0.365 + 0.745 = 1
- Children may try to use a formal written method to find complements to 1 instead of using known number bonds.

Key questions

- What number bonds can you use to help you?
- What is the missing number in 64 + ______ = 100?
  How does this help you to work out the missing number in 0.64 + ______ = 1?
- What do you need to add to ______ to make 10/100/1,000?
  So what do you need to add to ______ to make 1?
- What is the same and what is different about finding complements to 10/100/1,000 and complements to 1?

Possible sentence stems

- 1 = ______ tenths = ______ hundredths = ______ thousandths
- ______ ones + ______ ones = 10 ones,
  so ______ tenths + ______ tenths = 10 tenths = 1
- ______ hundredths/thousandths + ______ hundredths/thousandths = 1

National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

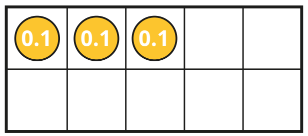
Complements to 1

Key learning

- Each square in the ten frame represents 1 tenth.

  The ten frame represents 1 whole.

  Complete the statements.



3 tenths + ______ tenths = 10 tenths

10 tenths = 1 whole

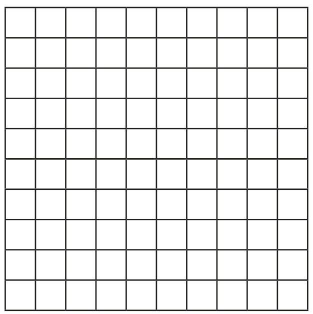
___ . ___ + ___ . ___ = 1

Use a ten frame to complete the calculations.

▸ 0.8 + ______ = 1
▸ 1 = ______ + 0.4
▸ 0.1 + ______ = 1
▸ 1 = 0.5 + ______

- Each square in the hundred square represents 1 hundredth of the whole.

  Use the hundred square to complete the calculations.



▸ 0.55 + ______ = 1
▸ 1 = 0.32 + ______
▸ 0.11 + 0.5 + ______ = 1

- Jack is working out 0.763 + ______ = 1

763 ones + 237 ones = 1,000 ones,
so 763 thousandths + 237 thousandths = 1,000 thousandths.
0.763 + 0.237 = 1

Use Jack's method to complete the calculations.

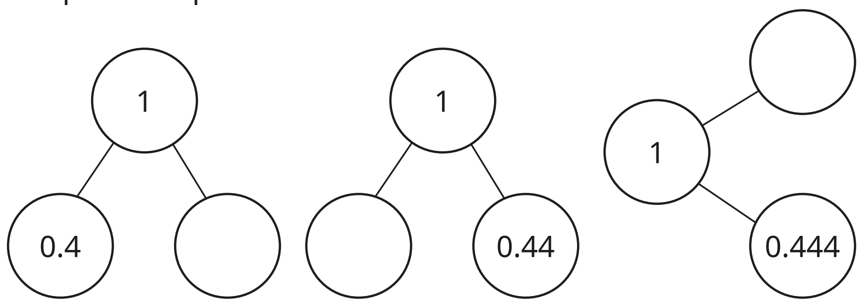
▸ 0.356 + ______ = 1
▸ 1 = 0.873 + ______
▸ ______ + 0.456 = 1
▸ 1 = ______ + 0.048

- Complete the calculations.

▸ 0.3 + ______ = 1
▸ 0.35 + ______ = 1
▸ 0.399 + ______ = 1

What is the same and what is different?

- Complete the part-whole models.

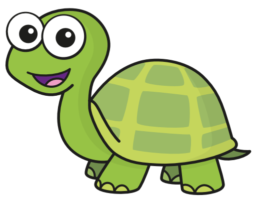


Complements to 1

Reasoning and problem solving

Tiny is working out the missing number.

$0.333 + \boxed{} = 1$



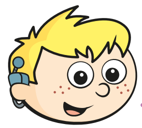
Explain why Tiny is incorrect.

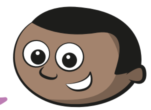
What is the missing number?

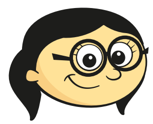
0.667

Max, Mo and Annie are baking.

They have 1 kg of flour between them.







What is the mass of the flour that will be left over?

Give your answer in kilograms.

Compare methods with a partner.

0.325 kg

White Rose Maths

Add and subtract decimals across 1

Notes and guidance

In this small step, children add and subtract decimals that cross 1

For some numbers, using known facts is again a useful strategy, for example 6 + 7 = 13, so 0.6 + 0.7 = 1.3. Children can also use their experience from the previous step of finding complements to 1, using the "make 1" strategy to help them add and subtract. This requires a secure understanding of flexible partitioning, which allows them to partition decimals into appropriate numbers. For example, when calculating 0.64 + 0.45, children can use their knowledge of finding complements to 1: 0.64 + 0.36 = 1, therefore 0.45 should be partitioned into 0.36 and 0.09, leading to 0.64 + 0.36 = 1 and 1 + 0.09 = 1.09. Part-whole models or other diagrams can be used to support this. Similarly, when subtracting decimals, encourage children to subtract to get to 1 first, then subtract the remaining decimal.

Things to look out for

- Children may make place value errors, for example using 6 + 7 = 13 to deduce 0.6 + 0.7 = 0.13
- Children may make errors with complements to 1 by looking at columns individually, for example thinking that adding 0.38 to 0.72 makes 1

Key questions

- How could partitioning one of the numbers help you?
- How do you decide which number to partition?
- How could you partition this number to help find a complement to 1? What number is left?
- How can you use your number bond knowledge to help you?
- What is the same and what is different about crossing 1 when adding and subtracting decimals?

Possible sentence stems

- ______ can be partitioned into ______ and ______
- The first number is ______ away from 1

  The second number can be partitioned into ______ and ______

  The total is 1 + ______ = ______
- I can subtract ______ to get to 1 and then subtract ______ from 1

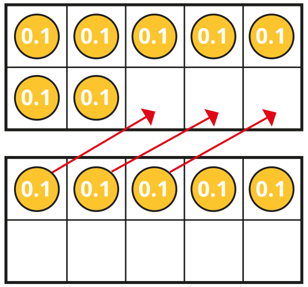
National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

Add and subtract decimals across 1

Key learning

- Huan is using ten frames to work out 0.7 + 0.5



0.7 + 0.3 = 1
1 + 0.2 = 1.2
0.7 + 0.5 = 1.2

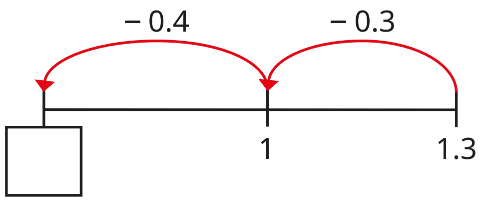
Use Huan's method to work out the additions.

0.8 + 0.6	0.2 + 0.9	0.4 + 0.9	0.8 + 0.9

- Scott is using a number line to subtract decimals crossing 1

He is working out 1.3 – 0.7

Complete Scott's workings.

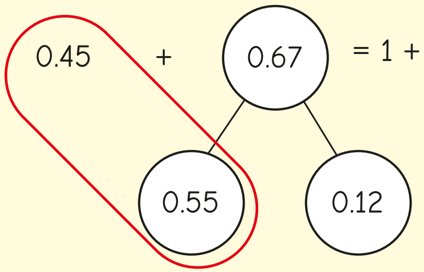


1.3 – 0.3 = 1
1 – 0.4 = $\boxed{}$

Use Scott's method to work out the subtractions.

1.3 – 0.4	1.5 – 0.9	1.6 – 0.8	1.2 – 0.5

- Dani is finding a complement to 1 to work out 0.45 + 0.67

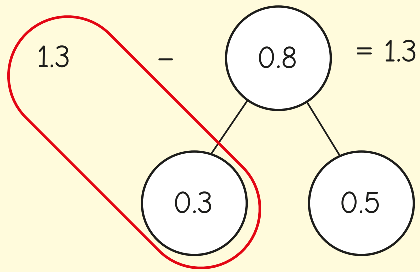


= 1 + 0.12 = 1.12

Use Dani's method to work out the additions.

0.74 + 0.78	0.74 + 0.42	0.57 + 0.65	0.81 + 0.46

- Kim uses partitioning to work out 1.3 – 0.8



= 1.3 – 0.3 – 0.5 = 1 – 0.5
= 0.5

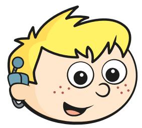
Use Kim's method to work out the subtractions.

1.1 – 0.4	1.24 – 0.59	1.36 – 0.48

Add and subtract decimals across 1

Reasoning and problem solving

Max is working out 0.78 + 0.43



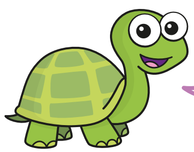
I will add 4 tenths to 7 tenths, 3 hundredths to 8 hundredths and then add my answers.

Will Max's method work?

How do you know?

Yes

Tiny is working out 0.8 + 0.4



8 + 4 = 12, so
0.8 + 0.4 = 0.12

What mistake has Tiny made?

What is the correct answer?

1.2

You need a partner and a 6-sided dice for this game.

0 . ☐ ☐

Take turns to roll the dice twice and create a decimal number less than 1 using the digits you rolled.

Repeat to create a second number.

Add your two numbers together.

Repeat until you have each added four numbers.

The winner is the person whose total is the closest to 1.5 **without** going above 1.5

Compare strategies as a class.

Add decimals with the same number of decimal places

Notes and guidance

In this small step, children add decimal numbers with the same number of decimal places, using the formal written method for the first time.

Children begin by looking at calculations with no exchanges before moving on to calculations that involve exchanges and numbers with up to 3 decimal places. Place value charts and counters are extremely helpful in ensuring that children understand the value of each digit and when an exchange is needed. When there are 10 or more in a place value column, children can physically exchange, for example, 10 tenths for 1 whole. They could also compare using column methods for integers and decimals, for example comparing 46 + 38 with 4.6 + 3.8

Children also perform decimal calculations with money, converting amounts in pence to pounds if necessary.

Things to look out for

- Children may not line up the columns correctly, particularly if the calculation involves zero as a placeholder.
- Children may position the decimal point incorrectly.
- Children may forget to add the exchanged digit.

Key questions

- How can you represent this calculation using a place value chart?
- What happens when there are 10 or more counters in a place value column? What is the same and what is different in the formal written method?
- Why is the position of the decimal point important?
- Why is it important to line up the columns?
- Will this addition involve an exchange? How do you know?

Possible sentence stems

- _____ ones + _____ ones = ones,

  so _____ tenths + _____ tenths = _____ tenths
- The greatest number I can have in any column is _____

  If the total is greater than _____, I need to make an _____

National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

Add decimals with the same number of decimal places

Key learning

- Use the place value chart and the column method to work out 3.42 + 4.14

Ones	Tenths	Hundredths
1 1 1	0.1 0.1 0.1 0.1	0.01 0.01
1 1 1 1	0.1	0.01 0.01 0.01 0.01

	3	· 4	2	
+	4	· 1	4	
		·		

Use place value charts and the column method to work out the additions.

5.2 + 3.6 | 4.13 + 2.45 | 3.146 + 1.513 | 4.054 + 3.624

- Use the place value chart and the column method to add 2.83 and 4.41

Ones	Tenths	Hundredths
1 1	0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.01 0.01 0.01
1 1 1 1	0.1 0.1 0.1 0.1	0.01

	2	· 8	3	
+	4	· 4	1	
		·		

Use place value charts and the column method to work out the additions.

4.7 + 3.6 | 3.29 + 4.65 | 8.714 + 2.613 | 15.86 + 13.48

- Use the column method to work out the additions.

	4	· 4	2
+	3	· 5	3
		·	

	4	· 5	5
+	3	· 0	7
		·	

	4	· 6	0	2
+	3	· 9	4	9
		·		

- Filip buys a hat and a scarf.


£4.85


£9.15

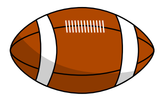
How much does it cost him altogether?

- Aisha buys three of these items.


£4.45


£5.59


£3.99


£4.05

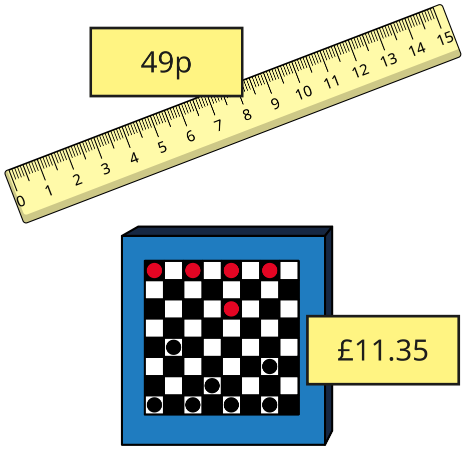
What is the most she could pay?

What is the least she could pay?

Add decimals with the same number of decimal places

Reasoning and problem solving

Tiny is working out the total cost of a ruler and a game.



		1	1 .	3	5	
	+	4	9 .			
		6	0 .	3	5	
		1				

Explain Tiny's mistake.

Tiny has put the price of the ruler in the wrong columns.

49p = £0.49

Use the digit cards to complete the column addition.

You may use each digit only once in each addition.

0	1	2	3	4
5	6	7	8	9

		.			
	+	.			
		.			

What is the greatest possible sum?

What is the smallest possible sum?

Is there more than one way of creating each total?

greatest: 18.39

smallest: 1.59

Subtract decimals with the same number of decimal places

Notes and guidance

In this small step, children subtract numbers with the same number of decimal places, using the formal written method for the first time.

As with addition, children first look at calculations with no exchanges, before moving on to calculations that involve exchanges and numbers up to 3 decimal places. Place value charts and counters continue to support understanding of the value of each digit and when an exchange is needed. Again, children should look at the formal and practical methods alongside each other to begin with. When an exchange is needed, children can physically exchange, for example, 1 one for 10 tenths. They could also compare using column methods for integers and decimals, for example comparing 76 – 28 with 7.6 – 2.8

Give children opportunities to apply subtraction to real-life contexts, for example using measures and money.

Things to look out for

- Children may not line up the columns correctly, particularly when zero is used as a placeholder.
- When subtracting using the column method, children may just find the difference between the digits, rather than making an exchange when necessary, for example 4.5 – 3.8 = 1.3

Key questions

- What are ______ ones/tenths/hundredths subtract ______ ones/tenths/hundredths?
- Will you need to make an exchange in this subtraction? How do you know?
- What can you exchange 1 one/tenth/hundredth for?
- Why is the position of the decimal point important?
- What does zero in a place value column mean? How does this affect a subtraction?

Possible sentence stems

- ______ ones/tenths subtract ______ ones/tenths is equal to ______ ones/tenths.
- I need to make an exchange because …
- I need to exchange 1 ______ for 10 ______

National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

Subtract decimals with the same number of decimal places

Key learning

- Use the place value chart and the column method to work out 4.23 – 2.12

Ones	Tenths	Hundredths
1 1 1 1	0.1 0.1	0.01 0.01 0.01

$$\begin{array}{rccc} & 4 & .\,2 & 3 \\ - & 2 & .\,1 & 2 \\ \hline & & . & \\ \hline \end{array}$$

  Did you need to make any exchanges?

- Use the place value chart and the column method to work out 6.35 – 4.83

  Will you need to make any exchanges?

Ones	Tenths	Hundredths
1 1 1 1 1 1	0.1 0.1 0.1	0.01 0.01 0.01 0.01 0.01

$$\begin{array}{rccc} & 6 & .\,3 & 5 \\ - & 4 & .\,8 & 3 \\ \hline & & . & \\ \hline \end{array}$$

  Use a place value chart and a column method to work out the subtractions.

  5.7 – 2.4 | 8.56 – 3.37 | 8.313 – 2.614 | 13.24 – 12.06

- Use the column method to work out the subtractions.

$$\begin{array}{rcc} & 6 & .\,4 \\ - & 3 & .\,8 \\ \hline & . & \\ \hline \end{array}$$

$$\begin{array}{rcccc} & 7 & 3 & .\,0 & 4 \\ - & 3 & 9 & .\,1 & 2 \\ \hline & & & . & \\ \hline \end{array}$$

$$\begin{array}{rccc} & 5 & .\,0 & 5 \\ - & 2 & .\,1 & 5 \\ \hline & . & & \\ \hline \end{array}$$

$$\begin{array}{rcccc} & 2 & 4 & .\,6 & 3 \\ - & 1 & 7 & .\,8 & 1 \\ \hline & & & . & \\ \hline \end{array}$$

- Tom has £12.45

  He buys a football for £6.99

  How much money does he have left?

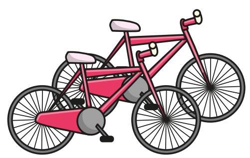
  Compare methods with a partner.

- Annie and Amir are doing a sponsored bike ride.

  Annie cycles 8.47 miles.

  Amir cycles 5.95 miles.

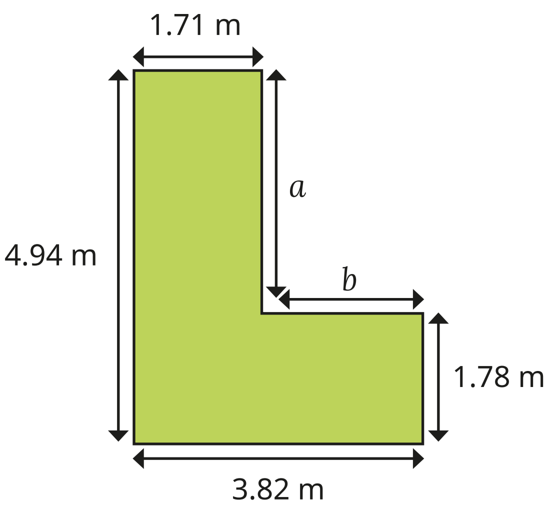
  How much further does Annie cycle than Amir?



Subtract decimals with the same number of decimal places

Reasoning and problem solving

Work out the lengths of sides a and b.



a = 3.16 m

b = 2.11 m

What is the perimeter of the hexagon?

17.52 m

Dexter and Nijah have some money.

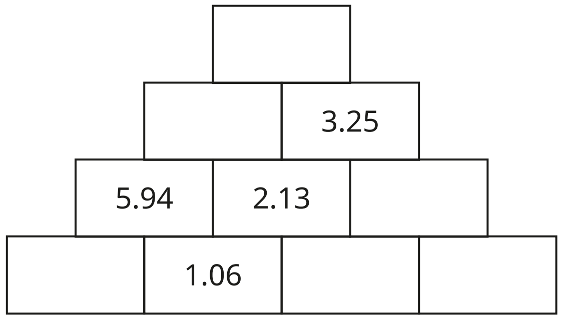
Dexter has £3.45 more than Nijah.

They have £12.45 altogether.

How much money does Nijah have?

£4.50

In the number pyramid, each number is the sum of the two numbers below it.



Complete the number pyramid.

11.32

8.07

1.12

4.88 1.07 0.05

Add decimals with different numbers of decimal places

Notes and guidance

In this small step, children extend their knowledge of adding decimal numbers to include numbers with a different number of decimal places.

Emphasise the importance of lining up the decimal point in order to ensure that digits with the same place value are also aligned. A place value chart is a useful representation to reinforce this, as children can see the value of each digit in the correct place value column. Children could be encouraged to "fill" empty columns with trailing zeros to promote an understanding of using the zero as a placeholder and making it easier to see how the numbers line up.

Children could also use estimation to think about whether their answers are sensible.

As in previous steps, it may be useful to begin with examples that do not require an exchange, so that children can focus on the new learning of adding numbers with a different number of decimal places.

Things to look out for

- Children may not line up digits correctly.
- Children may put trailing zeros in the wrong place, for example writing 8.6 as 8.06 instead of 8.60

Key questions

- How can you show this addition on a place value chart?
- What happens when there are 10 or more counters in a place value column?
- Why is the position of the decimal point important?
- Why is it important to line up the columns?
- Will this addition involve an exchange? How do you know?
- What could you add to the spaces that do not contain a digit, to help you?

Possible sentence stems

- When adding two decimal numbers, I need to keep the ______ in line.
- ______ tenths + ______ tenths = ______ tenths, so I do/do not need to make an exchange.

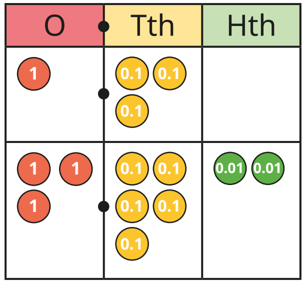
National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

Add decimals with different numbers of decimal places

Key learning

- Use the place value chart and column method to work out 1.3 + 3.52

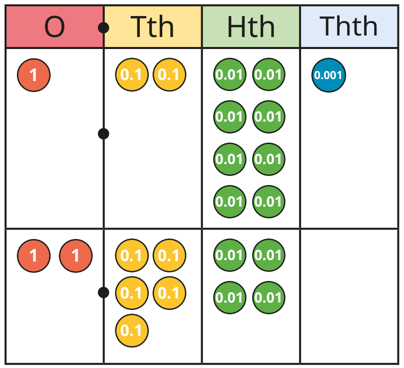


		1 ·	3		
	+	3 ·	5	2	
		·			

Work out the additions.

▶ 5.7 + 3.16 ▶ 2.017 + 3.5 ▶ 4.61 + 3.372

- Use the place value chart and column method to work out 1.281 + 2.54



		1 ·	2	8	1	
	+	2 ·	5	4		
		·				

Work out the additions.

▶ 4.7 + 3.56 ▶ 2.8 + 1.317 ▶ 3.595 + 4.62

- Use the column method to work out the additions.

		4 ·	7	5	3	
	+	3 ·	1	7		
		·				

		2 ·	6	8		
	+	1 ·	4	0	6	
		·				

		5 ·	6	8		
	+	2 ·	3	3	2	
		·				

- Complete the bar model.

4.35	12.7

- Sam is cycling in a race.

  She has cycled 3.145 km and has 4.1 km left to cycle.

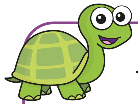
  What is the total distance of the race?

- Work out the additions.

8.7 m + 5.29 m	0.63 litres + 0.8 litres
6.3 kg + 2.75 kg	5.173 km + 4.08 km

Add decimals with different numbers of decimal places

Reasoning and problem solving



Tiny is working out
4.144 + 1.4

What mistake has Tiny made?

What is the correct answer?

		4 •	1	4	4	
	+			1 •	4	
		4 •	1	5	8	

5.544

Find a solution to the addition with:

- no exchanges
- 1 exchange
- 2 exchanges

$\square.\square\square + \square.\square\square\square = 3.678$

multiple possible answers, e.g.
1.15 + 2.528   2.28 + 1.398   2.79 + 0.888

Write the additions in the correct columns in the table.

9.99 + 0.1   9.99 + 1

9.99 + 0.001   9.99 + 0.01

No exchange	Exchange in ones column	Exchange in tenths column	Exchange in hundredths column	Exchange in thousandths column

Some additions may go in more than one column.

Add two more additions to each column, where the numbers have a different number of decimal places.

no exchange: 9.99 + 0.001
ones column: 9.99 + 1,
9.99 + 0.1, 9.99 + 0.01
tenths column:
9.99 + 0.1, 9.99 + 0.01
hundredths column:
9.99 + 0.01

Subtract decimals with different numbers of decimal places

Notes and guidance

In this small step, children extend their knowledge of subtracting decimal numbers to include numbers with a different number of decimal places.

It is important that children continue to practise lining up the decimal point carefully and ensure that each digit is in the correct column. A place value chart could be used to reinforce this. In the column method, show children how to "fill" empty columns with zeros, which will support them when exchanges are required. They need to be secure with the fact that, for example, 6 and 6.0 have the same numerical value, as do 4.7 and 4.70 and so on.

Children need a good understanding of column subtraction from previous steps, knowing when to make an exchange – particularly when zeros are involved.

Things to look out for

- Children may not line up digits correctly.
- In calculations such as 7.6 – 2.38, children may subtract where there are pairs of numbers but just write the last digit, giving the answer of 5.38, instead of writing 7.60 – 2.38 and making an exchange.
- Children may struggle when multiple exchanges are required, for example 13 – 2.532

Key questions

- How should the digits be lined up in a column subtraction?
- How do you show that there is nothing in a place value column?
- Do you need to make an exchange? How do you know?
- How do you make an exchange if there is a zero in the column that you want to make the exchange from?
- Is the column subtraction method the most efficient method to use in this example?

Possible sentence stems

- When subtracting two decimal numbers, I need to keep the ______ in line.
- If I need to subtract hundredths and there is no digit in the hundredths column, I can put in a ______ and then make an ______

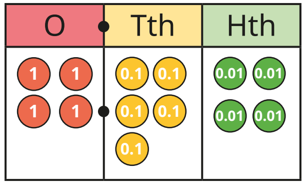
National Curriculum links

- Recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents
- Solve problems involving number up to 3 decimal places

Subtract decimals with different numbers of decimal places

Key learning

- Alex is using a place value chart and column subtraction to work out 4.54 – 1.4

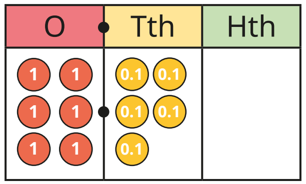


	4.	5	4
–	1.	4	
	3.	1	4

Use place value charts and the column method to work out the subtractions.

2.65 – 1.4 | 5.42 – 1.3 | 7.326 – 4.01 | 8.72 – 4.1

- Teddy is using a place value chart and column subtraction to subtract 4.23 from 6.5



	6.	5	0
–	4.	2	3
	.		

Why can Teddy write 6.5 as 6.50?

Complete the calculation using place value counters to help you.

- Use the column method to work out the subtractions.

	4.	7	5	
–	3.	1	2	3
	.			

	5.	3	
–	2.	0	7
	.		

	6.	0	6
–	3.	7	
	.		

	8.	7		
–	2.	0	6	8
	.			

- Eva buys a bag of apples costing £4.27

  She pays with a £10 note.

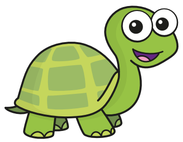
  How much change does she get?

- Work out the subtractions.
  - 5,000 g – 3,200 g = ______ g
  - 5 kg – 3.2 kg = ______ kg
  - 450 cm – 255 cm = ______ cm
  - 4.5 m – 2.55 m = ______ m
  - 550 ml – 60 ml = ______ ml
  - 0.55 l – 0.06 l = ______ l

Subtract decimals with different numbers of decimal places

Reasoning and problem solving

Tiny is working out 4.9 – 3.84



		4 •	9		
	–	3 •	8	4	
		1 •	1	4	

What mistake has Tiny made?

Work out the correct answer.

1.06

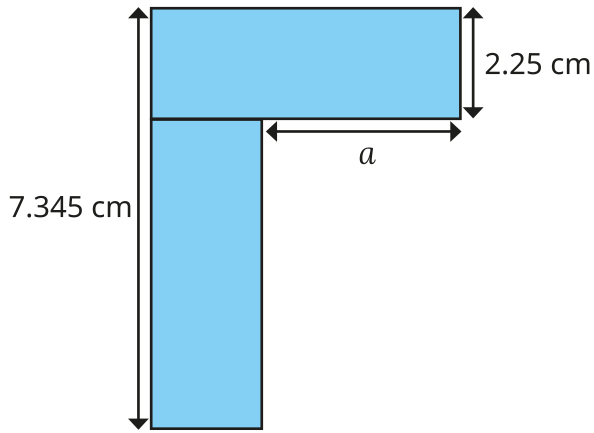
Rosie, Mo and Dora each have some money.

- Rosie has £1.63 more than Mo.
- Dora has £4 more than Rosie.
- Dora has £7.60

How much money do they have altogether?

£13.17

The shape is made of two identical rectangles.



Find the length of the part marked a.

2.845 cm

Efficient strategies for adding and subtracting decimals

Notes and guidance

In this small step, children explore a range of different calculation strategies to solve addition and subtraction problems, making decisions about which strategy would be the most effective for each problem.

Encourage children to consider the question carefully rather than automatically choosing the same option every time. They can experiment by solving the same calculation in a number of ways and considering which way was the most efficient and why. In particular, discuss when mental strategies are more appropriate than written, for example when compensation can be used, such that adding 9.99 can be simplified to add 10 and then subtract 0.01. Number lines are useful to support this approach.

Things to look out for

- Children may automatically use formal written methods, even when they are less efficient.
- Children may not transfer strategies used with integers to decimals without explicit teaching.
- When working mentally, children may make place value errors.

Key questions

- Do you need to make an exchange?
- What methods could you use?
  Which is most efficient for this calculation?
- When would you use a mental method?
- When would you use an informal jotting such as a number line?
- When would a formal method be more efficient?
- What integer is 9.9 close to?
  How can this help with the calculation?
- How could partitioning help with this calculation?

Possible sentence stems

- ______ is close to ______, so I can change the calculation to ______
- I will work this out using ______ because …

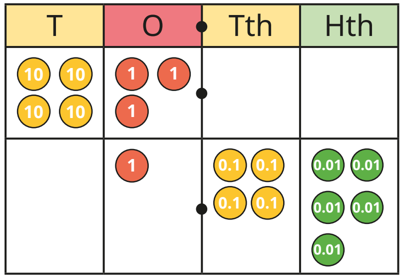
National Curriculum links

- Solve problems involving number up to 3 decimal places

Efficient strategies for adding and subtracting decimals

Key learning

- Dani uses a place value chart and a written method to work out 43 + 1.45



		4	3 •			
	+		1 •	4	5	
		4	4 •	4	5	

Could Dani have worked the answer out using a mental method?

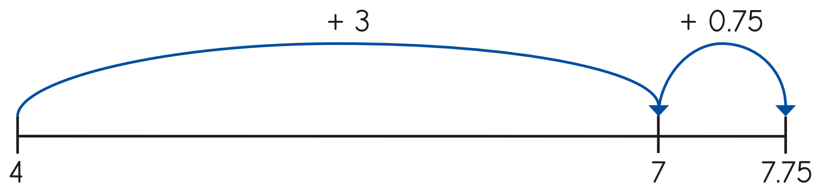
Which of these calculations could you work out mentally?

For which calculations would you use a written method?

▸ 8.2 + 3.1 ▸ 6.9 + 0.45 ▸ 9.8 – 4 ▸ 90.8 – 0.45

▸ 18.02 + 34.19 ▸ 6.7 + 0.25 ▸ 9.8 – 4.56 ▸ 9.8 – 0.4

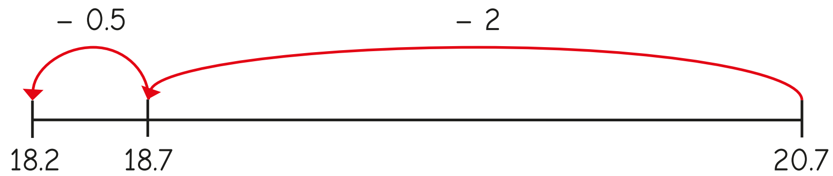
- Whitney uses a number line to work out 4 + 3.75



Use Whitney's method to work out the additions.

▸ 7 + 0.65 ▸ 4 + 3.2 ▸ 12 + 4.63 ▸ 19 + 8.784

- Brett is counting back along a number line to work out 20.7 – 2.5



Use Brett's method to work out the subtractions.

▸ 16.8 – 2.5 ▸ 12.9 – 4.3 ▸ 14.6 – 8.05 ▸ 15.75 – 8.32

- Work out 8.4 + 3.42 using:
  - a mental method
  - a number line
  - the column method.

Which method do you think is best?

Would this be the best method to work out 8.4 – 3.42?

Explain your answer.

- Use your preferred method to work out the calculations.

43 – 2.14 + 0.86	23 + 4.105	19 – 0.25	19 – 17.37

Compare methods with a partner.

Efficient strategies for adding and subtracting decimals

Reasoning and problem solving

For each calculation, decide if you would use a mental method, an informal jotting or the formal written method.

57.9 + 4.8	12.8 + 5.4	5.6 + 2.1
9.5 – 4.3	8.6 – 7.7	3.25 – 1.37

Mental method	Informal jotting	Formal written method

Explain your choices.

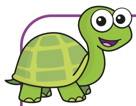
Add one more calculation to each column.

Discuss as a class.

Work out the missing digits.

	3	1	. $\boxed{}$	0
–		$\boxed{}$	. 3	7
	2	9	. 6	3

31.00 – 1.37



Tiny is working out 63.7 – 9.9

63.7 – 9.9 = 63.7 – 10 – 0.1
= 53.7 – 0.1
= 53.6

What mistake has Tiny made?

How could you work out the change from £20 when you spend £6.99?

Tiny should have subtracted 10 and then **added** 0.1

Decimal sequences

Notes and guidance

In this small step, children combine their knowledge of number sequences and decimals to explore decimal sequences.

Given a range of sequences, children look for patterns and use and find simple rules that involve adding or subtracting a decimal each time. It is important to note that they are not expected to generate algebraic expressions at this stage. Children should, however, use the language associated with sequences such as “term” and “rule”. They should make predictions about the next term or subsequent terms in a sequence or, given different terms in a sequence, work backwards to find previous terms. Number lines are useful for representing sequences.

This step supports children’s understanding of counting in decimals, particularly across an integer, and prepares them for further study of sequences in Year 6

Things to look out for

- Children may make errors when crossing an integer boundary, for example 0.3, 0.6, 0.9, 0.12
- When looking for terms earlier in a sequence, children may use the operation for the rule instead of the inverse operation, for example adding when they need to subtract.

Key questions

- Are the terms increasing or decreasing in value?
- Are the terms increasing or decreasing by the same amount each time? If so, by how much?
- What will the next term in the sequence be?
- What will the ______ term in the sequence be?
- How can you tell if you need to make an exchange?
- How can you work out the previous term in a sequence? Does it make a difference if the sequence is increasing or decreasing?

Possible sentence stems

- Each term is ______ than the previous term.

  The difference between the terms is ______

  As the sequence is increasing/decreasing, I need to add/subtract ______ to work out the next term.

National Curriculum links

- Read, write, order and compare numbers with up to 3 decimal places
- Solve problems involving number up to 3 decimal places

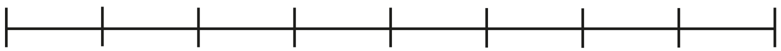
Decimal sequences

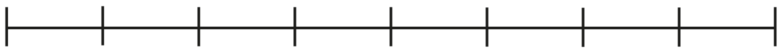
Key learning

- Complete the sequence.

1st term	2nd term	3rd term	4th term	5th term
1.21	1.32	1.43		

- Complete the number lines.





- Write the rule for each sequence.
  - 3.4, 3.6, 3.8, 4
  - 3.4, 3.2, 3, 2.8
  - 3.4, 3.42, 3.44, 3.46
  - 3.4, 3.38, 3.36, 3.34

  Work out the next term in each sequence.

- Use the rule to find the missing terms in the sequences.
  - Rule: add 0.3

    0.4, ______, ______, ______, ______
  - Rule: add 0.25

    ______, ______, 3.75, ______, ______
  - Rule: subtract 1.1

    ______, ______, ______, 7.8, ______

- A library charges a £1.50 fine if a book is not returned on the due date, and 15p per day for every day after that.

  Use the sequence to work out the fine for a book that is one week overdue.

  £1.50, £1.65, ______, ______, ______, ______, ______

- The 1st term of a sequence is 0.7 and the 3rd term is 1

  What is the 2nd term of the sequence?

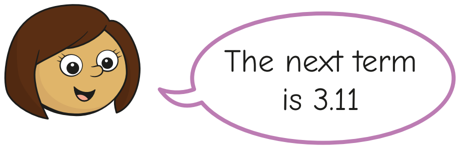
  What is the 5th term?

Decimal sequences

Reasoning and problem solving

Here is a sequence.

3.5, 3.7, 3.9 ...



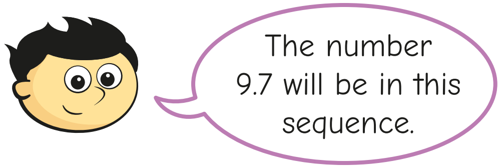
Explain why Kim is wrong.

What is the next term?

4.1

Here is a sequence.

9.48, 9.52, 9.56, 9.6 ...



Do you agree with Jack?

Explain your answer.

No

0.83	0.78
0.93	0.88

Put the cards in order to make a sequence.

What is the rule?

Could there be a different sequence and a different rule?

0.78, 0.83, 0.88, 0.93

rule: add 0.05

0.93, 0.88, 0.83, 0.78

rule: subtract 0.05

Huan and Alex are writing number sequences starting at zero.

- Huan's rule is + 0.9
- Alex's rule is + 1.2

What is the first number they will both write?

What other numbers will they both write?

3.6

7.2, 10.8 ...

all multiples of 3.6

Multiply by 10, 100 and 1,000

Notes and guidance

In this small step, children learn to multiply decimals by 10, 100 and 1,000

Children multiplied integers by 10 and 100 in Year 4 and moved on to multiply by 1,000 in the Autumn term of Year 5. Despite this experience, they may still make the mistake of over-generalising and simply "adding zeros". Concrete resources and stem sentences can be used to enable children to make accurate generalisations about what happens to the digits in a number when they multiply by 10, 100 or 1,000. Representations such as place value charts allow children to physically move plain counters to the left and recognise that all digits move, for example, 1 place to the left when multiplying by 10. They can also use a Gattegno chart to recognise that multiplying by 10 and "10 times the size" is the same.

Things to look out for

- Children may assume that they add a zero to the original number when multiplying by 10
- Children may "move the decimal point" instead of recognising that it is the digits that increase in value when multiplying by 10, 100 and 1,000

Key questions

- What is the value of each digit in the number?
- How many places to the left do the counters move when you multiply by 10/100/1,000?
- Where would the digits move to if you multiplied the number by 10/100/1,000?
- How many times greater than ______ is ______?
- If you multiply a number by 10 and then multiply the answer by 10, how many times greater than the original number is your final answer?

Possible sentence stems

- To multiply by 10/100/1,000, I move all the digits ______ places to the left.
- 10 times greater than ______ is ______
- Multiplying by 100/1,000 is the same as multiplying by 10 ______ times.

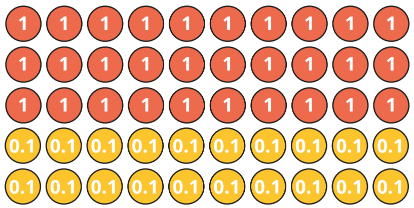
National Curriculum links

- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000

Multiply by 10, 100 and 1,000

Key learning

- The place value counters show 3.2 multiplied by 10

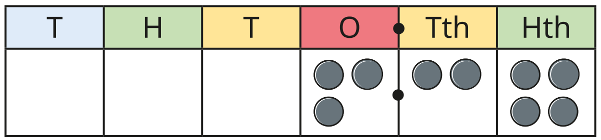


  - Can you make any exchanges?
  - Complete the sentences.

    ______ multiplied by 10 is equal to ______

    ______ is 10 times the size of ______

- Use the place value chart to multiply 3.24 by 10, 100 and 1,000



Complete the sentence.

When you multiply by ______, you move the counters ______ places to the left.

- Use a place value chart to multiply the decimals by 10, 100 and 1,000

4.24	2.401	4.21

- Mo is using a Gattegno chart to work out 4.9 × 10

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

4 × 10 = 40
0.9 × 10 = 9
So 4.9 × 10 = 49

Use the Gattegno chart to work out the multiplications.

- 0.6 × 10
  0.6 × 100
  0.6 × 1,000
- 2.4 × 10
  2.4 × 100
  2.4 × 1,000
- 1.35 × 10
  1.35 × 100
  1.35 × 1,000

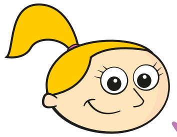
What patterns do you notice?

- Multiply each number by 10, 100 and 1,000

3.14	0.13	0.033

Multiply by 10, 100 and 1,000

Reasoning and problem solving

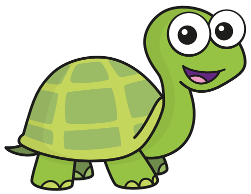


Do you agree with Eva?

Explain your answer.

Yes

Tiny is multiplying by 10



What mistake has Tiny made?

What is the correct answer?

31.04

Without calculating, write <, > or = to make the statements correct.

4.732 × 100 ◯ 47.32 × 10

10 × 13.82 ◯ 1,000 × 1.382

0.723 × 10 × 10 ◯ 100 × 0.723

1,000 × 3.81 ◯ 30.81 × 100

Explain your reasoning.

=

<

=

>

Scott has £4.87

Tom has 10 times as much money as Scott.

How much more money does Tom have than Scott?

£43.83

Divide by 10, 100 and 1,000

Notes and guidance

In this small step, children explore dividing integers and decimal numbers by 10, 100 and 1,000. This builds on their learning from Year 4, where they learned to divide 1- and 2-digit numbers by 10

Children should begin to recognise the links with multiplying by 10, 100 and 1,000 and notice the inverse relationship. Concrete resources and stem sentences can be used to enable children to make accurate generalisations about what happens to the digits in a number when they divide by 10, 100 or 1,000. A place value chart allows children to physically move counters to the right and recognise that all of the digits move, for example, 2 places to the right when dividing by 100. Children can also use a Gattegno chart to recognise that dividing by 10 and "one-tenth of the size" is the same.

Things to look out for

- Children may make errors with zero placeholders, for example 30.4 ÷ 10 = 3.4
- Children may mix up the rules for multiplication and division.
- Children may "move the decimal point" instead of recognising that it is the digits that decrease in value when dividing by 10, 100 and 1,000

Key questions

- What is the value of each digit in the number?
- If you divide by 10/100/1,000, how many places to the right do the counters move?
- Where would the digits move to if you divided the number by 10/100/1,000?
- How many times smaller is ______ than ______?
- If you divide a number by 10 and then divide the answer by 10, how many times smaller than the original number is your final answer?

Possible sentence stems

- To divide by 10/100/1,000, I move all the digits ______ places to the right.
- ______ is one-tenth the size of ______
- Dividing by 100/1,000 is the same as dividing by 10 ______ times.

National Curriculum links

- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000

Divide by 10, 100 and 1,000

Key learning

- Use the place value chart to divide 14 by 10, 100 and 1,000

T	O	Tth	Hth	Thth

Complete the sentence.

When you divide by ______, you move the counters ______ places to the right.

- Use a place value chart and counters to divide the numbers by 10, 100 and 1,000

4	15	301

- Use the place value chart to complete the divisions.

H	T	O	Tth	Hth	Thth
	2	7			

$27 \div 10 =$ ______

$27 \div 100 =$ ______

$27 \div 1{,}000 =$ ______

- Filip is using a Gattegno chart to work out $5.8 \div 10$

100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009

$5 \div 10 = 0.5$
$0.8 \div 10 = 0.08$
$5.8 \div 10 = 0.58$
0.58 is one-tenth the size of 5.8

Use the Gattegno chart to work out the divisions.

- $42 \div 10$
  $42 \div 100$
  $42 \div 1{,}000$
- $713 \div 10$
  $713 \div 100$
  $713 \div 1{,}000$
- $102 \div 10$
  $102 \div 100$
  $102 \div 1{,}000$

What patterns do you notice?

- There are 100 pence in £1

Use this fact to convert the amounts from pence to pounds.

- 210p = £ ______
- 132p = £ ______
- 2,456p = £ ______

Divide by 10, 100 and 1,000

Reasoning and problem solving

Amir is working out 4.08 ÷ 10

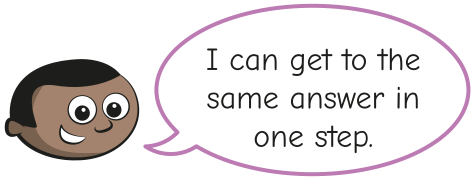
What mistake has Amir made?

What is the correct answer?

0.408

Mo divides 72 by 1,000

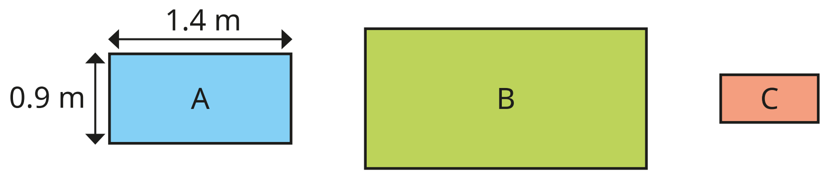
He then multiplies the answer by 10



Explain Mo's method.

Mo can divide by 100 to get the same answer.

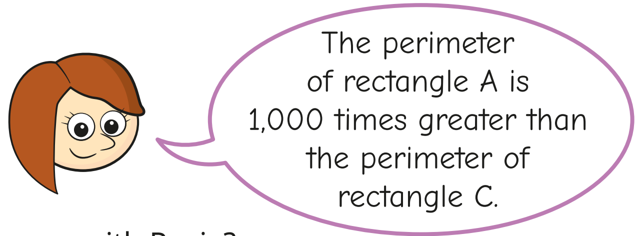
Here are three rectangles.



The sides of rectangle B are 10 times greater than rectangle A.

The sides of rectangle C are one-hundredth the size of rectangle B.

Work out the side lengths of rectangles B and C.



Do you agree with Rosie?

Explain your answer.

B: 14 m and 9 m
C: 0.14 m and 0.09 m

No

Multiply and divide decimals – missing values

Notes and guidance

In this small step, children apply their knowledge of multiplying and dividing by 10, 100 and 1,000 to work out missing values.

Through the use of concrete resources and stem sentences in the two previous steps, children have generalised what happens to the digits in a number when they multiply and divide by 10, 100 or 1,000. They now use these generalisations to support them to find missing values in calculations. Gattegno charts can be used to recognise how many rows a counter has moved up or down, allowing children to work out if the number is 10, 100 or 1,000 times greater or smaller. A place value chart allows them to physically move counters to the left or right to work out if the number is 10, 100 or 1,000 times greater or smaller. Children should recognise the inverse relationship between multiplying and dividing by 10, 100 and 1,000 and use this to find the missing values.

Things to look out for

- Children may mix up multiplication and division and move counters or digits in the wrong direction.
- Children may make errors with numbers that include zero as a placeholder, especially within numbers such as 3.04

Key questions

- What is the value of each digit?
- How many times smaller is ______ than ______?
- How many times greater is ______ than ______?
- How have the values of the digits changed?
- Has the number been multiplied or divided? How do you know?
- In which direction have the digits moved? How many places have the digits moved? What does this tell you?

Possible sentence stems

- The digits have moved ______ places to the left/right, so the number has been ______ by ______
- The digits have moved ______ places to the left/right, so the number is ______ times greater/smaller.

National Curriculum links

- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000

Multiply and divide decimals – missing values

Key learning

- Use the place value chart to work out the missing value.

  4.23 × ______ = 42.3

T	O	Tth	Hth
	4	2	3

- Use a place value chart and counters to work out the missing values.
  - 3.45 × ______ = 34.5
  - 84 ÷ ______ = 0.84
  - 4.56 ÷ ______ = 0.456
  - 1.03 × ______ = 103

- Mo divides a number by 100 and ends up with 0.52

H	T	O	Tth	Hth	Thth
		0	5	2	

  What number did Mo start with?

- Work out the missing numbers.
  - ______ ÷ 10 = 4.9
  - ______ × 10 = 0.45
  - 1,000 × ______ = 273
  - ______ ÷ 100 = 2.103

- Dexter uses a Gattegno chart to work out the missing value in the calculation 4.82 × ______ = 482

1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009

  - Complete the sentences.

    Each counter moves up ______ rows to get to 482

    482 is ______ times the size of 4.82

    4.82 × ______ = 482
  - Use the Gattegno chart to work out the missing values.

    3.4 × ______ = 34

    ______ ÷ 10 = 64.5

    ______ × 5.62 = 5,620

    4.6 ÷ ______ = 0.046

    1,000 × ______ = 345

    ______ ÷ 100 = 3.02

- Complete the calculations.
  - ______ ÷ 10 = 1.93 ÷ 100
  - 34.2 ÷ ______ = 0.342 × ______

Multiply and divide decimals – missing values

Reasoning and problem solving

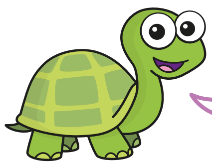
Is the statement true or false?

$420 \div 100 = 0.042 \times 100$

Explain your answer.

True

$\square \div 100 = 0.594$



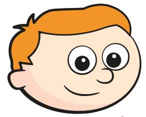
I can multiply 0.594 by 100 to find the missing value.

Do you agree with Tiny?

Explain your answer.

Yes

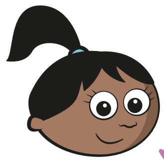
Ron thinks of a number.



I multiplied my number by 10 and then divided it by 1,000. I ended up with 0.034

What number was Ron thinking of?

3.4



I started with the same number as Ron and ended up with 340

What did Sam do to her number?

multiplied by 100