Spring Block 4

Fractions, decimals and percentages

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Small steps

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Step 2	Fractions as division
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Small steps

Step 9	Percentages – missing values

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Decimal and fraction equivalents

Notes and guidance

In Year 5, children explored common equivalents between fractions and decimals. In this small step, they extend this learning to include more complex equivalents.

A hundred square is a useful representation to allow children to explore equivalence. Using fraction and decimal walls also enables children to see the relationship between fractions such as $\frac{1}{5}$ and $\frac{2}{10}$ and therefore their decimal equivalents.
They look at methods for finding more complex equivalents by finding a common denominator of 100. These should include examples where children need to simplify fractions with larger denominators, for example $\frac{146}{200}$

Things to look out for

- If children are not confident finding equivalent fractions, they may find converting more complex fractions to decimals difficult.
- Children may be comfortable with the idea of finding a common denominator of 100, but struggle with examples that do not lend themselves to this strategy, for example $\frac{1}{8}$

Key questions

- If the whole has been split into 10/100 equal parts, what is each part worth as a fraction/decimal?
- If you know that _______ is equivalent to _______, what is _______ as a decimal?
- How can you convert fractions with a denominator of 100 to decimals?
- How can you convert fractions with a denominator that is a factor of 100 to decimals?
- How can you find equivalent fractions?
- Why might it be helpful to find an equivalent fraction with a denominator of 100/1,000?

Possible sentence stems

- The first/second digit after a decimal point represents _______
- To find an equivalent fraction, I need to _______ or _______ the _______ and the _______ by the same number.

National Curriculum links

- Use common factors to simplify fractions; use common multiples to express fractions in the same denomination

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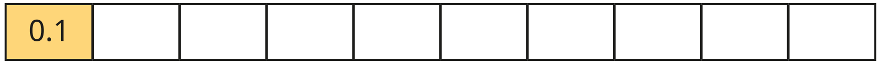
Decimal and fraction equivalents

Key learning

- The bar model is split into tenths.



  - ▶ Complete the sentences.

    The whole has been divided into ______ equal parts.

    Each part is worth ______

    As a fraction, this is written ______

  - ▶ On a similar bar model, shade:
    - 4 parts
    - 5 parts
    - 7 parts
    - 10 parts

    What decimal and what fraction is shown in each diagram?

- Use a blank hundred square.
  - ▶ Complete the sentences to match the hundred square.

    The whole has been divided into ______ equal parts.

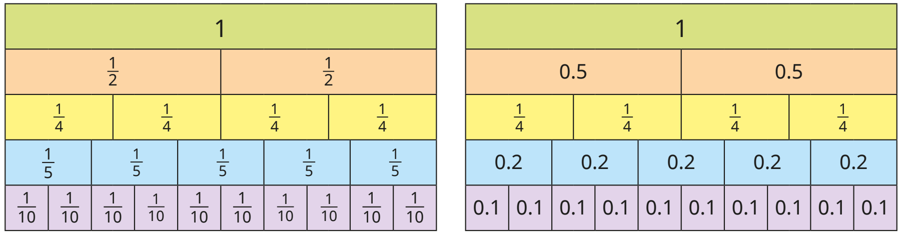
    Each part is worth ______

    As a fraction, this is written ______

  - ▶ On different hundred squares, shade:
    - 9 parts
    - 25 parts
    - 75 parts
    - 13 parts
    - 50 parts
    - 90 parts

    What decimal and what fraction is shown in each of your hundred squares?

- Use the fraction and decimal walls to complete the equivalents.



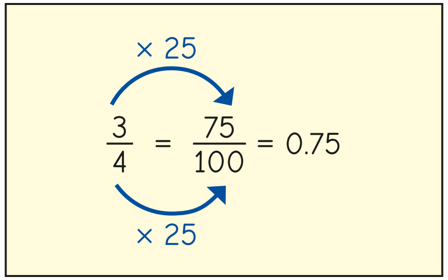
▶ $\frac{1}{2} = \frac{\square}{4} = \frac{\square}{10} = \_\_\_\_\_\_.\_\_\_\_\_\_$

▶ $\frac{3}{4} = \_\_\_\_\_\_.\_\_\_\_\_\_\ \_\_\_\_\_\_$

▶ $0.2 = \frac{1}{\square} = \frac{\square}{10}$

▶ $\frac{4}{5} = \frac{\square}{\square} = \_\_\_\_\_\_.\_\_\_\_\_\_$

- Rosie has converted three-quarters to a decimal.



Use Rosie's method to find the decimal equivalents of the fractions.

$\frac{17}{20}$ $\frac{23}{50}$ $\frac{11}{25}$ $\frac{112}{200}$ $\frac{275}{500}$ $\frac{192}{300}$

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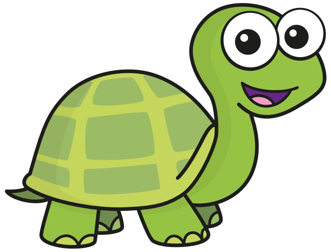
Decimal and fraction equivalents

Reasoning and problem solving

Tiny wants to convert $\frac{137}{500}$ to a decimal.

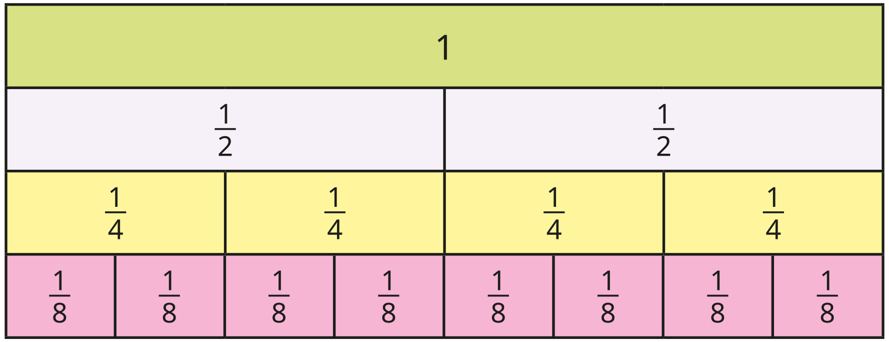
I can divide 500 by 5 to get a denominator of 100, but then I cannot divide 137 by 5, so I cannot convert it to a decimal.



Explain a different method that Tiny could use.

Write $\frac{137}{500}$ as a decimal.

0.274



To convert $\frac{1}{8}$ to a decimal, would you use an equivalent fraction with a denominator of 10, 100 or 1,000?

Use your choice to convert $\frac{1}{8}$ to a decimal.

Now use your answer to convert $\frac{3}{8}$ to a decimal.

Why is it easy to convert $\frac{4}{8}$ to a decimal?

1,000 | 0.125 | 0.375

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Fractions as division

Notes and guidance

In this small step, children build on the learning from the previous step as they look at fractions as division to support them in converting between fractions and decimals.

Children explore the idea of fractions as divisions, learning that, for example $\frac{3}{4}$ can be interpreted as 3 ÷ 4. They use place value counters to exchange ones for tenths and share them into equal groups to see that, for example, $\frac{1}{5} = 0.2$

Children progress to performing multiple exchanges to find other decimal equivalents. Once confident with this concept, they work with the more abstract short division method. It can be helpful to explore more complex examples, for example those that give recurring decimal answers, such as $\frac{1}{3} = 0.\dot{3}$

Things to look out for

- Children may interpret the division the wrong way around, for example $\frac{4}{5}$ as 5 ÷ 4 rather than 4 ÷ 5
- Children may need support to use extra zeros as placeholders when dividing, to avoid errors such as 3 ÷ 4 = 0.7 remainder 2

Key questions

- If the denominator is ______, how many equal parts are there? What are you dividing by?
- Can you share 1 one into 4 equal parts? What can you exchange the 1 one for?
- What can you exchange the remaining ______ tenths for?
- What do you notice about the decimal parts when dividing 1 by 3?
- What does “recurring” mean?
- How do you know that $\frac{1}{2} = 2$ or $\frac{5}{8} = 1.6$ cannot be correct?

Possible sentence stems

- The fraction ______ can be expressed as ______ ÷ ______
- ______ ÷ ______ is the same as the fraction ______
- I can exchange 1 ______ for ______

National Curriculum links

- Associate a fraction with division and calculate decimal fraction equivalents for a simple fraction

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Fractions as division

Key learning

- Write each fraction as a division.
  - $\frac{3}{4}$
  - $\frac{7}{9}$
  - $\frac{112}{137}$

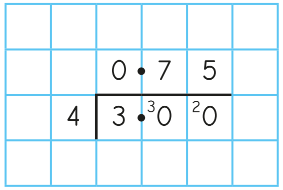
  Write each division as a fraction.
  - 2 ÷ 3
  - 5 ÷ 8
  - 24 ÷ 35

- Aisha uses place value counters to convert $\frac{1}{2}$ to a decimal by dividing 1 whole by 2

$\frac{1}{2} = 0.5$

  - Use Aisha's method to find the decimal equivalent of $\frac{1}{5}$
  - Use place value counters to find the decimal equivalent of $\frac{1}{4}$

- Kim converts $\frac{3}{4}$ to a decimal.



$\frac{3}{4} = 0.75$

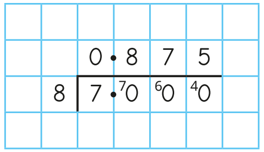
  Use Kim's method to find the decimal equivalent of each fraction.
  - $\frac{2}{5}$
  - $\frac{4}{5}$
  - $\frac{3}{8}$
  - $\frac{5}{8}$

- Use division to find the decimal equivalents of $\frac{2}{3}$, $\frac{5}{6}$ and $\frac{2}{9}$

  What do you notice?

- Teddy, Rosie and Jack have each found the decimal equivalent of $\frac{7}{8}$

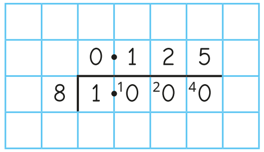
Teddy



7 ÷ 8

$\frac{7}{8} = 0.875$

Rosie



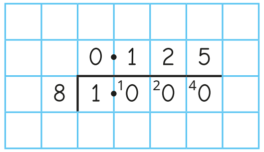
1 ÷ 8

$\frac{1}{8} = 0.125$

$\frac{7}{8} = 7 \times 0.125$

$\frac{7}{8} = 0.875$

Jack



1 ÷ 8

$\frac{1}{8} = 0.125$

$\frac{7}{8} = 1 - 0.125$

$\frac{7}{8} = 0.875$

  - Explain why each method works.
  - Whose method do you prefer?
  - Use your preferred method to find the decimal equivalent of $\frac{19}{20}$

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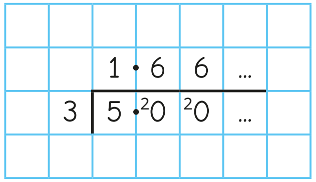
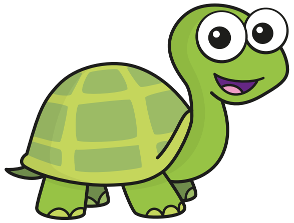
Fractions as division

Reasoning and problem solving

Tiny uses division to find the decimal equivalent of $\frac{3}{5}$





$\frac{3}{5} = 1.66 ...$

How do you know that Tiny must be incorrect?

What mistake has Tiny made?

What is the correct answer?

Tiny worked out 5 ÷ 3 instead of 3 ÷ 5

0.6

Filip shares 7 large pizzas equally with 7 of his friends.

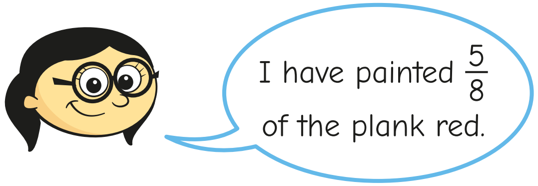
Esther shares 5 large pizzas with 5 of her friends.

Who gets more pizza, Filip or Esther?

Use decimals to help compare.

Filip

Annie has a plank of wood that is 1 metre long.



How long is the piece of wood that is painted red?

Give your answer in metres and then in centimetres.

0.625 m

62.5 cm

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Understand percentages

Notes and guidance

In this small step, children explore percentages. They were introduced to percentages for the first time in Year 5, learning that “per cent” relates to “the number of parts per 100” and that if the whole is split into 100 equal parts, then each part is worth 1%.

Using bar models, children split 1 whole into 10 equal parts to explore multiples of 10%. They estimate 5% on a bar model split into 10 equal parts by splitting a section in half, for example 45% is four full sections and half of another section. Other common percentages that are useful to explore are 50%, 25% and 20% by splitting the bar model into 2, 4 and 5 equal parts respectively. They then explore ways of making more complex percentages using a combination of these, for example 65% = 50% + 10% + 5%.

It is important for children to recap knowledge of complements to 100 to allow them to see that, for example, 35% + 65% = 100%.

Things to look out for

- Children may think that 1% means 1 unit rather than 1 part out of 100 equal parts.
- If children are not confident with dividing 100 by 10, 5, 4 and 2, they may struggle to use bar models to find common percentages.

Key questions

- What does “per cent” mean?
- How many parts are shaded/not shaded?
- What does 100% mean?
- How many equal parts is the bar model split into? What percentage is each part worth?
- How many ways could you make 95% using 50%, 25%, 10%, 5% and 1%?

Possible sentence stems

- If the whole is shared into 100/10/5/4/2 equal parts, each part represents ______%.
- If ______ parts are shaded, the percentage shown is ______%.
- To find ______%, I can halve ______%.

National Curriculum links

- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

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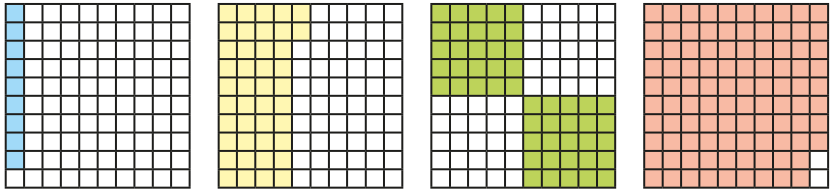
Understand percentages

Key learning

- Here are some hundred squares.

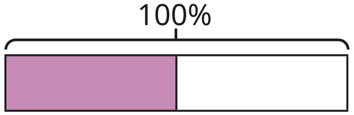


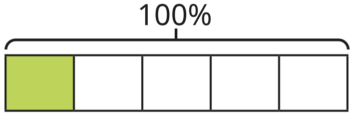
- ▶ How many parts out of 100 are shaded on each hundred square?
- ▶ What percentage of each hundred square is shaded?
- ▶ What percentage of each hundred square is **not** shaded?

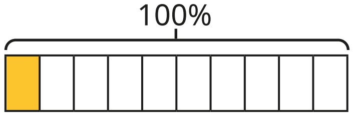
What do you notice?

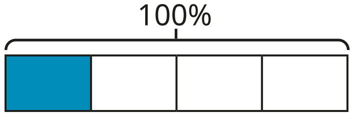
- What percentage of each bar model is shaded?

Use the sentences to help.





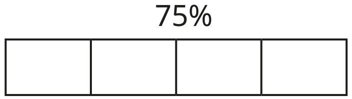


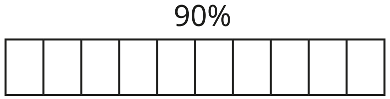


100% has been split into _______ equal parts.

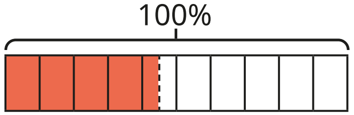
Each part is worth _______%.

- Shade the percentages on the bar models.





- 45% of the bar model is shaded.



Draw bar models to show the percentages.

15%

85%

55%

35%

95%

- Alex, Mo and Eva are exploring different ways of making 95%.

Alex

95% = 9 × 10% + 5%

Mo

95% = 50% + 25% + 20%

Eva

95% = 100% − 5%

Explain each child's thinking.

Find four different ways of making each percentage.

45%

15%

65%

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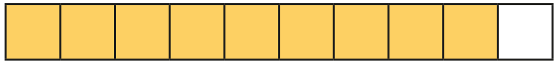
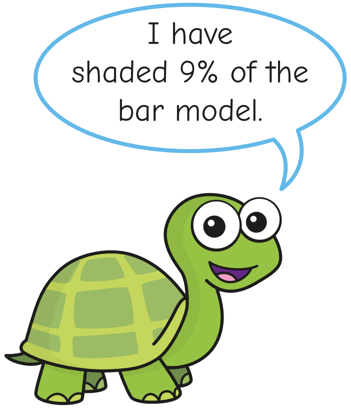
Understand percentages

Reasoning and problem solving

Tiny is shading percentages on bar models.





Explain the mistake that Tiny has made.

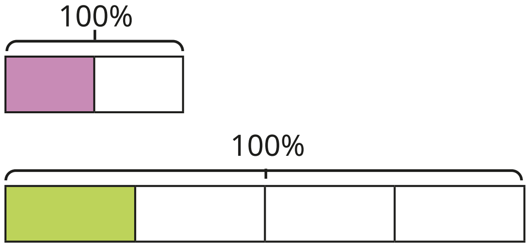
What percentage of the bar model has Tiny shaded?

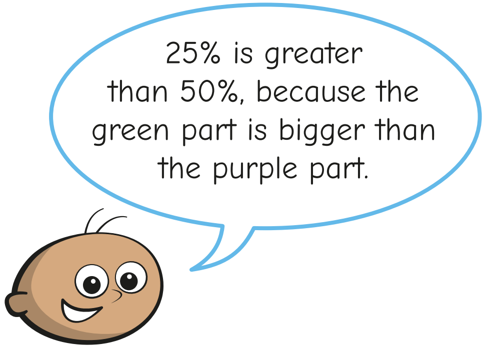
What would 9% look like on the bar model?

90%

Part of the first box shaded. Just under 10%

Tommy is comparing percentages.





Do you agree with Tommy?

Explain your answer.

No

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Fractions to percentages

Notes and guidance

In this small step, children recap Year 5 learning on equivalent fractions and percentages, using visual representations, before moving on to more abstract methods.

Children use hundred squares and bar models to explore equivalents, for example $\frac{1}{5}$ is the whole split into 5 equal parts and 100% split into 5 equal parts is 20%, so $\frac{1}{5}$ = 20%. They then explore the relationship with non-unit fractions, seeing that if $\frac{1}{4}$ is equal to 25%, then $\frac{3}{4}$ = 3 × 25% = 75%. More abstract methods allow children to convert more complex examples such as $\frac{11}{25}$.

They recognise that if they can find an equivalent fraction with a denominator of 100, then they can easily find percentage equivalences. Children explore examples where they are required to multiply (for example, $\frac{9}{20}$) or divide (for example, $\frac{132}{200}$).

Things to look out for

- Children need to be able to fluently find equivalent fractions.
- Children may not be confident with factors of 100, including 20 and 25

Key questions

- What is a percentage?
- If the whole is split into 100 equal parts, then what percentage is ______ parts equivalent to?
- How are percentages and fractions similar/different?
- If you know $\frac{1}{5}$ is equal to 20%, what percentage is $\frac{4}{5}$ equal to?
- How do you find an equivalent fraction?
- How many 20s/25s are there in 100?
- What do you know about the relationship between $\frac{1}{4}$ and $\frac{1}{8}$?

Possible sentence stems

- ______% is equivalent to $\frac{\square}{100}$
- $\frac{\square}{\square}$ is equivalent to $\frac{\square}{100}$ because …
- The fraction $\frac{\square}{\square}$ is equivalent to ______%.

National Curriculum links

- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

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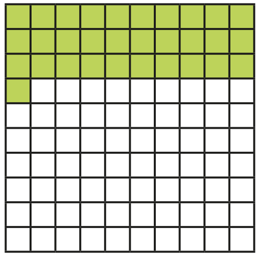
Fractions to percentages

Key learning

- Max uses a hundred square to convert $\frac{31}{100}$ to a percentage.



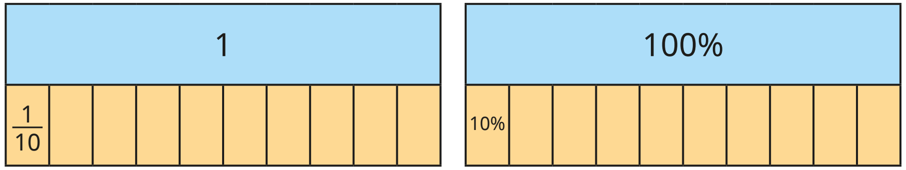
$$\frac{31}{100} = 31\%$$

Shade hundred squares to show the fractions.

$\frac{7}{100}$ $\frac{49}{100}$ $\frac{96}{100}$ $\frac{70}{100}$

What percentage is shown on each hundred square?

- The bar models show that $\frac{1}{10}$ is equal to 10%.



Use the bar models to complete the statements.

▶ $\frac{3}{10}$ = ________%

▶ $\frac{9}{10}$ = ________%

▶ $\frac{\square}{100} = 50\%$

▶ $\frac{\square}{\square} = 70\%$

- Whitney converts $\frac{3}{5}$ to a percentage.

$$\begin{tikzcd}\frac{3}{5} \arrow[r, phantom, "="] \arrow[r, bend left, "\times 20"] \arrow[r, bend right, "\times 20"'] & \frac{60}{100} = 60\%\end{tikzcd}$$

Use Whitney's method to convert the fractions to percentages.

$\frac{3}{4}$ $\frac{23}{50}$ $\frac{23}{25}$ $\frac{13}{20}$ $\frac{14}{20}$ $\frac{112}{200}$

- $\frac{2}{5}$ of the people in a stadium have brown hair.

17% of the people have ginger hair.

$\frac{4}{25}$ of the people have black hair.

The rest have blonde hair.

What percentage of the people have blonde hair?

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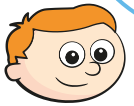
Fractions to percentages

Reasoning and problem solving

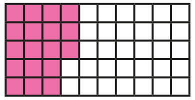


I know $\frac{2}{8}$ is equal to $\frac{1}{4}$ and $\frac{1}{4}$ is equal to 25%, so $\frac{2}{8}$ is also equal to 25%.

How can you use Ron's facts to work out $\frac{1}{8}$ as a percentage?

What is $\frac{1}{8}$ as a percentage?

12.5%



Huan thinks that 18% of the grid has been shaded.

Dora thinks that 36% of the grid has been shaded.

Who do you agree with?

Explain your answer.

Dora

In a maths test, Scott answered 58% of the questions correctly.

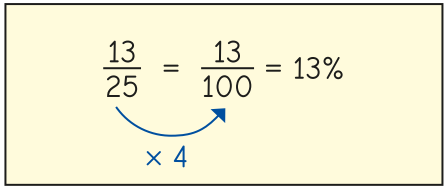
Nijah answered $\frac{2}{5}$ of the questions incorrectly.

Who answered more questions correctly?

Explain your reasoning.

Nijah

Tiny converts $\frac{13}{25}$ to a percentage.



$$\frac{13}{25} = \frac{13}{100} = 13\%$$

What mistake has Tiny made?

What is the correct percentage?

52%

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Equivalent fractions, decimals and percentages

Notes and guidance

In this small step, children continue to explore the fraction, decimal and percentage equivalents that they began in Year 5

Children use hundred squares, bar models and number lines to recap equivalents to $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{10}$ as well as related non-unit fractions such as $\frac{3}{4}$, $\frac{2}{5}$ and $\frac{7}{10}$. They then look at more abstract methods of converting between fractions, decimals and percentages. Learning from the previous step is reinforced, in which equivalent fractions are found with a denominator of 100, allowing for a straightforward conversion to decimals and percentages. Children also convert decimals or percentages into a fraction with a denominator of 100 and then simplify where possible, for example 15% = $\frac{15}{100} = \frac{3}{20}$. This enables them to find equivalents to more complex numbers, such as 92% or 0.76

Things to look out for

- Children may not be confident with methods for finding equivalent fractions – both fractions with a denominator of 100 and those that need simplifying.

Key questions

- How many parts has the whole been split up into? What fraction is each part worth?
- If the whole is 100%, what is $\frac{1}{2}/\frac{1}{4}/\frac{1}{5}$?
- If $\frac{1}{10}$ is equal to 10%, what is $\frac{3}{10}$ equal to?
- How do you find equivalent fractions?
- How many 5s are there in 100?
- Can the fraction be simplified? How do you know?

Possible sentence stems

- If the whole is equal to 100%, then each part is worth ______%.
- If $\frac{1}{\square}$ is equal to ______%, then $\frac{\square}{\square}$ is equal to ______%.
- To find an equivalent fraction with a denominator of 100, I need to ______ by ______

National Curriculum links

- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

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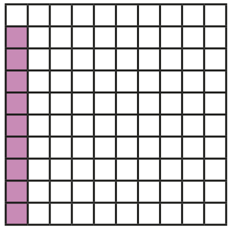
Equivalent fractions, decimals and percentages

Key learning

- Complete the sentences to describe the hundred square.



The fraction shaded is $\frac{\square}{100}$

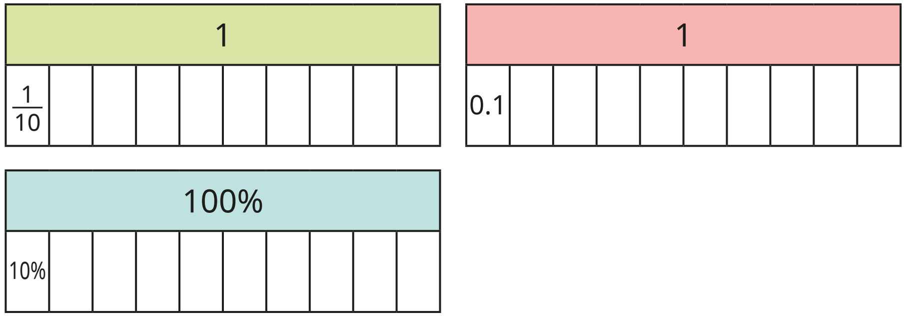
The decimal shaded is ______

The percentage shaded is ______

- What are the fraction and decimal equivalents of 97%?

  What are the percentage and fraction equivalents of 0.23?

- What is the same about each bar model? What is different?

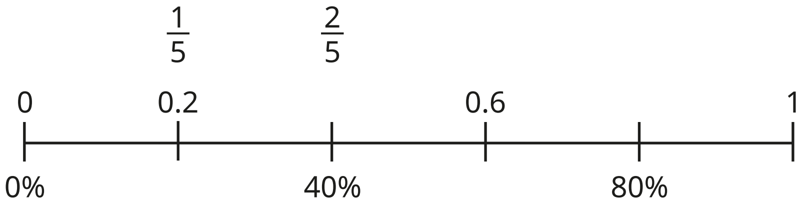


  - Shade three parts of each bar model.

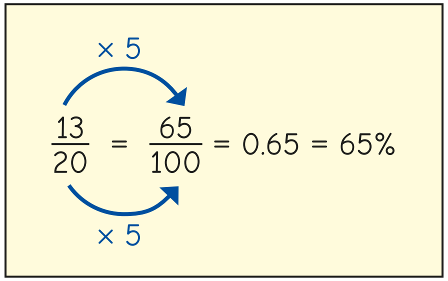
    What fraction, decimal and percentage is shaded?

  - What other equivalent fractions, decimals and percentages can you find?

- Complete the number line to show the equivalent fractions, decimals and percentages.



- Dexter converts $\frac{13}{20}$ to a decimal and a percentage.



$$\frac{13}{20} = \frac{65}{100} = 0.65 = 65\%$$

  Explain Dexter's method.

  Use Dexter's method to write each fraction as a decimal and as a percentage.

  $\frac{9}{20}$ $\frac{23}{25}$ $\frac{23}{50}$ $\frac{146}{200}$

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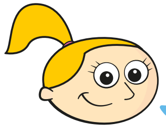
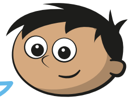
Equivalent fractions, decimals and percentages

Reasoning and problem solving



Eva

I know that 45% is equivalent to $\frac{45}{100}$



Amir

I know that 45% is equivalent to $\frac{9}{20}$

Who do you agree with?

Explain your reasoning.

They are both correct, but Amir has written the fraction in its simplest form.

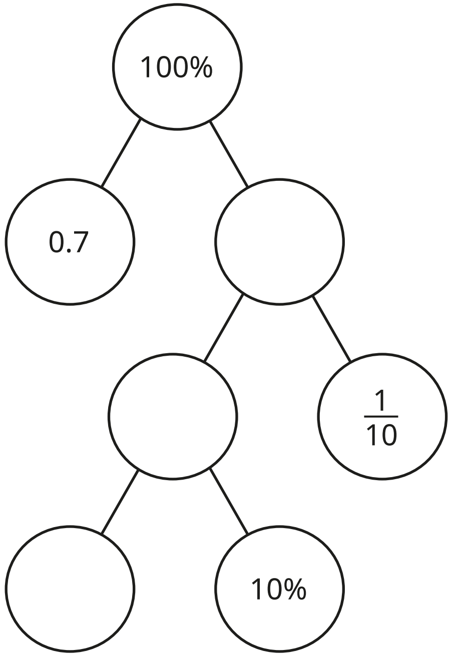
Which of these pairs are equivalent?

$\frac{11}{25}$ and 44%	$\frac{23}{50}$ and 23%
$\frac{17}{20}$ and 0.17	$\frac{49}{50}$ and 0.98

$\frac{11}{25}$ and 44%

$\frac{49}{50}$ and 0.98

Complete the part-whole model.



Is there more than one way to complete it? How do you know?

Create your own question like this for a partner.

0.3, 30%, $\frac{30}{100}$, $\frac{3}{10}$

0.2, 20%, $\frac{20}{100}$, $\frac{2}{10}$, $\frac{1}{5}$

0.1, 10%, $\frac{10}{100}$, $\frac{1}{10}$

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Order fractions, decimals and percentages

Notes and guidance

In Year 5, children compared and ordered decimal numbers with up to 3 decimal places. In Year 6 Autumn Block 3, they ordered fractions with the same numerator or denominator. In this small step, they use their conversion skills from recent steps to order and compare fractions, decimals and percentages.

Children explore a range of strategies to compare and order numbers, including converting to the same form. Ask children to discuss if they prefer converting amounts to decimals, percentages or fractions and why. Children also look at strategies such as comparing amounts to a half and whether some amounts are closer or further away from the whole.

For consistency, use the word “greatest” rather than “biggest” or “largest” when comparing numbers.

Things to look out for

- Children may decimalise the percentage, for example 0.67%.
- Children may turn numerators into decimals or percentages even if the denominator is not 100, for example $\frac{45}{50}$ = 0.45 = 45%.

Key questions

- What fraction/decimal/percentage is ______ equivalent to?
- Which is the greater amount, ______ or ______? How do you know?
- Which of the amounts are greater than a half?
- Which of the amounts is closer to 1 whole?
- Where do these amounts go on a number line?
- Is it easier to convert the numbers to fractions, decimals or percentages?

Possible sentence stems

- ______ is greater/smaller than one half, and ______ is smaller/greater than one half, so ______ is greater/smaller than ______
- ______ is equivalent to ______, so it is greater/smaller than ______

National Curriculum links

- Compare and order fractions, including fractions >1
- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

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Order fractions, decimals and percentages

Key learning

- Teddy knows that $\frac{11}{20}$ is greater than a half and 42% is less than a half because it is less than 50%, so $\frac{11}{20}$ is greater than 42%.

  Use Teddy's method to write "greater" or "less" to complete the sentences.

  ▸ 0.45 is _______ than $\frac{16}{30}$

  ▸ $\frac{251}{500}$ is _______ than 15%.

  ▸ 50% is _______ than 0.309

  ▸ $\frac{13}{24}$ is _______ than 0.5

- Aisha knows that $\frac{9}{10}$ is closer to 1 whole than a half, but 52% is closer to a half than 1 whole, so $\frac{9}{10}$ is greater than 52%.

  Use Aisha's method to write <, > or = to compare the amounts.

  0.61 ○ 95%   0.809 ○ $\frac{26}{50}$ 61% ○ $\frac{33}{35}$

- Kim converts $\frac{13}{20}$ to $\frac{65}{100}$, which is equivalent to 65%.

  She uses this to recognise that $\frac{13}{20} < 67\%$.

  Use Kim's method to write <, > or = to compare the amounts.

  $\frac{34}{50}$ ○ 68% $\frac{24}{25}$ ○ 98% $\frac{4}{10}$ ○ 38%   44% ○ $\frac{9}{20}$

- Convert 0.38 and $\frac{1}{4}$ to percentages.

  Use your conversions to write 45%, 0.38 and $\frac{1}{4}$ in ascending order.

- Order the numbers from greatest to smallest.

50%	$\frac{2}{5}$	0.45	$\frac{3}{10}$	54%	0.05

- Explain why $\frac{13}{10}$ is greater than 87%.

- Write <, > or = to compare the amounts.

  $\frac{2}{3}$ ○ 1.1   105% ○ $\frac{19}{20}$ 1.01 ○ 100%

- Write the values in ascending order.

$\frac{1}{2}$	0.48	2.7	65%	$\frac{21}{20}$	49%

Compare methods with a partner.

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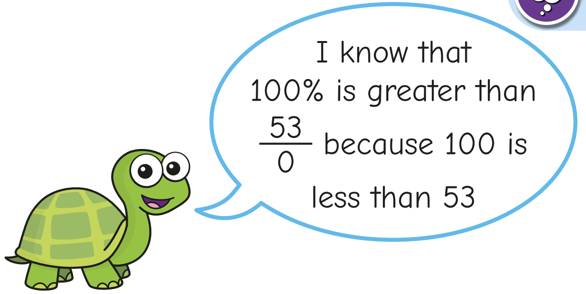
Order fractions, decimals and percentages

Reasoning and problem solving



Do you agree with Tiny?

Explain your answer.

No

Is the statement true or false?

There is no fraction, decimal or percentage that is greater than $\frac{99}{100}$, 0.99 or 99%, but smaller than 1 whole.

Explain your answer.

False

Write a fraction, decimal and percentage that could complete the comparison.

$\frac{3}{5} < \boxed{} < \frac{4}{5}$

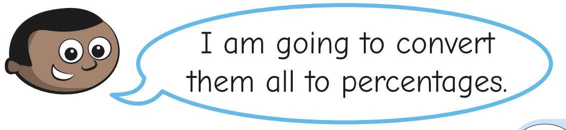
multiple possible answers, e.g.

$\frac{7}{10}$, 70%, 0.7,

$\frac{13}{20}$, 75%, 0.78

Mo wants to write the numbers in descending order.

87%	0.19	$\frac{17}{15}$
0%	2.19	$\frac{4}{8}$



Explain why Mo does not need to do this.

Write the numbers in descending order.

2.19, $\frac{17}{15}$, 87%, $\frac{4}{8}$, 0.19, 0%

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Percentage of an amount – one step

Notes and guidance

In this small step, children calculate percentages of amounts for the first time. Children are familiar with finding fractions of amounts, but it may be worth recapping this before moving on to percentages.

Children find percentages of amounts that can be completed in one step, for example finding 1%, 10%, 20%, 25% and 50% by dividing by 100, 10, 5, 4 and 2 respectively. Using bar models to represent this allows children to see the links to finding fractions of amounts. They explore different strategies for dividing by these amounts, looking for the most efficient method for the calculation, including moving the digits when dividing by 10 and 100, halving and halving again for dividing by 4, as well as the formal written division method.

Things to look out for

- Knowing that to find 10% of a number they divide by 10 may confuse some children, leading to misconceptions such as dividing by 20 to find 20%.
- Children may answer every question by dividing the number by 100 to find 1% and then multiplying, rather than solving in one step.

Key questions

- How are percentages and fractions similar/different?
- How do you find a fraction of an amount?
- How can you represent this question with a bar model?
- How many lots of 10/20/25/50% are there in 100%?
- What do you need to divide a number by to find 10/20/25/50%?
- What strategies could you use to divide by ______?

Possible sentence stems

- There are ______ lots of ______% in 100%

  To find ______% of a number, I need to divide by ______
- The whole amount is worth ______ %.

  To find ______%, I need to divide the whole by ______
- If 100% is equal to ______, then ______% is equal to ______

National Curriculum links

- Solve problems involving the calculation of percentages and the use of percentages for comparison

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Percentage of an amount – one step

Key learning

- There are two lots of 50% in 100%.

100%	
50%	50%

This means that to find 50% of an amount, you divide it by 2

Work out 50% of each number.

240 360 170 1

- There are four lots of 25% in 100%.

100%			
25%	25%	25%	25%

This means that to find 25% of an amount, you divide it by 4

Work out 25% of each number.

240 360 170 1

What do you notice about your answers?

Why does this happen?

- Use the bar model to complete the sentences for 10% and 20%.

100%									
20%		20%		20%		20%		20%	
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

There are _______ lots of _______% in 100%.

To find _______% of an amount, you divide it by _______

- Work out the percentages.

10% of 500	10% of 380	10% of 3
20% of 500	20% of 380	20% of 3

What do you notice?

- 100 ÷ 100 = 1

So to find 1% of an amount, divide it by 100

Find 1% of each number.

500 250 608 24,200 3.7

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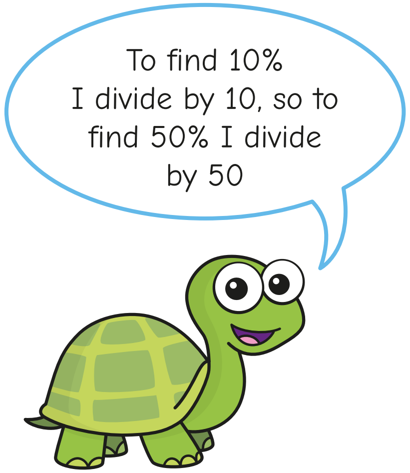
Percentage of an amount – one step

Reasoning and problem solving

Tiny is finding percentages of amounts.



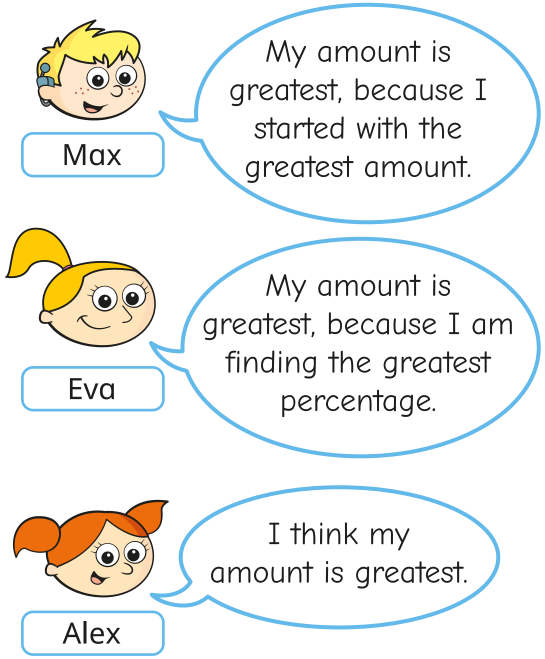
Explain the mistake that Tiny has made.

What do you need to divide by to find 50%?

What percentage would you find if you divided by 50?

2

2%



Max	20% of 480
Eva	50% of 210
Alex	25% of 424

Who do you agree with?

Talk about it with a partner.

Alex

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Percentage of an amount – multi-step

Notes and guidance

In this small step, children build on the learning of the previous step by finding percentages of amounts that require more than one step.

Using knowledge of how to find 1%, 10%, 20%, 25%, 50%, children find multiples of these amounts. For example, to find 75% they can find 25% and multiply it by 3; to find 60% they can find 10% and multiply it by 6. They then move on to more complex percentages.

Allow children time to explore different ways of making percentages without actually calculating the percentages of amounts, for example 45% can be made from 25% + 10% + 10%, 5% × 9, 1% × 45, 50% – 5%. Once children recognise that percentages can be made in a range of ways, they apply this to finding a percentage of an amount using the most efficient method.

Things to look out for

- Children often do not explore subtraction as an efficient strategy, particularly subtracting from the whole, for example 95% = 100% – 5%.
- Children may rely on finding 1% and then multiplying it, rather than considering more efficient methods.

Key questions

- How can you find 1%/10%/20%/25%/50% of a number?
- How can you use 10% to find 30%?
- How can the percentage 36% be made using 1%, 5%, 10%, 20%, 25%, 50% and 100%?
- If you know 1% of an amount, how can you work out 37% of that amount?
- If you know 1% of an amount, how can you work out 99% of that amount?

Possible sentence stems

- ______% is made up of ______%, ______ and ______%.
- ______% of ______ is equal to ______
- If 100% is equal to ______, then ______% is equal to ______
- ______% is equal to ______ lots of ______%.

National Curriculum links

- Solve problems involving the calculation of percentages and the use of percentages for comparison

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Percentage of an amount – multi-step

Key learning

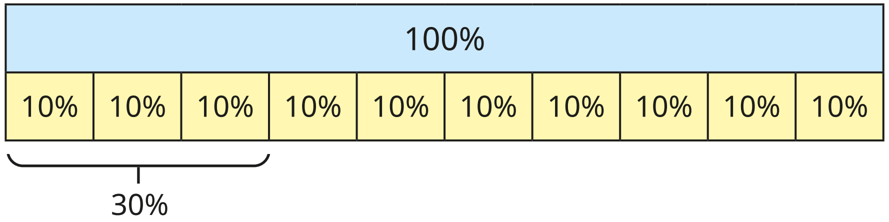
- Work out 1% of each number.

500	180	2,000	15

Use your answers to work out the percentages of amounts.

3% of 500	2% of 180	7% of 2,000	5% of 15

- The bar model shows that 30% is made up of three lots of 10%.



Use the bar model to help you work out the percentages.

30% of 500	70% of 5,000	90% of 25

- Calculate the percentages.

75% of 500	40% of 500	80% of 500

- Here is a method for finding 11% of 250

10% of 250 = 25

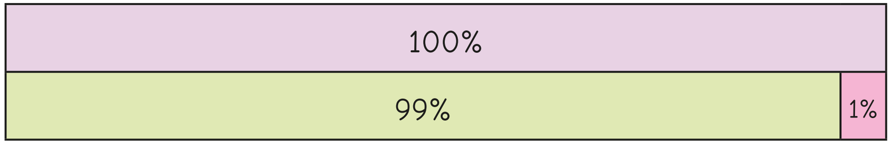
1% of 250 = 2.5

11% of 250 = 25 + 2.5 = 27.5

Use this method to work out the percentages.

11% of 400	51% of 400	21% of 400	26% of 400
36% of 6,400	41% of 900	66% of 80	87% of 2,000

- Rosie knows that 99% of an amount is 1% less than the full amount, so she finds 1% and takes that away from the total.



Use this to work out the percentages.

99% of 8,000	99% of 4.5	98% of 450	49% of 60

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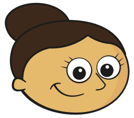
Percentage of an amount – multi-step

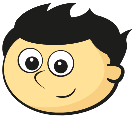
Reasoning and problem solving

Dora, Jack, Mo and Rosie were asked to find 90% of a number.



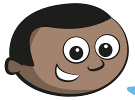
I found 10% and multiplied it by 9

Dora



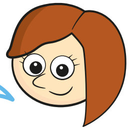
I found 1% by dividing by 100, then I multiplied my answer by 90

Jack



I worked out 50% + 10% + 10% + 10% + 10%.

Mo



I found 10% and subtracted it from 100%

Rosie

Whose method is correct?

Explain your answer.

All the methods are acceptable ways of finding 90%.

Work out 24% of 3.5 metres.

Give your answer in centimetres and in metres.

Compare methods with a partner.

84 cm, 0.84 m

Work out the percentages of amounts.

45% of 60

60% of 45

What do you notice?

Does this always happen?

27

27

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Percentages – missing values

Notes and guidance

For the final small step in this block, children use their understanding of percentages to find the whole number from a given percentage. This links back to the previous step, as children will have to know how many lots of ______% are in 100% and multiply accordingly. For example, if they know 20% of a number, then they multiply that by 5 to work out 100%.

Once confident with simple percentages such as 1%, 10%, 20%, 25% or 50%, children work out percentages such as 12% that cannot be solved in one step. With examples such as these, children recognise that for any percentage, they can find 1% first before multiplying up to 100%. For example, if they know 9% of a number, they divide that by 9 then multiply by 100. Similarly, if they know 30% of a number, they can divide that by 3 and then multiply by 10

Things to look out for

- Children may be confused with two-step solutions, for example saying "30% of a number is 12, so I will multiply 12 by 30"
- Children may use inefficient methods to multiply, for example using the formal method for × 10

Key questions

- If you know ______% of a number, how can you work out the whole?
- How many lots of ______% are there in 100%?
- If you know 23%, how can you find 1%? Once you know 1%, how can you find 100%?
- If you know 40%, how can you find 10%? Once you know 10%, how can you find 100%?
- How can linking percentages to fractions help you to answer this question?

Possible sentence stems

- If ______% of a number is ______, then the whole is ______
- There are ______ lots of ______% in 100%.
- If ______% of a number is ______, then 1% of the number is ______, so 100% is ______

National Curriculum links

- Solve problems involving the calculation of percentages and the use of percentages for comparison

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Percentages – missing values

Key learning

- If you know 10% of a number, you can multiply by 10 to find the whole.

100%									
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

Work out the missing numbers.

▶ 10% of _______ = 2.8
▶ 10% of _______ = 709
▶ 10% of _______ = 45p
▶ 10% of _______ = 38 g

- ▶ If 50% of a number is 123, what is the number?
  ▶ If 25% of a number is 45, what is the number?
  ▶ If 20% of a number is 70, what is the number?

- Tom knows that 30% of a number is 210

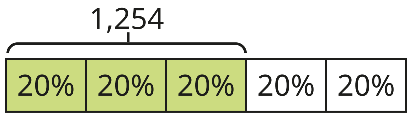
He then works out the whole by finding 10% first.

10% = 210 ÷ 3 = 70
100% = 70 × 10 = 700

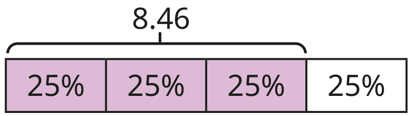
Use Tom's method to work out the missing numbers.

▶ 30% of _______ = 360
▶ 70% of _______ = 4.9
▶ 90% of _______ = 0.36 kg
▶ 60% of _______ = 92p

- Use the bar models to work out the missing numbers.



60% of _______ = 1,254



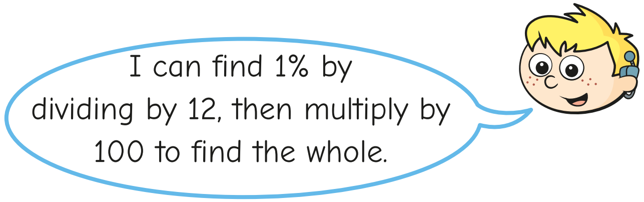
75% of _______ = 8.46

- If you know 1% of a number, you can work out the whole by multiplying by 100

Use this fact to work out the missing numbers.

▶ 1% of _______ = 0.06
▶ 1% of _______ km = 56 m
▶ 3% of _______ = 0.27
▶ 1% of _______ g = 2.9 g

- 12% of a number is 36



Use Max's method to find the whole.

- Annie is thinking of a number.

15% of her number is 90

What is her number?

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Percentages – missing values

Reasoning and problem solving

A bag contains red, blue and yellow balloons.

20% of the balloons in the bag are red.

There are 24 red balloons.

There are three times as many blue balloons as yellow balloons.

How many blue and yellow balloons are there in the bag?

72 blue, 24 yellow

Fill in the missing values to make the statement correct.

25% of ☐ = ☐ % of 60

Can you find more than one way?

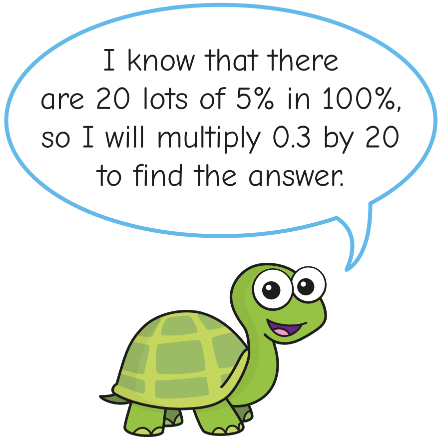
multiple possible answers, e.g.

25% of 60 = 25% of 60

25% of 120 = 50% of 60

Tiny is solving this problem.

5% of ☐ = 0.3



5% = 0.3
100% = 0.3 × 20 = 6

Do you agree with Tiny?

Explain your answer.

Yes

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Spring Block 5

Area, perimeter and volume

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Small steps

Step 1	Shapes – same area
Step 2	Area and perimeter
Step 3	Area of a triangle – counting squares
Step 4	Area of a right-angled triangle
Step 5	Area of any triangle
Step 6	Area of a parallelogram
Step 7	Volume – counting cubes
Step 8	Volume of a cuboid

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Shapes – same area

Notes and guidance

In this small step, children recap learning from previous years by finding the areas of shapes. It may be useful to remind children about the differences between area and perimeter, which will be covered explicitly in the next step.

Children find the areas of shapes by counting squares and then identify shapes that have the same area. It should become clear to children that shapes can look different but still have the same area. Rectilinear shapes are included here.

Children then explore instances when multiplication can be used to find the areas of shapes. They should begin to identify rectangles that will have the same area by using factor pairs rather than relying on counting squares. They can also use factor pairs to draw rectangles that have the same area.

Things to look out for

- Children may confuse area and perimeter.
- When counting squares, children may miscount or use inefficient strategies.
- Children may not use factor pairs to notice shapes that have the same area or to create shapes with the same area.

Key questions

- How can you find the area of this shape? Is there more than one way?
- Do shapes that have the same area have to look the same?
- How can you use factor pairs to find shapes that would have the same area?
- How would you draw more than one rectangle that has an area of ______ cm^2?

Possible sentence stems

- The total number of squares in the rectangle is ______
  The area of the rectangle is ______ cm^2
- The length of the rectangle is ______ cm.
  The width of the rectangle is ______ cm.
  The area of the rectangle is ______ cm^2

National Curriculum links

- Recognise that shapes with the same areas can have different perimeters and vice versa

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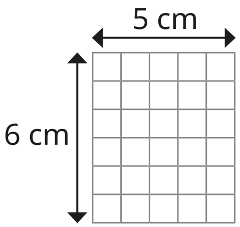
Shapes – same area

Key learning

- Complete the sentences to describe the rectangle.



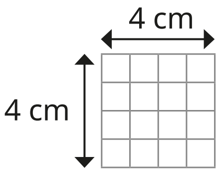
The length of the rectangle is ______ cm.

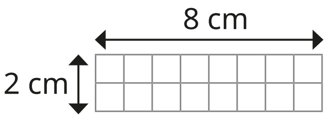
The width of the rectangle is ______ cm.

The total number of squares in the rectangle is ______

The area of the rectangle is ______ cm²

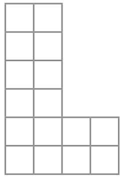
Use the same method to find the areas of these rectangles.





What do you notice?

- Each square represents 1 cm²

A


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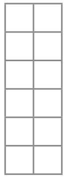

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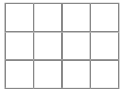

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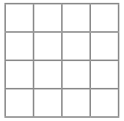

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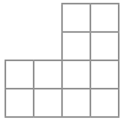
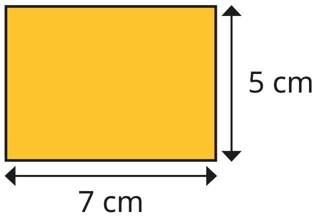
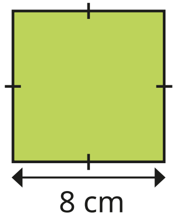


  - Which shapes have an area of 12 cm²?
  - Which shapes have an area of 16 cm²?
  - Why is there more than one representation for each?

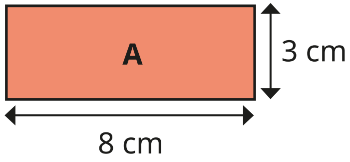
- Find the areas of the rectangles.

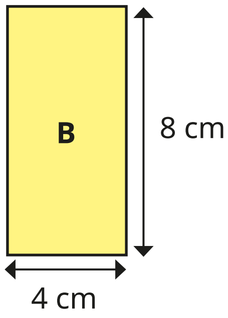


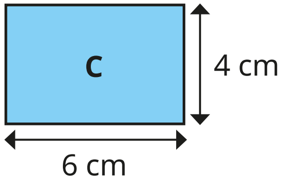


Explain your method to a partner.

- Which two rectangles have the same area?







How do you know?

- Draw as many rectangles as possible that have these areas.

All the side lengths should be whole numbers.

  - 36 cm²
  - 16 cm²
  - 17 cm²

What do you notice about your last answer?

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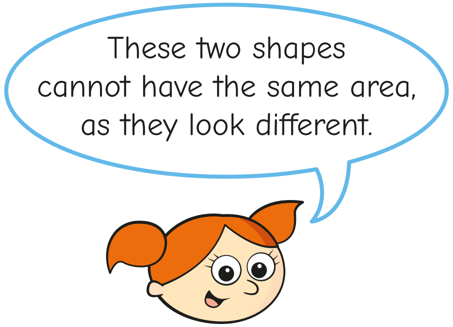
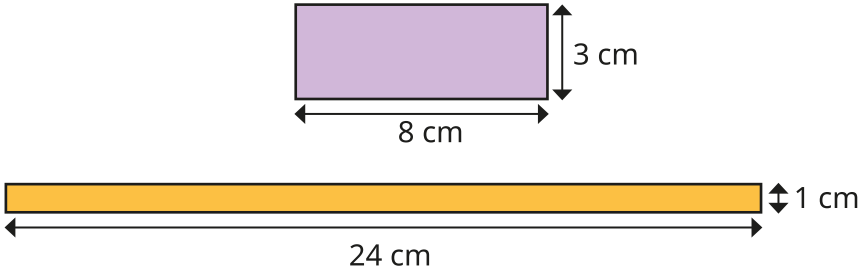
Shapes – same area

Reasoning and problem solving



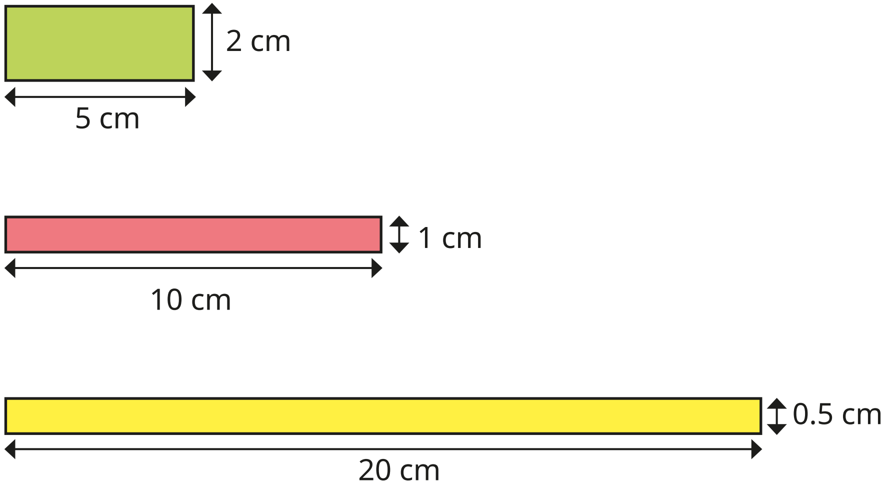


Do you agree with Alex?

Explain your answer.

No

Which rectangle has the greatest area?



Sketch the next rectangle in the pattern.

What is its area?

How do you know?

All the rectangles have the same area. | 10 cm^2

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Area and perimeter

Notes and guidance

Building on the previous step and reinforcing learning from Year 5, in this small step children find the areas and perimeters of rectangles and rectilinear shapes.

Children explore methods for finding the perimeters and areas of rectangles and rectilinear shapes and compare their efficiency. When finding the area of a rectilinear shape, encourage children to look for the most efficient way to split the shape rather than always splitting it the same way. They should pay close attention when calculating unknown side lengths, and explain how they know whether they need to add or subtract. They can also explore when it may be efficient to find the area of a rectilinear shape by subtracting the missing part from the area of a whole rectangle.

Things to look out for

- Children may confuse area and perimeter.
- When finding the area of a rectilinear shape, children may not split the shape in the most efficient way.
- When calculating the perimeter, children may not use efficient strategies, instead relying on adding lengths in order.
- Children may struggle to work out missing side lengths or forget to do so.

Key questions

- What is perimeter? What is area?
- How can you find the perimeter of the rectangle?
- How can you find the area of the rectangle?
- What is the formula to find the area of a rectangle?
- How can you split the rectilinear shape into rectangles? Is there more than one way?
- How is finding the area/perimeter of a rectilinear shape different to finding the area/perimeter of a rectangle? How is it similar?
- How can you work out the other side lengths?

Possible sentence stems

- The formula to find the area of a rectangle is …
- To find the perimeter of a rectangle, I …

National Curriculum links

- Recognise that shapes with the same areas can have different perimeters and vice versa
- Recognise when it is possible to use formulae for area and volume of shapes

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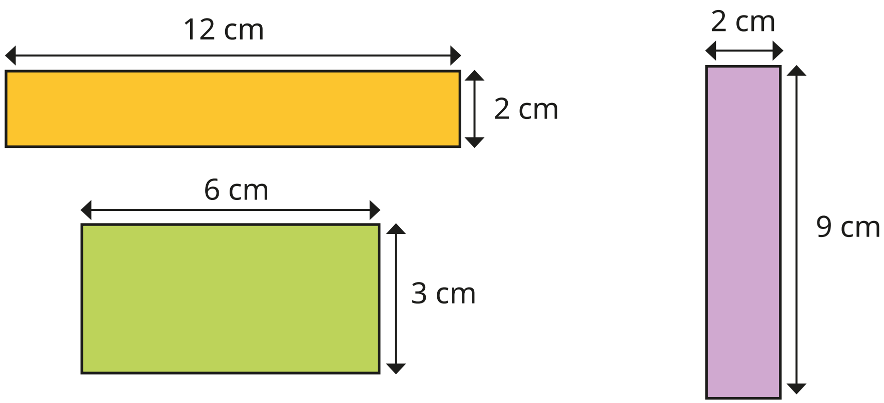
Area and perimeter

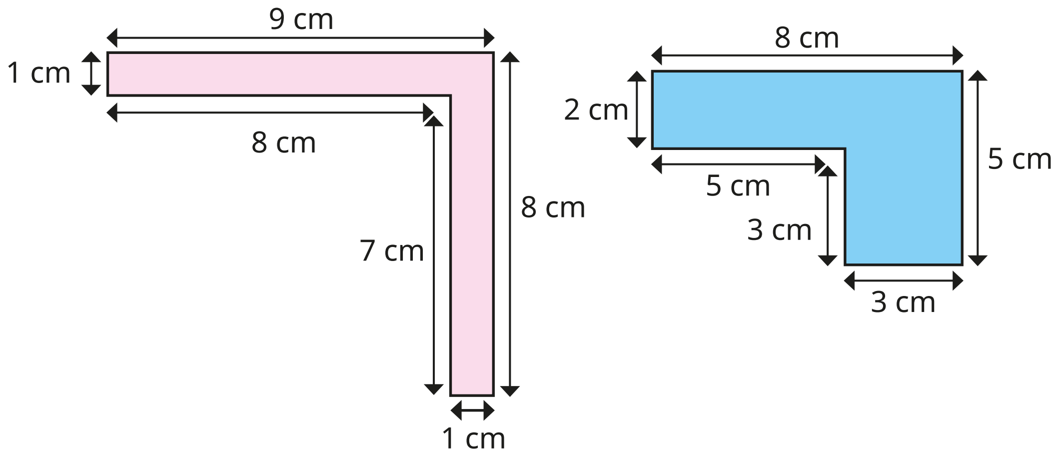
Key learning

- Find the area and perimeter of each rectangle.

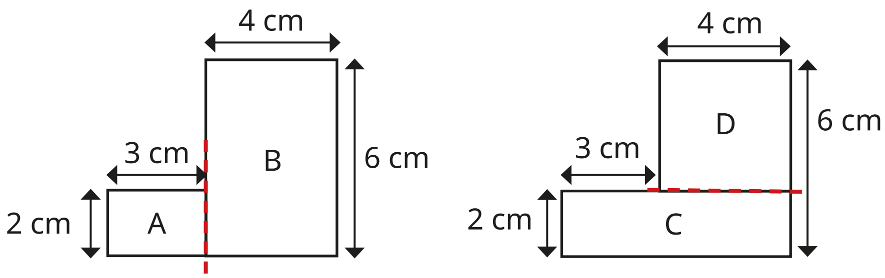


Compare methods with a partner.

- Work out the perimeters of the rectilinear shapes.



- Both of these rectilinear shapes are made from two rectangles.

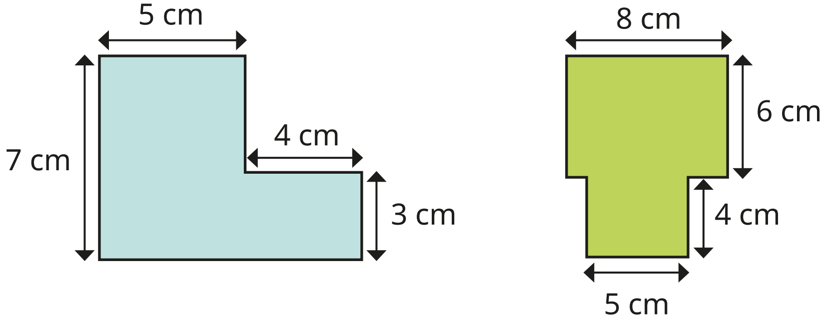


Work out the areas of the rectangles to work out the areas of the rectilinear shapes.

What do you notice?

Why does this happen?

- Find the area and perimeter of each shape.



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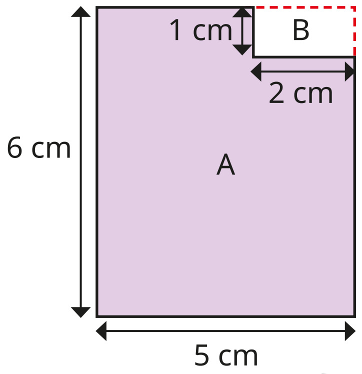
Area and perimeter

Reasoning and problem solving

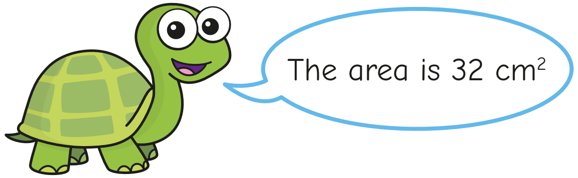
Tiny is finding the area of this shape.



Area of A = 6 cm × 5 cm
= 30 cm^2

Area of B = 1 cm × 2 cm
= 2 cm^2

Total area = 32 cm^2

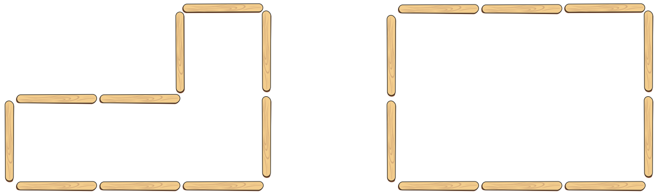


Do you agree with Tiny?

Explain your answer.

No

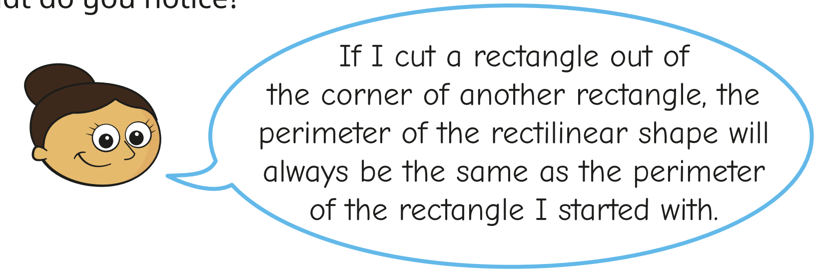
Dora has made two rectilinear shapes using lolly sticks.



The length of each lolly stick is 10 cm.

Work out the perimeter of each shape.

What do you notice?



Do you agree with Dora?

Talk about it with a partner.

both 60 cm | Yes

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Area of a triangle – counting squares

Notes and guidance

In this small step, children are introduced to finding the area of a triangle by counting squares. They estimated area in Year 5, but may need to be reminded of efficient strategies for calculating and estimating areas of shapes.

Children first find the areas of triangles that require them to only count full and half squares. They can calculate these separately and then combine them to find the area. They then move on to estimating the areas of triangles that involve sections of squares greater and less than half. Children also explore creating their own triangles with a specific area.

Some links are made between the area of a rectangle and the area of a triangle, but the formula is not introduced until the next step.

Things to look out for

- Children may count half squares as full squares.
- Without an efficient method, children may not count squares accurately.
- Children may find it difficult to draw a triangle with a specific area.
- If a triangle is not placed on a line, children may believe it is impossible to estimate its area.

Key questions

- How is finding the area of a triangle similar to finding the area of a rectangle when counting squares? How is it different?
- How will you count the squares accurately?
- Is more or less than half the square shaded?
- Can you see any parts of squares that combine to make approximately one full square?
- How does the area of the rectangle link to the area of a triangle? Why do you think this happens?

Possible sentence stems

- The triangle has _______ full squares.
  The triangle has _______ half squares.
  The area of the triangle is _______ cm^2
- The approximate area of the triangle is _______ cm^2

National Curriculum links

- Calculate the area of parallelograms and triangles

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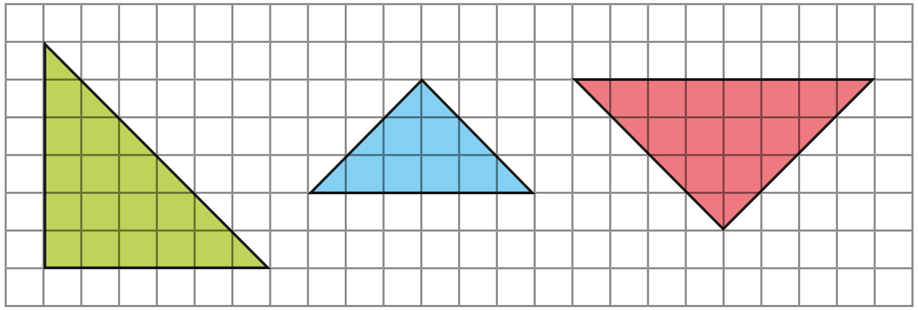
Area of a triangle – counting squares

Key learning

- Complete the sentences to find the area of the triangles.



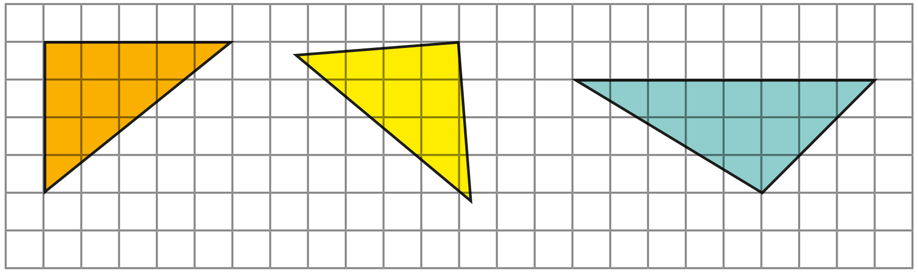
The triangle has ______ full squares.

The triangle has ______ half squares.

______ + ______ = ______

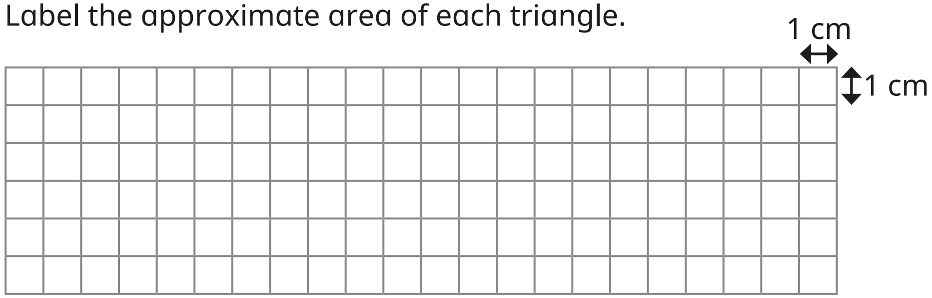
The total area of the triangle is ______ cm^2

- Estimate the areas of the triangles by counting squares.

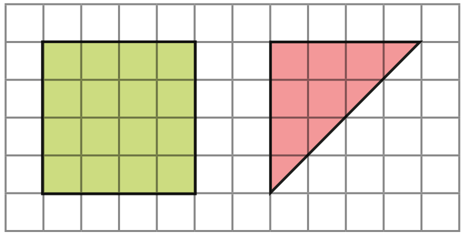


- Draw three different triangles that have an area between 5 cm^2 and 15 cm^2

Label the approximate area of each triangle.



- Work out the area of each shape by counting squares.



What do you notice about the area of the triangle compared to the area of the square?

Does this always happen?

Draw a rectangle and a triangle to explore the pattern.

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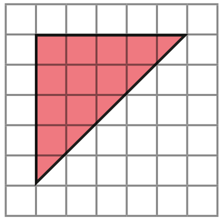
Area of a triangle – counting squares

Reasoning and problem solving

Tiny says that the area of the triangle is 15 cm^2

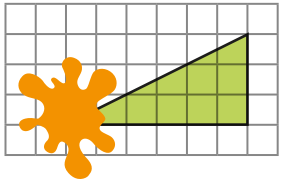


Tiny is incorrect.

Explain what Tiny has done wrong.

Tiny has counted the half squares as full squares.

Part of the triangle has been covered.

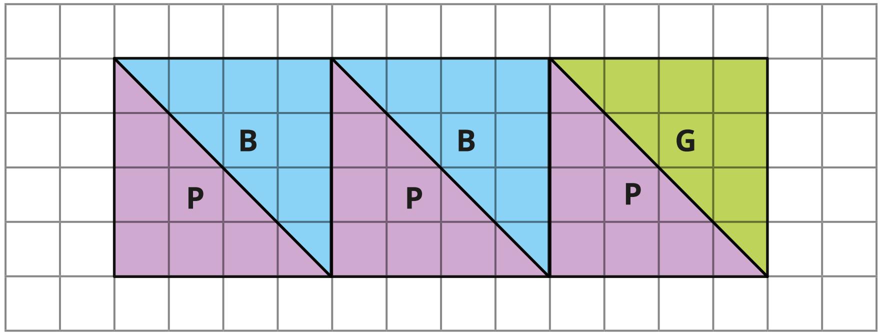


Estimate the area of the whole triangle.

Would your estimate change if the splat was in a different place?

9 cm^2

Huan draws three squares and splits them into six right-angled triangles.



What is the total area of the purple (P) triangles?

What is the total area of the blue (B) triangles?

What is the area of the green (G) triangle?

Compare methods with a partner.

purple: 24 cm^2

blue: 16 cm^2

green: 8 cm^2

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Area of a right-angled triangle

Notes and guidance

In this small step, children look in more detail at finding the areas of right-angled triangles.

Children move on from counting squares to identifying and using a formula. They explore the fact that a right-angled triangle with the same length and perpendicular height as a rectangle has an area that is half the area of the rectangle. They then adapt the formula for the area of a rectangle to find the area of a right-angled triangle. Children use the formula area = $\frac{1}{2}$ × base × perpendicular height rather than $\frac{1}{2}$ × length × width in readiness for the next step, where they look at non-right-angled triangles. This vocabulary should be explored and children should be confident identifying the correct parts of the triangle.

Things to look out for

- Children may not identify that a rectangle can be made into two right-angled triangles.
- Children may not be able to identify the base and perpendicular height, choosing the incorrect measurements to multiply.
- Children may not associate multiplying by $\frac{1}{2}$ with dividing by 2

Key questions

- How can you split the rectangle into two right-angled triangles?
- What do you notice about the two triangles?
- What do you notice about finding the area of a rectangle and finding the area of a right-angled triangle?
- What is the formula to find the area of a right-angled triangle?
- What does "perpendicular" mean?
- How do you know which measurement is the base/perpendicular height?

Possible sentence stems

- The area of the right-angled triangle is ______ the area of the rectangle.
- The formula for the area of a triangle is …

National Curriculum links

- Recognise when it is possible to use formulae for area and volume of shapes
- Calculate the area of parallelograms and triangles

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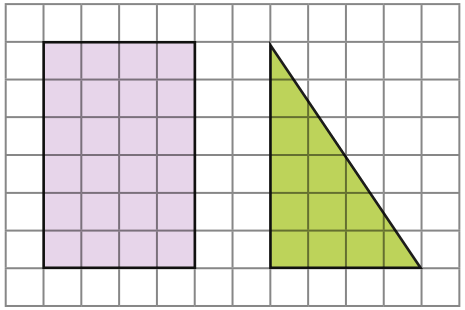
Area of a right-angled triangle

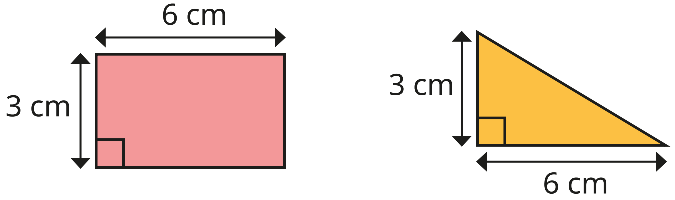
Key learning

- Here is a rectangle and a right-angled triangle.



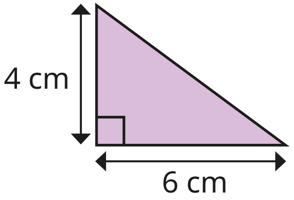
  - What is the area of the rectangle?
  - What is the area of the right-angled triangle?
  - What do you notice?

- Here is a rectangle and a triangle.



  - What is the area of the rectangle?
  - What is the area of the triangle?
  - How do you work out the area of a right-angled triangle?

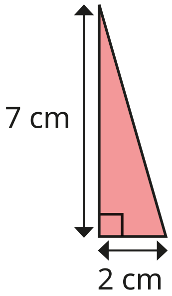
- Scott uses the formula to work out the area of this right-angled triangle.

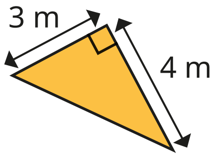


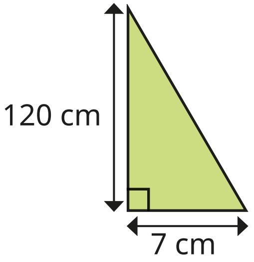
$$\text{area} = \frac{1}{2} \times \text{base} \times \text{perpendicular height}$$

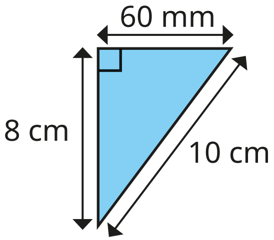
$$\text{area} = \frac{1}{2} \times 6 \times 4 = \frac{1}{2} \times 24 = 12 \text{ cm}^2$$

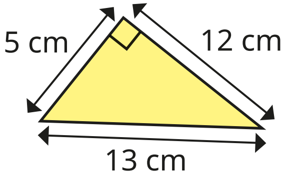
Use the formula to find the areas of the triangles.

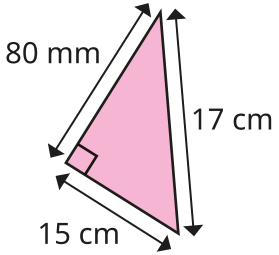












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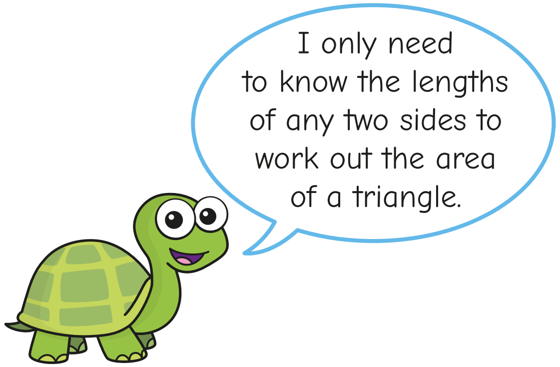
Area of a right-angled triangle

Reasoning and problem solving

Tiny is working out the area of a right-angled triangle.



Do you agree with Tiny?

Explain your answer.

No

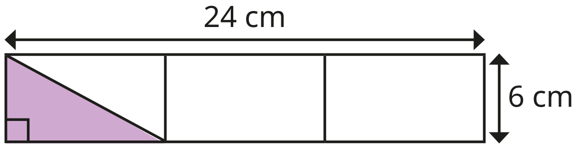
The area of a right-angled triangle is 54 cm²

What could the base and height be?

How many solutions can you find?

multiple possible answers, e.g.
18 cm and 6 cm

Calculate the area of the shaded triangle.



Compare methods with a partner.

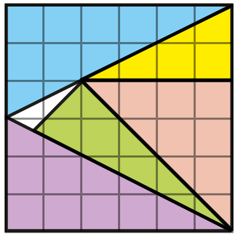
24 cm²

Aisha has placed five right-angled triangles onto a square.

The total area of the square is 36 cm²

1 cm² is not covered by a triangle.

What is the area of the green triangle?



5 cm²

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Area of any triangle

Notes and guidance

In this small step, children extend their knowledge of finding the area of a right-angled triangle to find the area of any triangle.

Children use the same formula as before, but now need to identify that the perpendicular height is not always the length of one of the sides. Initially, they find the areas of triangles where only the base and perpendicular height are given, before looking at triangles where more measurements are given.

Children need to understand that the base is not always at the bottom of a triangle and sometimes there may be more than one possible calculation they could use to find the area.

Things to look out for

- Children may not identify the base and perpendicular height correctly.
- Children may think that the base is always at the bottom of the triangle.
- Children may think that the measurement giving the perpendicular height is always labelled inside the triangle.
- If given more than two measurements, children may multiply the incorrect lengths.

Key questions

- What is the formula for the area of a triangle?
- How do you know which side is the base?
- How do you know what the perpendicular height is?
- How do you know that you are using the correct lengths?
- Is there more than one way to find the area of this triangle?
- Is the base always at the bottom of the triangle?

Possible sentence stems

- The formula for the area of a triangle is …
- The base is ______ cm.

  The perpendicular height is ______ cm.

  Area = $\frac{\square}{\square}$ × ______ × ______

National Curriculum links

- Recognise when it is possible to use formulae for area and volume of shapes
- Calculate the area of parallelograms and triangles

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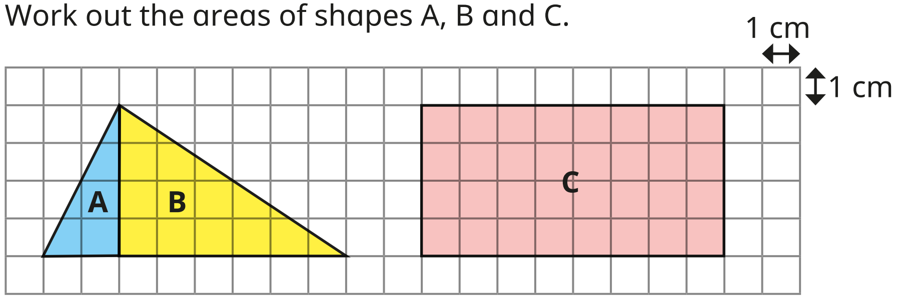
Area of any triangle

Key learning

- Work out the areas of shapes A, B and C.

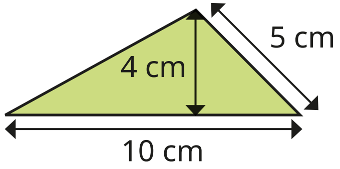


  - What is the total area of the scalene triangle formed by A and B?
  - Compare this area to the area of rectangle C.

    What do you notice?

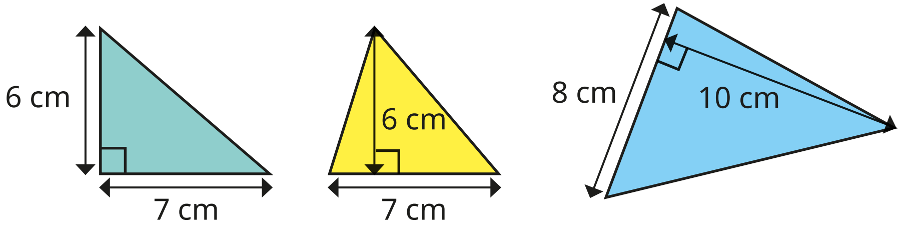
    Does this always happen?

- Here is a triangle.



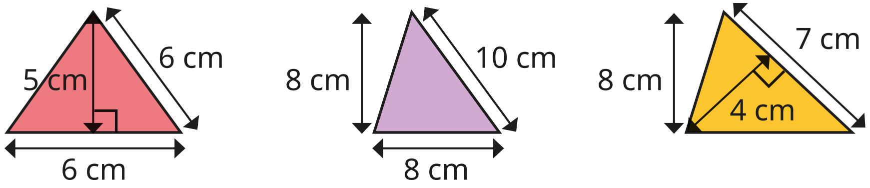
  - What is the length of the base of the triangle?
  - What is the perpendicular height of the triangle?
  - Use the formula area = $\frac{1}{2}$ × base × perpendicular height to work out the area of the triangle.

- Work out the areas of the triangles.

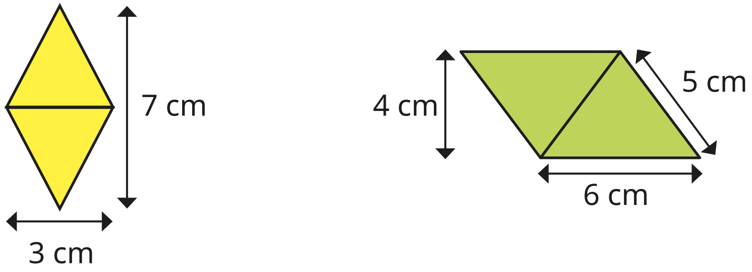


What is the same and what is different about the first two triangles?

- Find the area of each triangle.



- Calculate the area of each shape.



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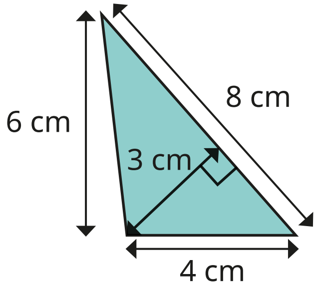
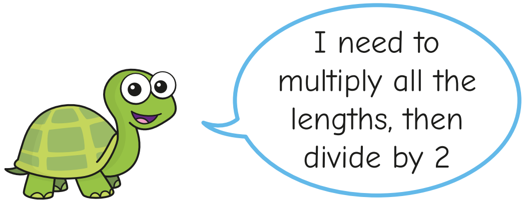
Area of any triangle

Reasoning and problem solving

Tiny is finding the area of this triangle.





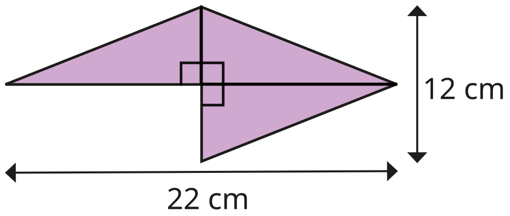
Explain why Tiny is incorrect.

Work out the area of the triangle.

Can you find more than one way to do it?

12 cm^2

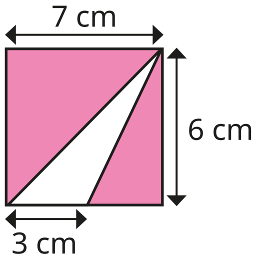
This shape is made up of three identical triangles.



What is the area of the shape?

99 cm^2

Here is a flag.



Find the area of the flag that is white.

Is there more than one way to find the answer?

9 cm^2

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Area of a parallelogram

Notes and guidance

In this small step, children explore the area of a parallelogram, identifying and using a formula.

Children look at the properties of a parallelogram and compare to a rectangle. Using the "cut-and-move method", they explore how the parts of the parallelogram can be rearranged to make a rectangle in which the length and width correspond to the base and perpendicular height of the parallelogram. Through this, they recognise that the area of a parallelogram can be found by using the formula area = base × perpendicular height.

As they did for triangles, children need to be able to identify the base and perpendicular height when given more than the required measurements. This needs to be carefully modelled so that children do not believe that area = $l \times w$. It may be useful to compare all the formulas they know for finding the areas of shapes.

Things to look out for

- When finding the area of a parallelogram, children may try to use the formula for finding the area of a rectangle or a triangle.
- Children may struggle to identify the base and perpendicular height.

Key questions

- How could you change the parallelogram into a rectangle? How will this help you to find the area?
- How can you count the squares accurately to find the area?
- How do you know you have found the base/ perpendicular height?
- What is the formula for finding the area of a parallelogram?
- When you have different units, what is your first step?

Possible sentence stems

- The base of the parallelogram is ______ cm.
  The perpendicular height of the parallelogram is ______ cm.
  The area of the parallelogram is ______ × ______ = ______ cm^2

National Curriculum links

- Recognise when it is possible to use formulae for area and volume of shapes
- Calculate the area of parallelograms and triangles

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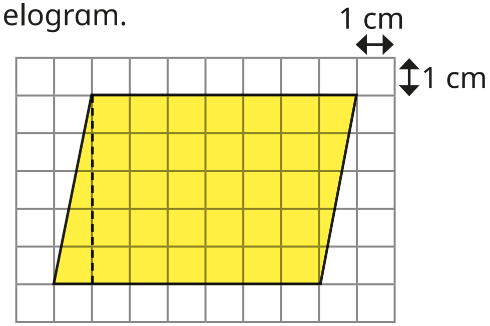
Area of a parallelogram

Key learning

- Here is a parallelogram.



  - Copy the parallelogram onto centimetre squared paper.

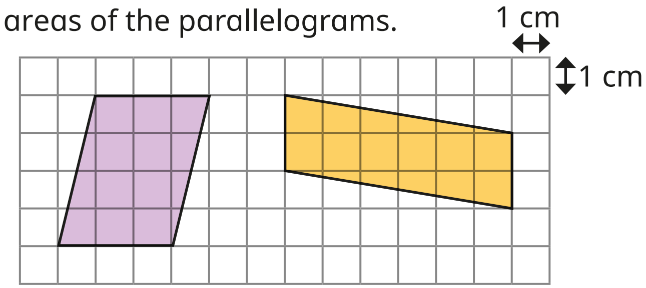
    Estimate its area by counting squares.
  - Now cut along the dotted line.

    Move the triangle to make a rectangle.

    What is the area of the rectangle?

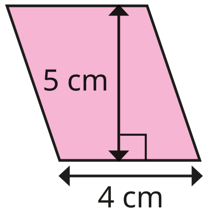
    What do you notice?

- Work out the areas of the parallelograms.



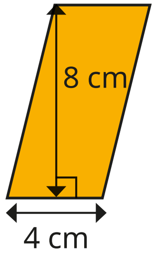
Explain your method to a partner.

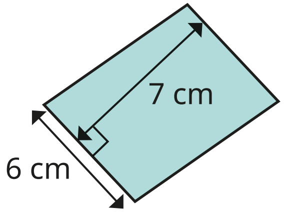
- Annie has worked out the area of this parallelogram.

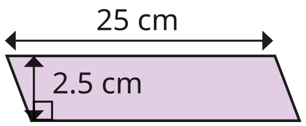


area = base × perpendicular height
= 4 cm x 5 cm
= 20 cm^2

Use Annie's method to find the areas of the parallelograms.

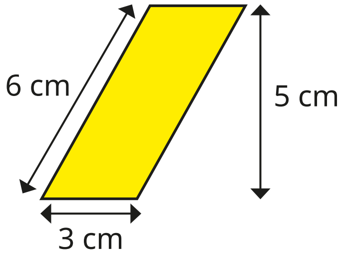


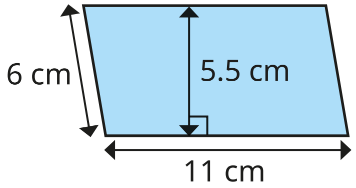




- Label the base b and perpendicular height h on each parallelogram.

  Then find the area of each shape.





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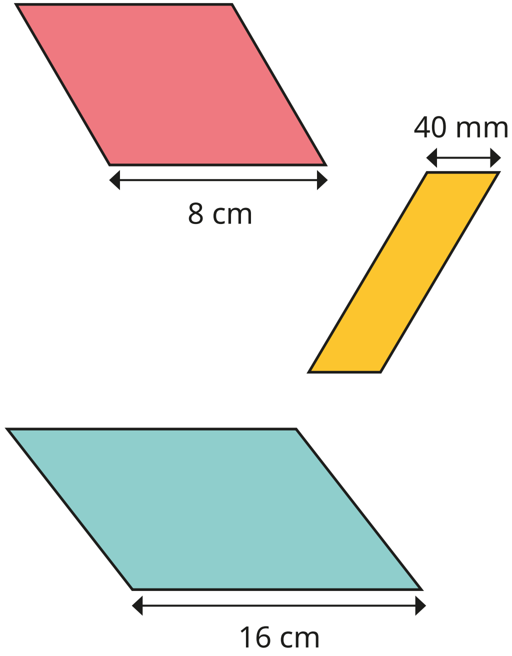
Area of a parallelogram

Reasoning and problem solving

These parallelograms each have an area of 40 cm^2

Find the perpendicular height of each shape.



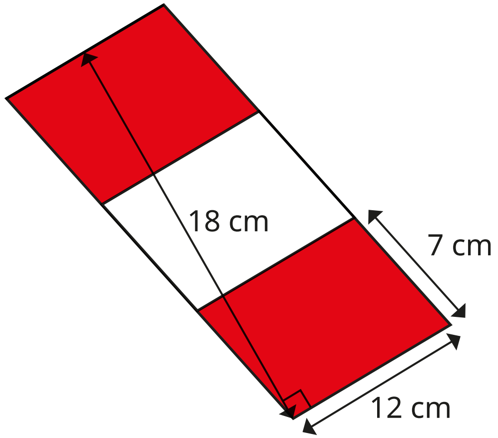
5 cm

10 cm

2.5 cm

All the parallelograms have the same area.

Find the total area of the shaded parallelograms.



Which measurement is not needed?

Find more than one method to work out the answer.

Which was more efficient?

144 cm^2

7 cm

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Volume – counting cubes

Notes and guidance

In Year 5, children began to explore volume as the amount of space that a solid object takes up. They started by counting cubes, before being introduced to cubic centimetres (cm^3) as a unit of measure for volume. This learning is recapped at the beginning of this small step.

Children then explore shapes where they can find the volume by multiplying the volume of a single layer by the number of equal layers. This can include cuboids and other prisms. Encourage children to explore the relationship between the total volume of a cuboid and its length, width and height, although there is no need to explicitly introduce the formula for finding the volume of a cuboid, as this will be covered in more detail in the next step.

Things to look out for

- Children may believe that shapes that look different visually must have different volumes.
- Children may ignore cubes that cannot be “seen” in an image, so it is important to discuss the possibility of hidden cubes and how children might know for certain that more cubes exist even if they cannot see them.

Key questions

- What is volume?
- How is volume different from area?
- How can you count the number of cubes efficiently?
- If each cube has a volume of 1 cubic centimetre (cm^3), what is the volume of the shape?
- How many cubes are there in this layer? How many equal layers are there? So how can you find the volume?
- What is the length/width/depth of this cuboid?

Possible sentence stems

- The volume of the shape is ______ cubes.
- The volume of the shape is ______ cm^3
- There are ______ cubes in each layer and ______ equal layers, so the volume is ______ cubes.

National Curriculum links

- Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units

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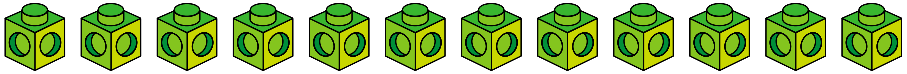
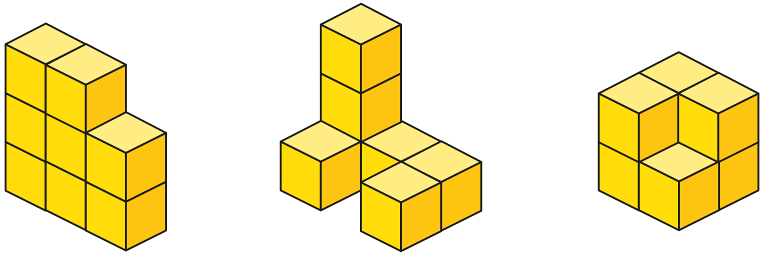
Volume – counting cubes

Key learning

- Using 12 cubes, how many different shapes can you make?

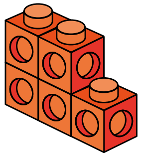


- How many cubes are used to make each shape?



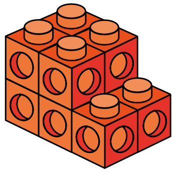
- Brett makes this shape using cubes.

  What is the volume of the shape in cubes?



  Mo makes an identical shape and attaches the shapes together like this.

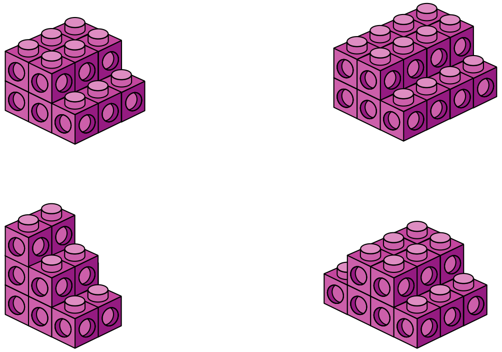
  What is the volume of the shape in cubes?



  What do you notice?

- Each shape is made using centimetre cubes.

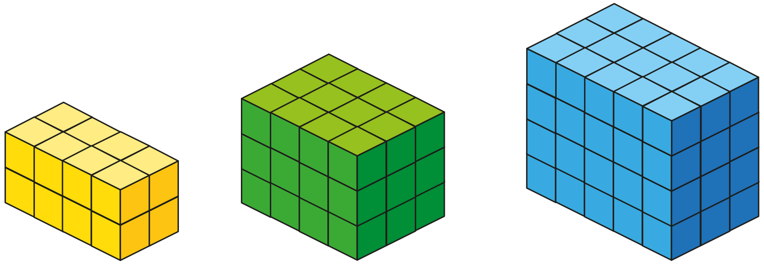
  Work out the volume of each shape in cm^3



  What is the quickest way of finding the volumes?

- Each cuboid is made using centimetre cubes.

  Find the volumes of the cuboids.



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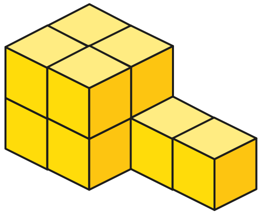
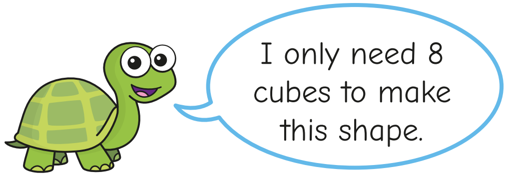
Volume – counting cubes

Reasoning and problem solving





Do you agree with Tiny?

Explain your reasons.

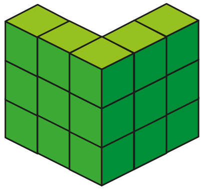
No

Make a cuboid using 24 cubes.

What are the dimensions of your cuboid?

How many different cuboids can you make with this number of cubes?

multiple possible answers, e.g.
6 cubes, 2 cubes and 2 cubes

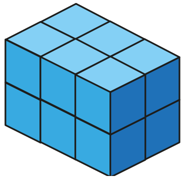


What could the volume of this shape be?

Compare answers with a partner.

between 15 and 23 cubes

Dani makes this cuboid.



She makes another cuboid by increasing the height, width and depth by 1 cube.

What is the difference in the volumes of the cuboids?

24 cubes

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Volume of a cuboid

Notes and guidance

In this small step, children move on from counting cubes to finding the volumes of cuboids using multiplication and applying a formula.

Children discover that they can use multiplication to find the number of cubes in one “layer” of the shape and then multiply this by the number of layers to find the total volume. This will help children identify the formula: volume of cuboid = length × width × height. They should recognise that the formula works whichever way they look at the cuboid and what they think of as a “layer”.

Once children understand the formula, encourage them to find the most efficient method to calculate the volume using the associative law of multiplication.

Things to look out for

- Children may think that it is impossible to find the volume without cubes.
- Children may think that they must always multiply $l \times w \times h$ in that order, which may not always be the most efficient calculation.
- When finding the volumes of cubes, children may think that they need more than one measurement.

Key questions

- What is volume?
- How many cubes are there in one layer? How do you know?
- How do you find the total volume of the cuboid?
- What is the formula to find the volume of a cuboid?
- What is the same and what is different about area and volume?
- What is the most efficient order to multiply the three numbers together?

Possible sentence stems

- There are ______ cubes in each layer.

  There are ______ layers.

  The volume of the cuboid is ______
- The length is ______. The width is ______. The height is ______.

  The volume of the cuboid is ______ × ______ × ______ = ______

National Curriculum links

- Calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units

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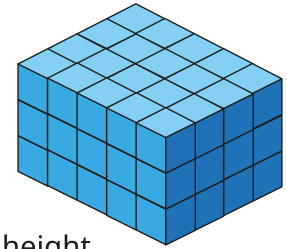
Volume of a cuboid

Key learning

- The cuboid is made using centimetre cubes.
  - What is the volume of the cuboid?
  - What is the length, width and height of the cuboid?
  - Find the product of the length, width and height.

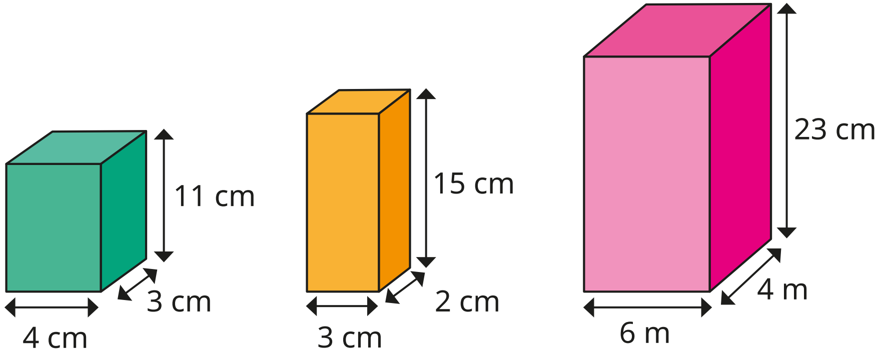


What do you notice?

- Here is the formula for the volume of a cuboid.

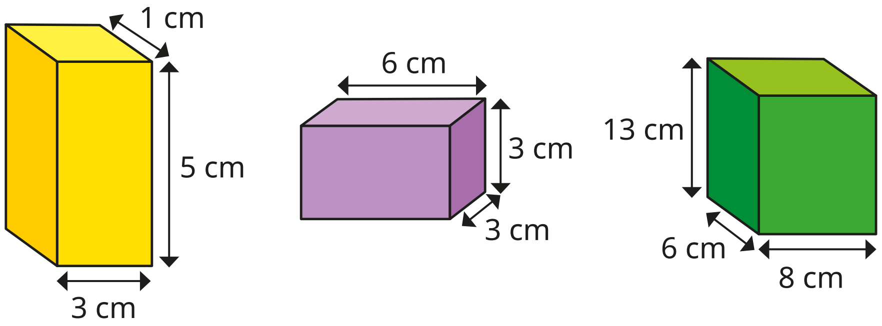
volume = length × width × height

Use the formula to find the volumes of the cuboids.

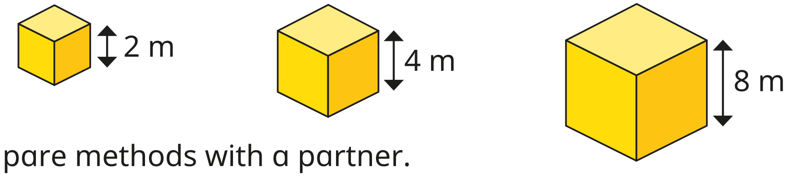


Does it matter in which order you multiply the numbers?

- Find the volumes of the cuboids.

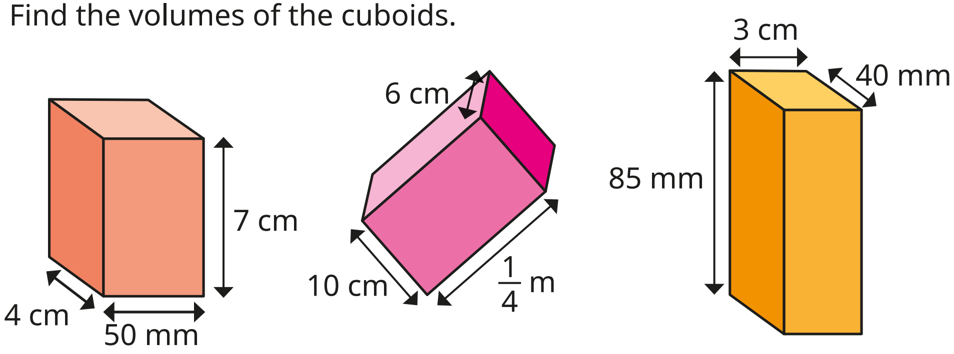


- Find the volumes of the cubes.



Compare methods with a partner.

- Find the volumes of the cuboids.



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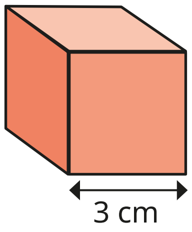
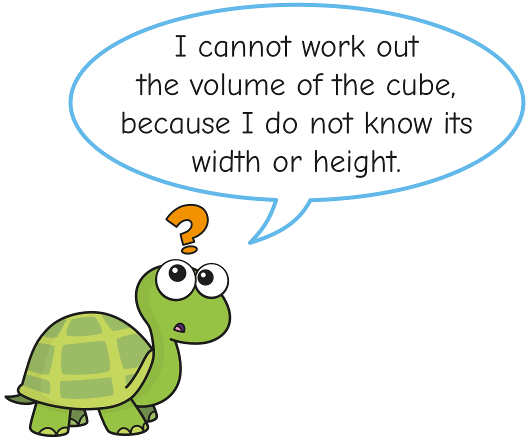
Volume of a cuboid

Reasoning and problem solving

Here is a cube.



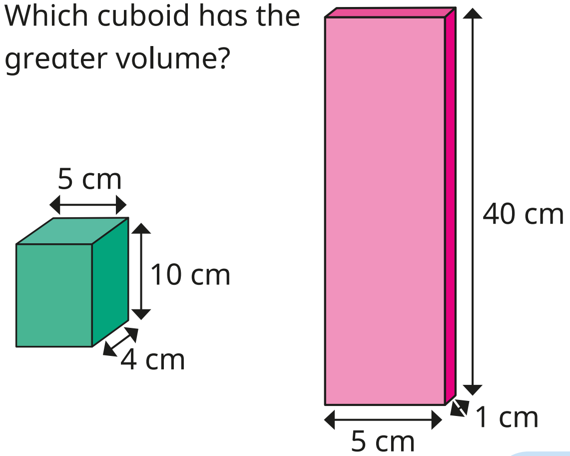


Do you agree with Tiny?

Explain your answer.

No

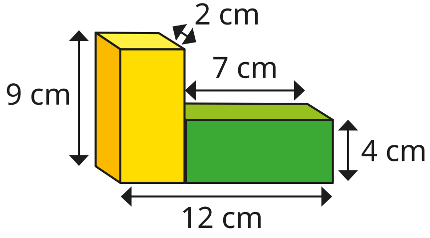
Which cuboid has the greater volume?



Explain how you know.

Both cuboids have the same volume: 200 cm^3

Calculate the volume of the compound shape.



146 cm^3

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Spring Block 6

Statistics

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Small steps

Step 1	Line graphs
Step 2	Dual bar charts
Step 3	Read and interpret pie charts
Step 4	Pie charts with percentages
Step 5	Draw pie charts
Step 6	The mean

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Line graphs

Notes and guidance

In Year 5, children focused on drawing, reading and interpreting simple line graphs. In this small step, they revisit that learning and progress to looking at more complex graphs, including ones with more than one line.

Children start by looking at simple line graphs and the information that can be gathered from them. They should recognise that they can only read off approximate values for data that lies between two marked points, which is why a dashed line is used. They then draw line graphs using given information. When doing this, it is important to discuss what each axis will represent, drawing children's attention to the fact that time is usually shown on the horizontal axis. When they are drawing line graphs, support children in choosing appropriate scales based on the numbers given.

Children also answer problems involving line graphs. They should be able to infer what has happened in a given situation based on the information provided in the line graph.

Things to look out for

- When drawing their own line graphs, children may need support to choose appropriate scales.
- When there is more than one line on a graph, children may use the wrong line.

Key questions

- How do you read information from a line graph?
- What does each axis represent?
- What is the smallest value in the data? What is the greatest?
- What intervals would be appropriate for this line graph?
- What does this line graph tell you?
- What does the direction of the line tell you about what happened?
- How can two sets of data be recorded on the same line graph?

Possible sentence stems

- The horizontal axis shows ______
  The vertical axis shows ______
- At ______, the graph reads ______
  At ______, the graph reads ______
  The difference between the two points is ______

National Curriculum links

- Interpret and construct pie charts and line graphs and use these to solve problems

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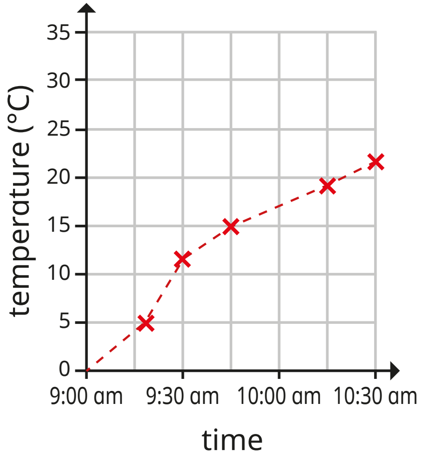
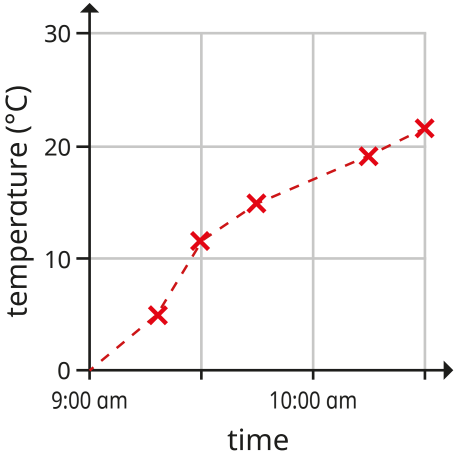
Line graphs

Key learning

- Discuss with a partner what is the same and what is different about the line graphs.





- ▶ What is the temperature at 9:45 am?
- ▶ At what time was the temperature approximately 12 °C?

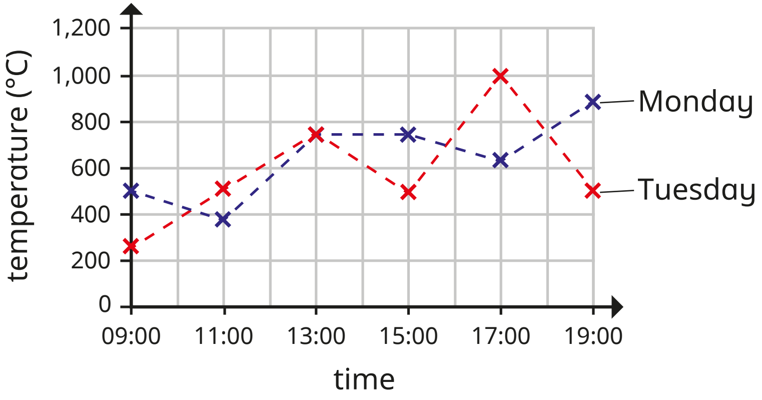
- The table shows the height a rocket reached between 0 and 60 seconds.

Time (seconds)	0	10	20	30	40	50	60
Height (metres)	0	8	15	25	37	50	70

Draw a line graph to represent the information.

- The graph shows water consumption over two days.

  The water consumption was recorded every 2 hours.



- ▶ At what times was the recorded amount of water consumed on Monday and Tuesday the same?
- ▶ Was more water consumed at 5:00 pm on Monday or Tuesday?

  Approximately how much more?

- The table shows the populations in the UK and Australia from 1995 to 2020

	1995	2000	2005	2010	2015	2020
UK	58,000,000	58,900,000	60,300,000	63,300,000	65,400,000	67,900,000
Australia	18,000,000	19,000,000	20,200,000	22,100,000	23,800,000	25,500,000

Draw a line graph to represent the information.

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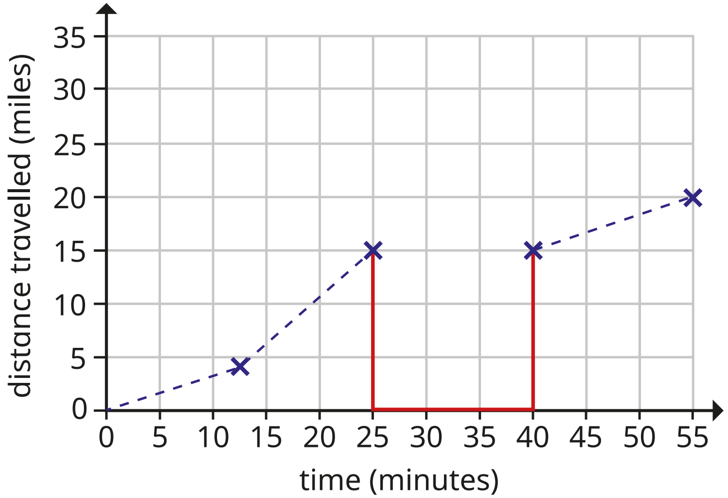
Line graphs

Reasoning and problem solving

This graph shows the distance travelled by a car.

The car stops between 25 and 40 minutes.

Tiny has added the red line to show the car stopped.

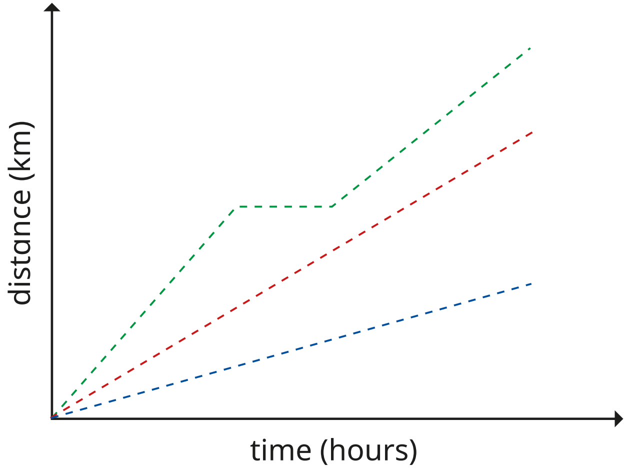


Do you agree with Tiny?

Explain your answer.

No

The graph shows some of Dr Lee's journeys.



What is the same and what is different about the journeys?

What might have happened during the green journey?

multiple possible answers, e.g.

All the journeys took the same length of time.

During the green journey, Dr Lee might have stopped for a rest.

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Dual bar charts

Notes and guidance

In this small step, children build on learning from earlier in the key stage as they explore dual bar charts, looking at the different information that can be seen from them, and discussing the similarities and differences when compared to a single bar chart. In particular, children should recognise the importance of a key to ensure that the bar charts can be interpreted.

It is useful to begin with a simple dual bar chart showing discrete data with small whole numbers, allowing children to explore a range of questions such as the total and difference between various amounts. This is a good opportunity to revisit reading scales and estimating from number lines.

The focus of this step is interpretation, but children could also explore drawing dual bar charts.

Things to look out for

- Children may only read one of each of the pairs of bars.
- Children may combine the pairs of bars and find a total, rather than considering them separately.
- Support may be needed to estimate from scales.

Key questions

- How is a dual bar chart different from a single bar chart?
- What information does this dual bar chart give?
- What is different about what the two bars show?
- How do you know which bar shows which information?
- What questions can be asked about this chart?
- What is the difference between ______ and ______?
- How much is ______ and ______ in total?

Possible sentence stems

- The first bar represents ______
  The second bar represents ______
- The difference between ______ and ______ is ______
- The bar is closer to ______ than ______, so I estimate that the value is ______

National Curriculum links

- Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs (Year 4)

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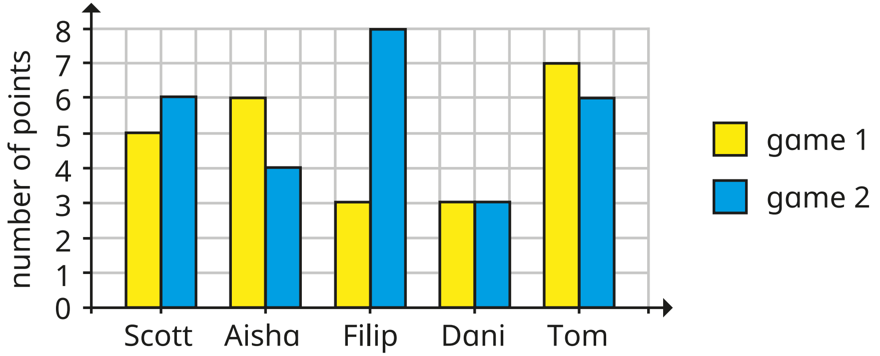
Dual bar charts

Key learning

- Five children play two games.

  Their scores for each game are recorded on a dual bar chart.

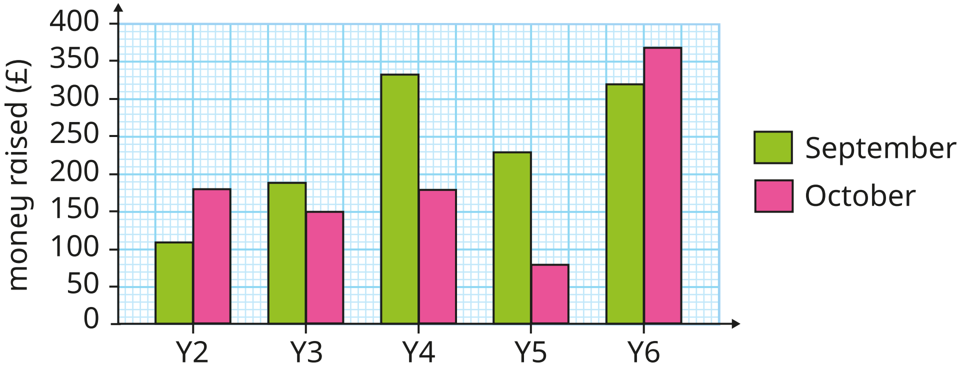


- ▶ Who scored the most points in game 1?
- ▶ Who scored the fewest points in game 2?
- ▶ Who scored the most points altogether in both games?
- ▶ How many children got a higher score on their second game?
- ▶ Which child scored the same on their first and second games?
- ▶ How many more points did Filip score on his second game than his first game?
- ▶ What is the difference between the total points scored in games 1 and 2?

What else can you find out?

- Years 2 to 6 are raising money for charity.

  The amount each year group raised in September and October is recorded in the dual bar chart.



- ▶ How much money was raised in September? How much was raised in October?
- ▶ Estimate how much more money Year 4 raised than Year 5 in October.
- ▶ Which year group has raised the most money so far?
- ▶ How much money was raised altogether in September and October?
- ▶ How much money in total have all five classes raised so far?

What else can you find out?

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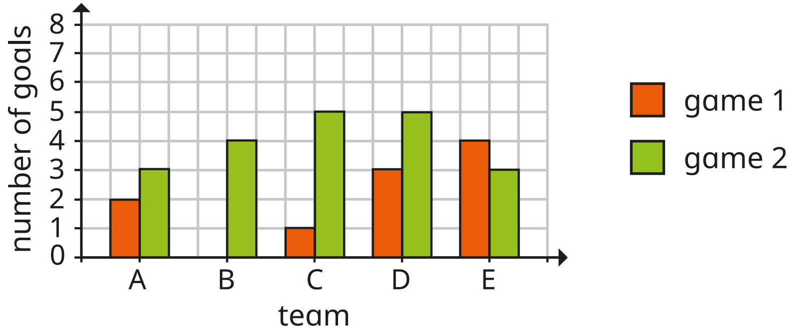
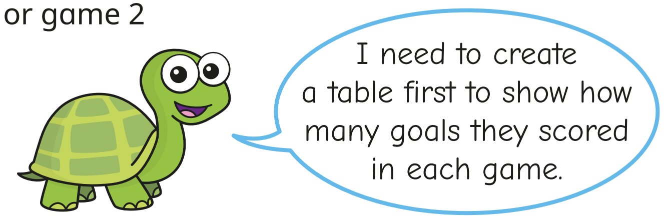
Dual bar charts

Reasoning and problem solving

The bar chart shows the number of goals scored by some teams in two games.



Tiny wants to work out whether each team scored more goals in game 1 or game 2

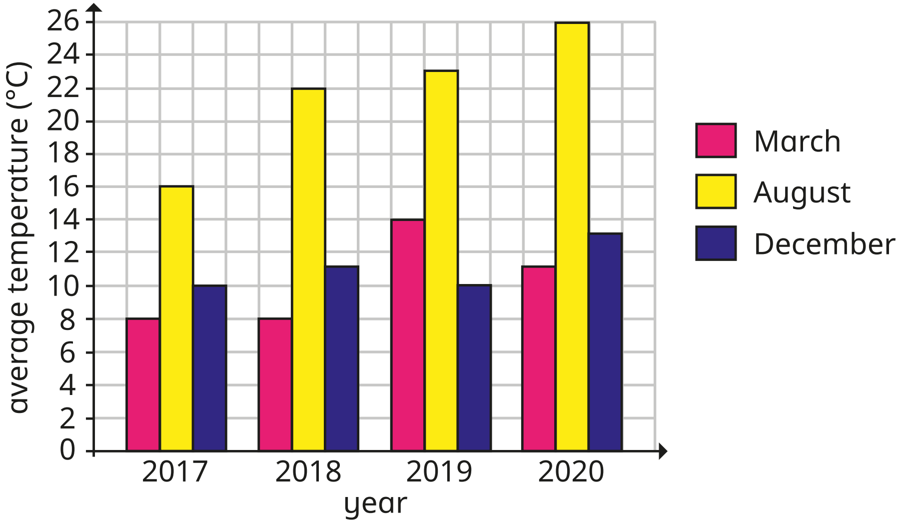


Do you agree with Tiny?

Explain your answer.

No

The bar chart shows the average temperature in a UK city.



Summarise what the chart tells you.

What questions could you ask a partner about this chart?

Compare answers as a class.

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Read and interpret pie charts

Notes and guidance

In this small step, children are introduced to pie charts for the first time. Discuss with children why a pie chart is a useful way to represent data. They should realise that a pie chart quickly and easily shows information as part of the whole. Discuss the fact that bar charts may show the numbers of most/least popular items quickly, whereas pie charts show something as more/less than a half/quarter etc. of the total.

Children first look at simple pie charts to identify the greatest/least amounts. They then move on to using the total number represented by a pie chart to work out what each equal part is worth. Finally, given the value of one part, children work out the total and/or the values of other parts of the pie chart.

Things to look out for

- Children may need a reminder of how to work out fractions of amounts.
- Children may confuse the total number with the value of one part.
- Children may think that because a sector is larger in one pie chart than another that it must represent a greater amount.

Key questions

- What does the pie chart show?
- What does each section of the pie chart show?
- Which of the choices was the most popular? How do you know?
- If you know the total, how can you work out the value of one part?
- If you know the value of one part, how can you work out the total number?
- How is a pie chart different from a bar chart?

Possible sentence stems

- There are ______ equal parts altogether.
  The total is ______, so each equal part is worth ______
- One part is worth ______
  There are ______ equal parts altogether, so the total is equal to ______

National Curriculum links

- Interpret and construct pie charts and line graphs and use these to solve problems

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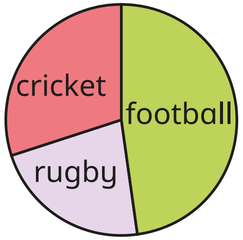
Read and interpret pie charts

Key learning

- Some children in a class were asked to name their favourite sport.

  The results are shown in the pie chart.

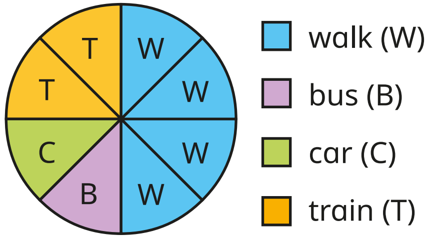


  Write **more** or **less** to complete the sentences.

  - ______ than half of the class have cricket as their favourite sport.
  - ______ than a quarter of the class have football as their favourite sport.

  Discuss with a partner what other sentences you can write about the information in the pie chart.

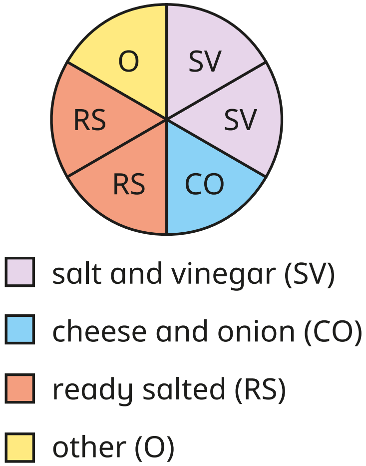
- The pie chart shows how 600 children travel to school.



  Work out how many children use each method to travel to school.

- Mo asked 180 people to name their favourite flavour of crisps.

  The results are shown in the pie chart.



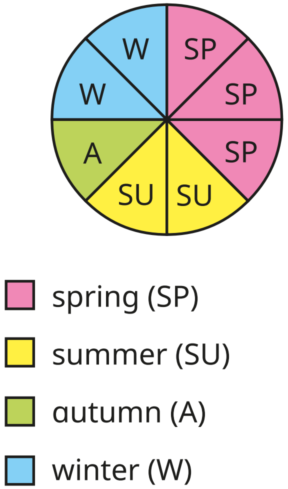
  - How many people chose ready salted?
  - How many people chose a flavour other than salt and vinegar?
  - How many more people chose salt and vinegar than cheese and onion?

  What other questions can you ask?

- In a survey, people were asked to name their favourite season of the year.

  The results are shown in the pie chart.

  48 people said that summer was their favourite season.



  - How many people took part in the survey?
  - How many people said that spring was their favourite season?

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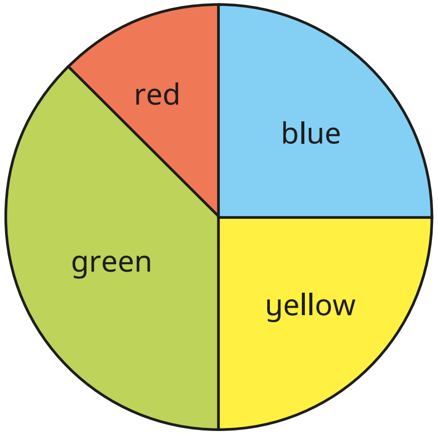
Read and interpret pie charts

Reasoning and problem solving

200 people were asked to name their favourite colour.

The pie chart shows the results.

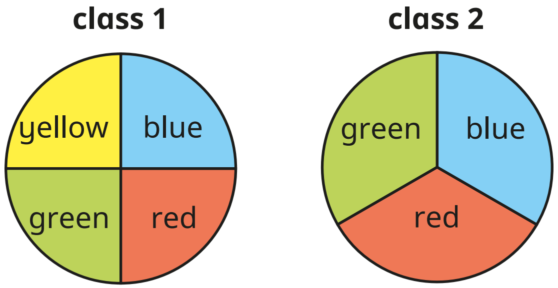


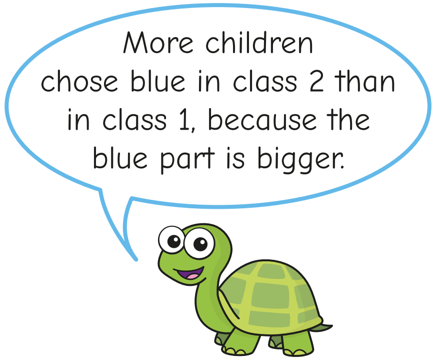
Approximately how many more people chose green as their favourite colour than chose red?

How did you work it out?

50

The pie charts show the favourite colours of the children in two classes.





Do you agree with Tiny?

Explain your answer.

No

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Pie charts with percentages

Notes and guidance

This small step revises children's understanding of percentages, in the context of pie charts.

Children need to know that a whole pie chart represents 100% of the data, so one half represents 50%, one quarter represents 25% and so on. It may also be useful to revisit efficient strategies for finding multiples of 10%, 20% and 25%.

Children look at pie charts where the total number is not given, and they need to work out the total from a given percentage. They can then work out the value of the remaining sections, using either the total or proportional reasoning (for example, knowing 40% must be 8 times the size of 5%).

Things to look out for

- Children may not use the most efficient strategy for working out the percentage of an amount.
- Children may assume two pie charts alongside each other represent the same amount.
- When given a part and asked to find the whole, children may not work backwards and instead continue to find a percentage of the amount given.

Key questions

- What percentage does the whole pie chart represent?
- What percentage does half/quarter of the pie chart represent?
- What percentages of an amount can you work out easily?
- How do you work out 10% of an amount? How does this help you to work out other percentages?
- If you know 10%/20%/25%, how can you work out the total?

Possible sentence stems

- If ______% is worth ______, then I can multiply/divide it by______ to find ______%.
- If the total is ______, then the part representing ______% is worth ______
- If the part representing ______% is worth ______, then the total is ______

National Curriculum links

- Interpret and construct pie charts and line graphs and use these to solve problems

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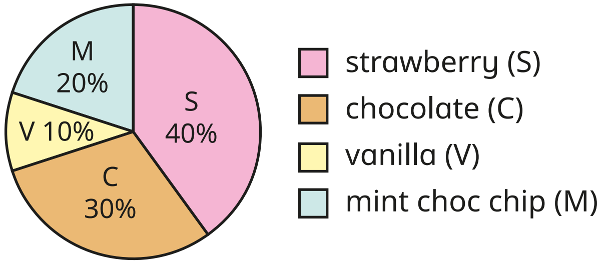
Pie charts with percentages

Key learning

- 150 children were asked to name their favourite flavour of ice cream.

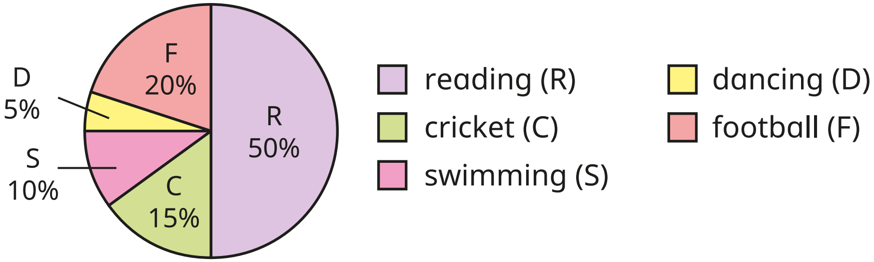
  The results are shown in the pie chart.



  How many children chose each flavour of ice cream?

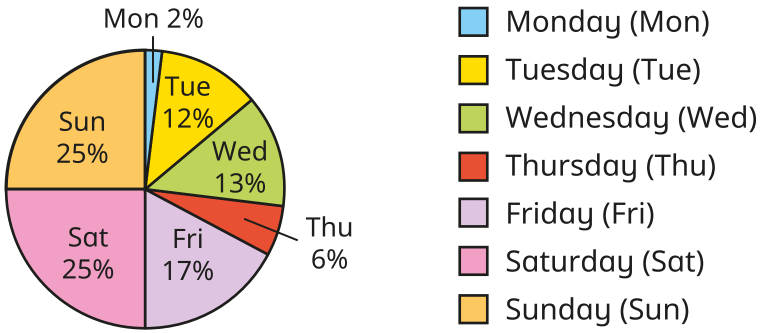
- 200 children in Key Stage 2 chose an after-school activity.

  The pie chart shows the results.



  - How many children chose each activity?
  - How many more children chose football than dancing?

- 1,200 people were asked to name their favourite day of the week.

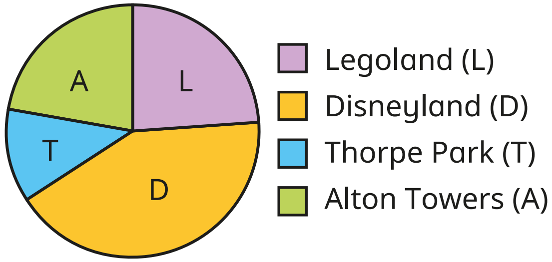


  Use the pie chart to create a table showing how many people chose each day of the week.

- 50 people were asked to name their favourite destination.

  The results were recorded in this table and a pie chart was drawn.

Destination	People
Legoland	12
Disneyland	21
Thorpe Park	6
Alton Towers	11



  Use the table to help you write the percentages on the pie chart.

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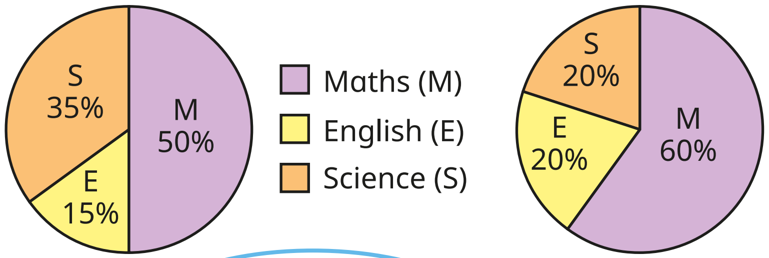
Pie charts with percentages

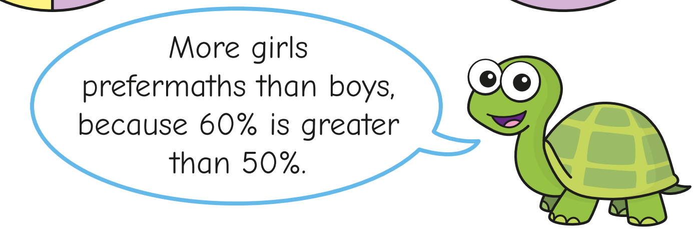
Reasoning and problem solving

120 boys and 100 girls were asked to name their favourite subject.

The results are shown in the pie charts.

boys' favourite subjects **girls' favourite subjects**





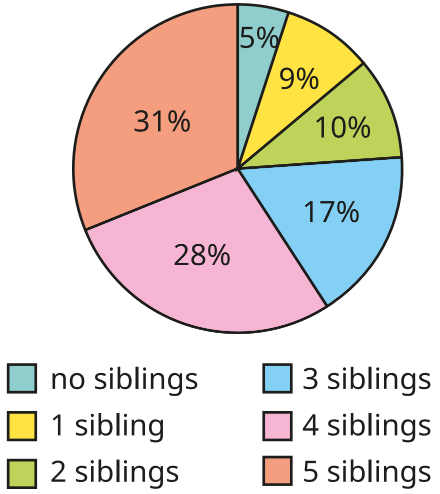
Do you agree with Tiny?

Explain your answer.

No

The pie chart shows the results of a survey about how many siblings people have.

15 people in the survey have no siblings.



Draw a table to show how many people each sector of the pie chart represents.

How many people took part in the survey?

No siblings: 15

1 sibling: 27

2 siblings: 30

3 siblings: 51

4 siblings: 84

5 siblings: 93

300

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Draw pie charts

Notes and guidance

In this small step, children complete their exploration of pie charts by drawing them.

Children recap what a pie chart represents, with the whole being worth 100%. They start by drawing simple pie charts, with each part being worth 50% or 25%, where they can easily see one half and one quarter of the chart. They then move on to constructing pie charts where guidelines are provided, firstly in 10% intervals and then at 1% intervals. Children need to use their conversion skills to work out what percentages are needed.

Finally, children construct pie charts using a protractor. They use division to work out how many degrees represent each item of data, and then multiplication to find the angle for each sector.

Things to look out for

- Children may confuse the angle with the percentage or the number that a sector represents.
- Children may need reminding how to use a protractor.
- When drawing a pie chart using a protractor, children may use the frequency as the size of the angle rather than working out what the angle should be.

Key questions

- What percentage does the whole pie chart represent?
- How can I show ______% of a pie chart?
- How many degrees are there in a full turn?
- If there are ______ in total and a part is ______, what fraction is the part of the whole?
- How can you work out the percentage/angle that represents each sector?
- How do you use a protractor? How do you know which scale to use?

Possible sentence stems

- The fraction/percentage of ______ is ______
- The whole pie chart is ______°

  This represents ______ items of data.

  Each item of data is represented by ______ ÷ ______ = ______°

National Curriculum links

- Interpret and construct pie charts and line graphs and use these to solve problems

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Draw pie charts

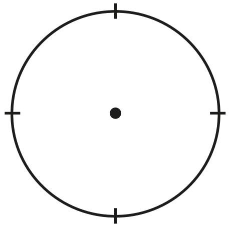
Key learning

- 20 cars drove past a school one morning.

  The table shows the colours of the cars.

  Complete the table and show the information on the pie chart.

Colour	Number	Fraction of total	% of total
Red	5		
Blue	5		
Black	10		

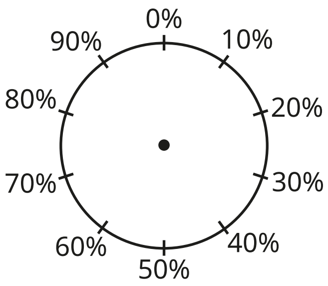


- 100 people were asked to name their favourite ice cream.

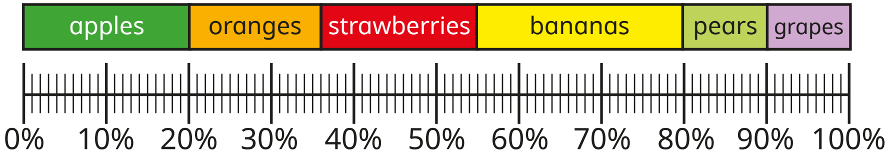
  The table shows the results.

  Use the information to draw a pie chart.

Flavour	Number	Fraction of total	% of total
Chocolate	10	$\frac{1}{10}$	10%
Vanilla	30		
Strawberry	20		
Mint	40		



- Draw a pie chart using the data shown in the percentage bar model.



What is the same and what is different about the two diagrams?

- The table shows how 36 children travel to school.

Type of transport	Number of children	Angle
Car	12	12 × 10 = 120°
Bike	7	
Walk	8	
Bus	5	
Scooter	4	
Total	**36**	**360°**

Complete the table.

Use a protractor to help you draw a pie chart to show the data.

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Draw pie charts

Reasoning and problem solving

Rosie asked the children in Year 6 to name their favourite sport.

The table shows the results.

Complete the table and draw a pie chart to show the information.

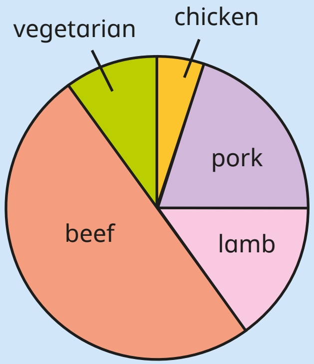
Sport	Total	Angle
Football	10	
Tennis	18	
Rugby		______ × 6 = 90°
Swimming	6	6 × 6 = 36°
Cricket		______ × 6 = 42°
Golf	4	4 × 6 = 24°
Total	**60**	**360°**

The owner of a restaurant is working out which Sunday dinner is most popular.

Complete the table and draw a pie chart to show the information.

Dinner	Total	Angle
Chicken	2	
Pork	8	
Lamb	6	
Beef	20	180°
Vegetarian	4	
Total		

Write some questions about your pie chart for a partner to answer.



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The mean

Notes and guidance

In the final small step in this block, children calculate and interpret the mean as an average.

Children may be familiar with the word "average", but are less likely to have heard of the mean. Begin by discussing what an average is and why averages are useful to summarise sets of data. Explain that the most commonly used average is the mean and show how it is calculated, recapping addition and division skills if necessary. Using simple data in familiar contexts will help children to understand the concept. Using concrete representations to model sharing out items can help children to make sense of the formula: mean = total number ÷ number of items.

When children are confident in finding the mean, they can be challenged to find missing data values if the mean is known. Children need to recognise that the first thing they need to do is to multiply to find the total.

Things to look out for

- Children may make calculation errors in the addition or division.
- Children may need support to realise they can "work backwards" to find the total when the mean is known.

Key questions

- How can you calculate the total number of ______?
- What operation do you use to share equally?
- How can you use the total to calculate the mean?
- Why would you want to find the mean of a set of data?
- For what sets of data would it be useful to calculate the mean?
- How can you use the mean to work out missing information?

Possible sentence stems

- The mean is the size of each part when the whole is shared ______
- The total is ______

  There are ______ numbers.

  Mean = ______ ÷ ______

National Curriculum links

- Calculate and interpret the mean as an average

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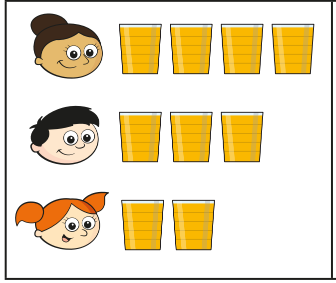
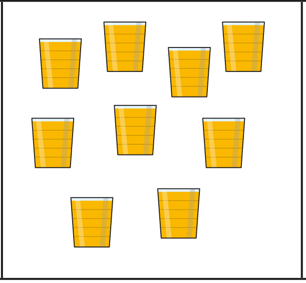
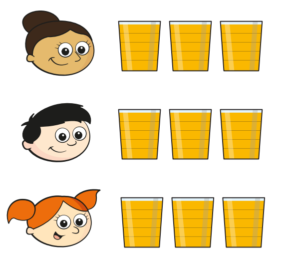
The mean

Key learning

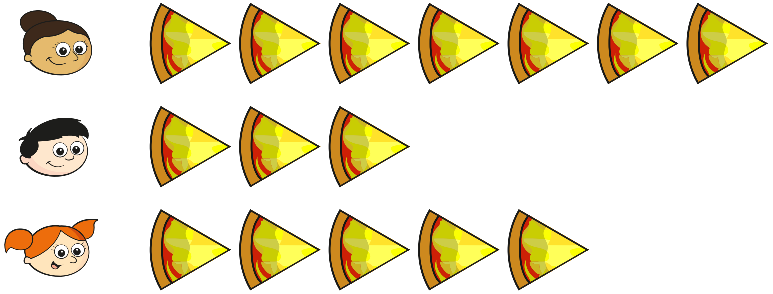
- Three children each drink some glasses of juice.

  The table shows a method to find the mean number of glasses of juice that each child had to drink.

Number of glasses per child	Total number of glasses	If each child had the same number of glasses
		

  How does the table show that the mean number of glasses that each child had is 3?

- Work out the mean number of slices of pizza eaten by each child.



- Here are the number of runs Jack scored in seven cricket matches.

  134, 60, 17, 63, 38, 84, 10

  Calculate the mean number of runs Jack scored in a match.

- The amount of money raised for charity by five children is shown in the table.

Child	Amount raised
Aisha	£24.55
Sam	£29.60
Tommy	£40
Filip	£21.20
Scott	£19.65

  What is the mean amount of money raised by the children?

- Calculate the mean of the numbers.

  0.145 0.05 0.28 0.205

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The mean

Reasoning and problem solving

The mean number of goals scored in six football matches was 4

Use this information to work out how many goals were scored in the 6th match.

Match	Number of goals
1	8
2	4
3	6
4	2
5	1
6	

3

Rosie takes 5 spelling tests.

Her mean score is 7

What scores might Rosie have got in each spelling test?

Compare answers with a partner

any set of 5 numbers that totals 35

- Mum is 48 years old.
- Scott is 4 years older than James.
- James is 7 years older than Esme.

The average age of pairs of family members are shown.

Mum
Dad } mean age of 50

Scott
James } mean age of 13

Anna
Esme } mean age of 6

Work out the age of each member of the family.

Work out the mean age of the whole family.

Mum: 48 years
Dad: 52 years
Scott: 15 years
James: 11 years
Anna: 8 years
Esme: 4 years

23 years

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