Spring Block 3

Fractions A

Small steps

Step 1	Understand the denominators of unit fractions
Step 2	Compare and order unit fractions
Step 3	Understand the numerators of non-unit fractions
Step 4	Understand the whole
Step 5	Compare and order non-unit fractions
Step 6	Fractions and scales
Step 7	Fractions on a number line
Step 8	Count in fractions on a number line

Small steps

Step 9	Equivalent fractions on a number line
Step 10	Equivalent fractions as bar models

Understand the denominators of unit fractions

Notes and guidance

Children begin this block by exploring the denominators of unit fractions. From Year 2, they know about halves, quarters and thirds and they now look at fractions with other denominators.

Children understand that a fraction can be seen as part of a whole and that to find a unit fraction, they divide the whole into equal parts. They then identify the role of the denominator, appreciating that this shows how many equal parts the whole has been divided into. This step explores unit fractions only, with the focus being on the denominator. Non-unit fractions are covered later in the block.

It is important that children are exposed to non-standard representations that they may be less familiar with, for example a square split into four equal parts by diagonal lines from the vertices.

Things to look out for

- Children may count only the shaded or non-shaded areas of diagrams to find the denominator.
- Children may not realise the importance of equal parts.
- Children may not realise that different diagrams can be used to represent the same fraction.

Key questions

- Is the diagram split into equal parts? How many equal parts are there?
- How many parts are shaded?
- What is the denominator of the fraction? How do you know?
- Why is the denominator of this fraction ______?
- Can you draw a different diagram to show the same fraction?
- If the shape has not been divided equally, can you find a fraction?

Possible sentence stems

- The shape is split into ______ equal parts.

  The denominator is ______

  The fraction that is shaded is $\frac{1}{\square}$

National Curriculum links

- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

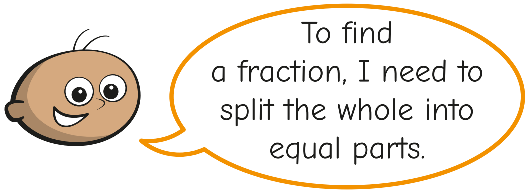
Understand the denominators of unit fractions

Key learning

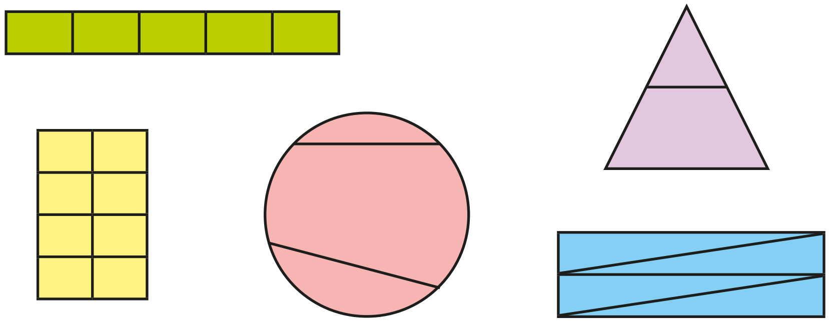
Give children a map of Europe. Tell them that Europe is the whole. Ask children to identify the parts and get them to answer using the stem sentence.

Europe is the whole. ______ is a part of the whole.

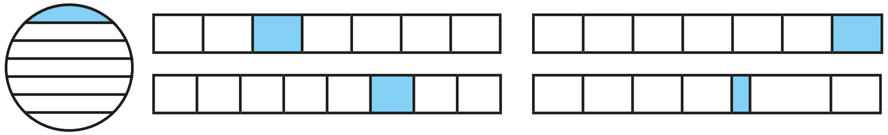
- Tommy is identifying fractions.



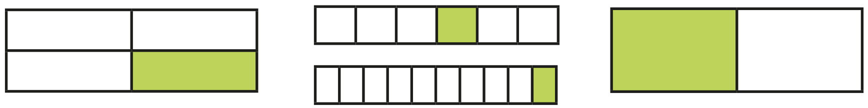
Which shapes have been split into equal parts?



- Which shapes have $\frac{1}{7}$ shaded?



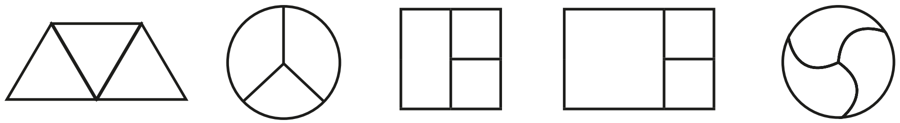
- Complete the sentences for each shape.



The denominator is ______ because the whole is divided into ______ equal parts.

The fraction shaded is ______

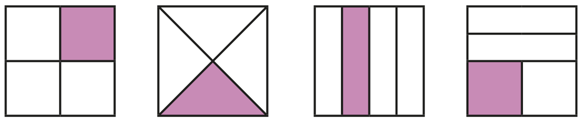
- Which shapes have been split into thirds?



Understand the denominators of unit fractions

Reasoning and problem solving

Which shapes show $\frac{1}{4}$?

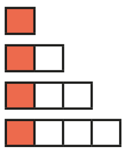


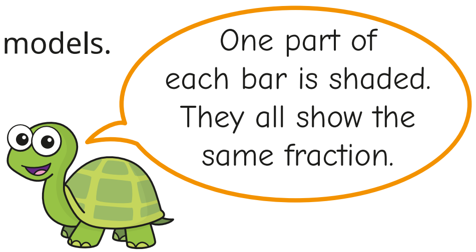
How do you know?

Find another way to show $\frac{1}{4}$

All the diagrams represent $\frac{1}{4}$ as all the shapes have been split into 4 equal parts.

Tiny is looking at these bar models.





Do you agree with Tiny?

Explain your answer.

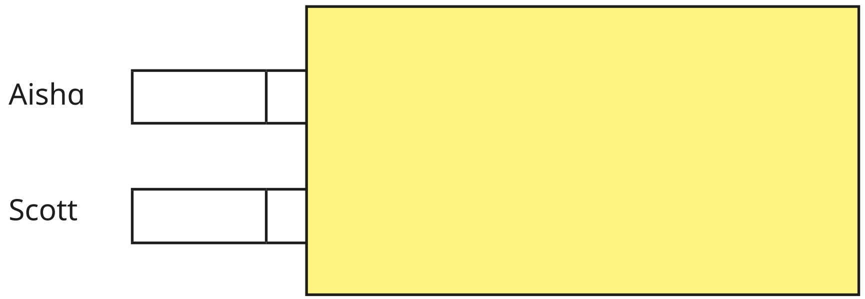
No

Aisha and Scott have folded two pieces of ribbon.

Aisha has folded her ribbon into 2 equal parts.

Scott has folded his ribbon into 5 equal parts.

Parts of their ribbons are hidden.



Whose ribbon is longer?

How do you know?

Scott's ribbon is longer.

Compare and order unit fractions

Notes and guidance

In this small step, children use their understanding of denominators developed in the previous step to compare and order unit fractions. They compare and order non-unit fractions later in the block.

Children compare fractions by observing the part-whole relationship. For example, if they split the whole into 4 equal parts, the parts will be bigger than if they had split the whole into 10 equal parts meaning $\frac{1}{4}$ is a bigger part of the whole than $\frac{1}{10}$ is. They use diagrams and bar models to illustrate this before moving on to understanding that when the numerators are the same then the greater the denominator, the smaller the fraction. Once this understanding is secure, children order unit fractions without pictorial support.

Things to look out for

- Children may believe that $\frac{1}{2}$ is smaller than $\frac{1}{3}$ because 2 is less than 3
- Children need to be secure in the meanings of the symbols for greater than and less than (> and <).
- The correct relationship will not be seen if the wholes are different sizes or if they are not split into equal parts.

Key questions

- What is the same and what is different about comparing fractions and comparing whole numbers?
- What is the denominator of the fraction? What is the numerator?
- Which is the greater/smaller denominator? Which is the greater/smaller fraction?
- What do you notice about the denominators and the order of the fractions? Why does this happen?
- Is $\frac{1}{4}$ greater than $\frac{1}{10}$? Can you draw a diagram to show this?

Possible sentence stems

- The denominator is ______ because …
- The numerator is ______ because …
- When the numerators are the same, then the ______ the denominator, the ______ the fraction.

National Curriculum links

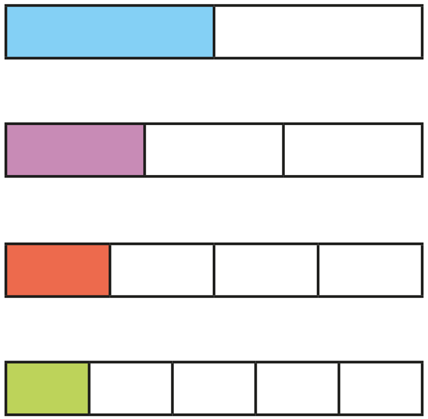
- Compare and order unit fractions, and fractions with the same denominators

Compare and order unit fractions

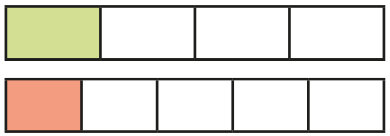
Key learning

- Match the fractions to the bar models.

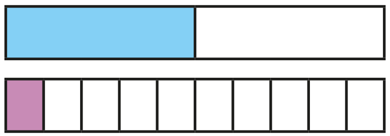
$\frac{1}{4}$
$\frac{1}{2}$
$\frac{1}{5}$
$\frac{1}{3}$



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



$\frac{1}{4} \bigcirc \frac{1}{5}$

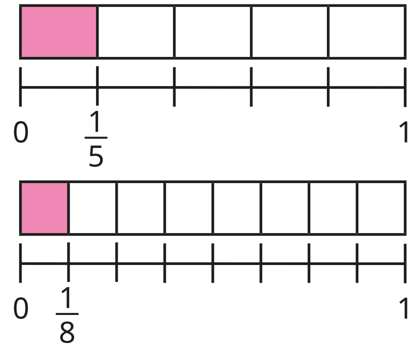


$\frac{1}{2} \bigcirc \frac{1}{10}$

Complete the sentence.

When the numerators are the same, then the ______ the denominator, the ______ the fraction.

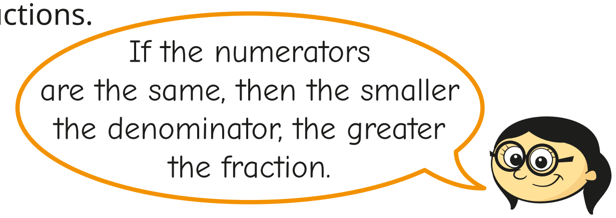
- Write < or > to compare the fractions.



$\frac{1}{5} \bigcirc \frac{1}{8}$

- Annie is comparing fractions.

$\frac{1}{3} > \frac{1}{12}$



Use Annie's method to compare the fractions.

$\frac{1}{10} \bigcirc \frac{1}{4}$ $\frac{1}{6} \bigcirc \frac{1}{7}$ $\frac{1}{100} \bigcirc \frac{1}{2}$

- Write each set of fractions in order, starting with the smallest fraction.

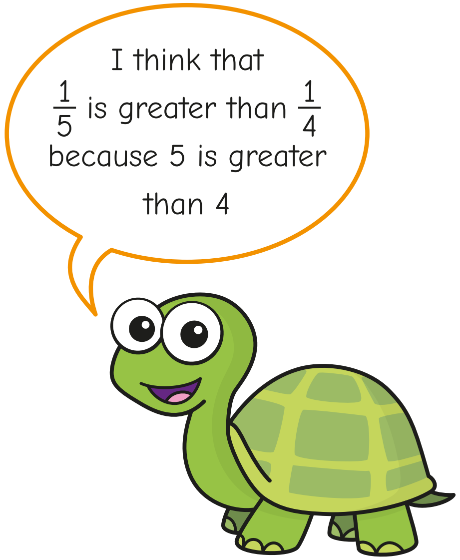
$\frac{1}{6}$ $\frac{1}{8}$ $\frac{1}{2}$ $\frac{1}{5}$ $\frac{1}{7}$

$\frac{1}{5}$ $\frac{1}{50}$ $\frac{1}{10}$ $\frac{1}{2}$ $\frac{1}{100}$

Compare and order unit fractions

Reasoning and problem solving

Tiny is comparing two unit fractions.



Do you agree with Tiny?

Explain your answer.

No

Huan has ordered some fractions, but one of them is in the wrong place.

$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{1}{15}$

Which fraction is in the wrong place?

How do you know?

$\frac{1}{4}$

Filip and Dani each have the same amount of juice.

Filip drinks $\frac{1}{3}$ of his juice.

Dani drinks $\frac{1}{4}$ of her juice.

Who has more juice left?

How do you know?

Dani

Understand the numerators of non-unit fractions

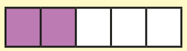
Notes and guidance

In this small step, children explore and understand the role of the numerator in unit and non-unit fractions.

Children need to be secure in their understanding of unit fractions before moving on to non-unit fractions. Children understand that a non-unit fraction is made up of a quantity of unit fractions, for example $\frac{3}{4}$ is the same as three single quarters or $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$

A range of representations, including shaded shapes, number lines and bar models, can be used to help children identify fractions. Concrete and pictorial resources are useful for demonstrating the role of the numerator as well as reinforcing the role of the denominator.

Things to look out for

- Children may not recognise that non-unit fractions are made up of quantities of unit fractions.
- When using diagrams, children may count the shaded parts as the numerator and the unshaded parts as the denominator, for example $\frac{2}{3}$ rather than $\frac{2}{5}$ 

Key questions

- How many equal parts is the whole split into?
- How many equal parts are shaded/circled?
- How do you know what the denominator/numerator is?
- Where can you see the denominator in the diagram? Where can you see the numerator?
- Can you draw a diagram/bar model to represent the fraction?
- What is the difference between a unit fraction and a non-unit fraction?

Possible sentence stems

- There are ______ equal parts.

  So the denominator is ______

  ______ of the equal parts are shaded.

  So the numerator is ______

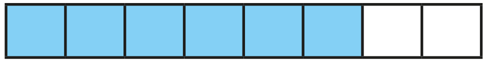
  The fraction shaded is $\frac{\square}{\square}$

National Curriculum links

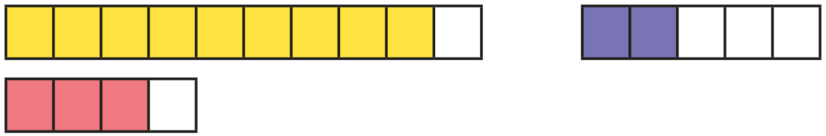
- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Understand the numerators of non-unit fractions

Key learning

- 
  - How many equal parts has the bar model been split into?
  - How many equal parts of the bar model are shaded?
  - What is the numerator?
    What is the denominator?
    How do you know?
  - What fraction of the bar model is shaded?

- What fraction of each bar model is shaded?



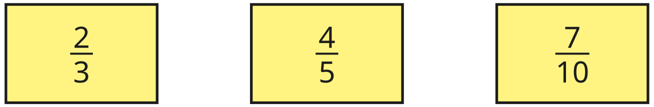
How do you know?

- The shape has been split into quarters.

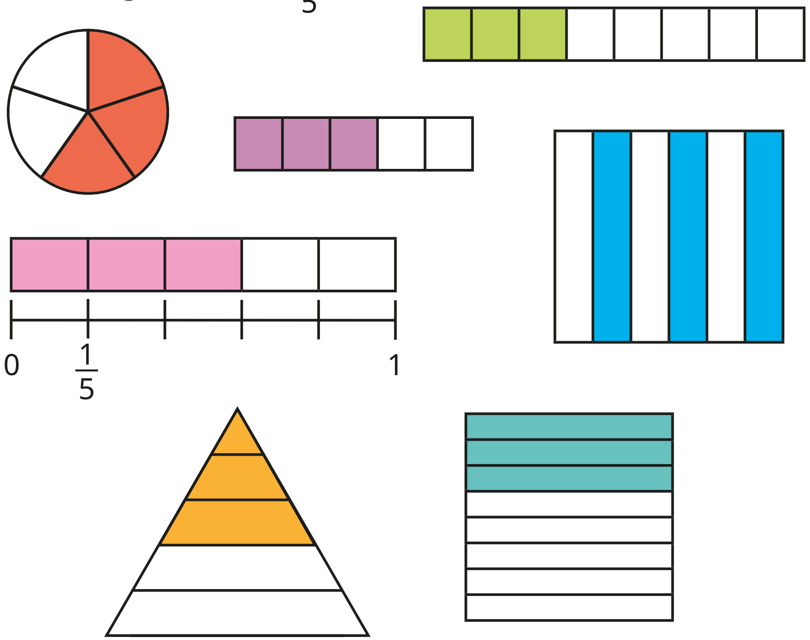
  - What fraction of the shape is shaded?
  - How many lots of one quarter are shaded?

What do you notice?

- Draw bar models to show each fraction.



- Which diagrams show $\frac{3}{5}$?

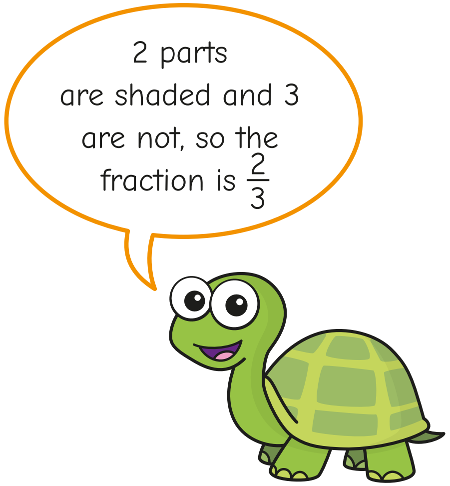


  - Draw another diagram that shows $\frac{3}{5}$
  - Draw another diagram that does not show $\frac{3}{5}$

Understand the numerators of non-unit fractions

Reasoning and problem solving

Tiny is working out the fraction shown in the bar model.

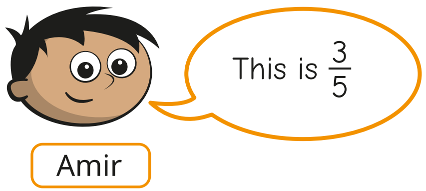


Do you agree with Tiny?

Why?

No

Amir and Dexter are looking at a bar model.



Who is correct?

Explain your answer.

Both are correct.

$\frac{3}{5}$ is the same as 3 one-fifths or $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$

Understand the whole

Notes and guidance

In this small step, children explore the whole in relation to fractions. They use diagrams and other representations to develop their understanding that when the numerator of a fraction is equal to its denominator, then the fraction is equivalent to 1 whole.

Once this understanding is secure, children move on to “making the whole”. Children start by using diagrams to identify how many equal parts a shape has been split into and how many are shaded, before thinking about how many more parts need shading to make the whole. This will be investigated further when adding and subtracting fractions is covered later in Year 3

Things to look out for

- Children may think that the numerator of a fraction is not allowed to be equal to the denominator.
- Children may not recognise when a whole has not been split into equal parts.
- Children may not utilise their knowledge of number bonds because they do not recognise the connection. For example, they may know that 3 + 4 = 7, but not use this knowledge to support them when working out $\frac{3}{7} + \frac{?}{7} = 1$

Key questions

- Is the whole split into equal parts?
- How many equal parts has the whole been split into?
- What fraction is shaded?
- How many more parts do you need to shade to make 1 whole?
- What do you notice about the two numerators?
- What do you notice about the numerator and the denominator when the whole is shaded?

Possible sentence stems

- The whole is split into ______ equal parts.

  ______ of the parts are shaded.

  I need to shade ______ more parts to make the whole.
- When the numerator is equal to the denominator, the fraction is equal to ______

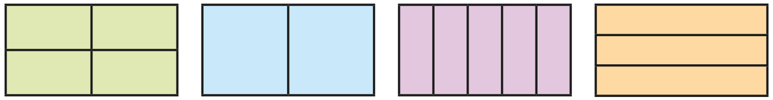
National Curriculum links

- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Understand the whole

Key learning

- Complete the sentences for each shape.

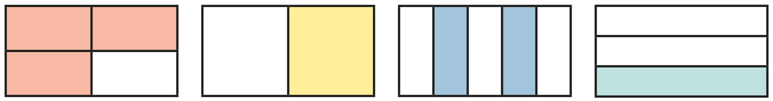


The whole is split into ______ equal parts.

______ parts are shaded.

$\frac{\square}{\square}$ of the shape is shaded.

- What fraction of each shape is shaded?



  - Shade each shape to complete the whole.
  - What fraction of each shape did you need to shade?
  - Complete the sentences for each shape.

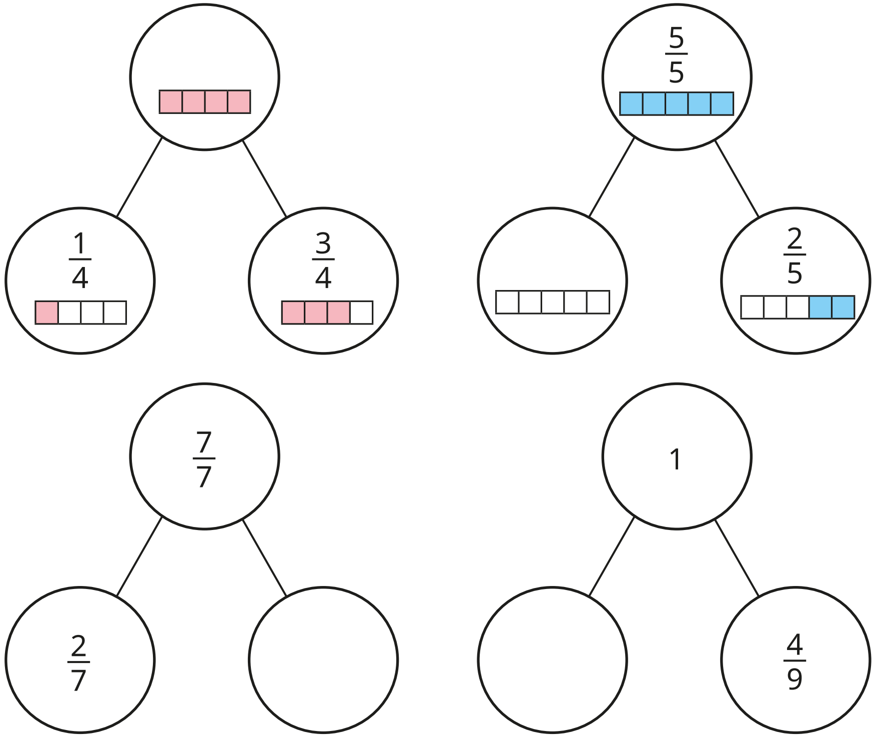
$\frac{\square}{\square}$ of the shape is shaded.

$\frac{\square}{\square}$ more needs to be shaded to complete the whole.

- Complete each fraction so that it is equal to 1 whole.

$\frac{6}{\square}$ $\frac{\square}{7}$ $\frac{10}{\square}$ $\frac{\square}{11}$ $\frac{100}{\square}$

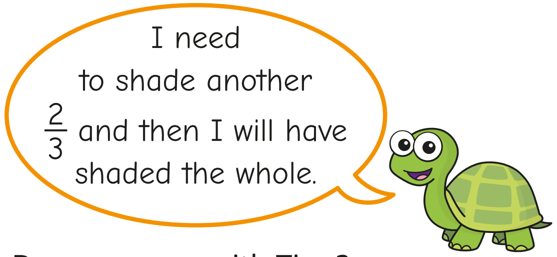
- Complete the part-whole models.



Understand the whole

Reasoning and problem solving

Tiny is drawing a bar model.



Do you agree with Tiny?

Explain your answer.

No

Jo and Max are running in the same race.

Jo has run $\frac{3}{4}$ of the race.

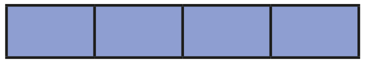
Max has run $\frac{5}{6}$ of the race.

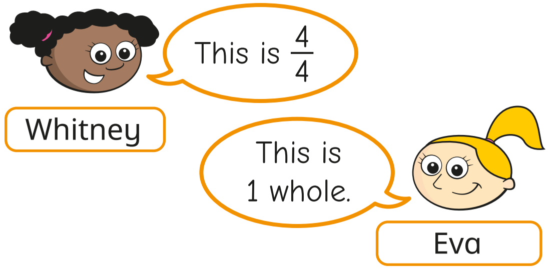
Who has further left to run?

How do you know?

Jo

Whitney and Eva are looking at this bar model.





Who do you agree with?

Explain your answer.

Both

Dexter is thinking of a fraction.

$\frac{3}{8}$ more than Dexter's fraction is 1 whole.

What fraction is Dexter thinking of?

How do you know?

$\frac{5}{8}$

Compare and order non-unit fractions

Notes and guidance

In this small step, children use their knowledge of comparing and ordering unit fractions from Step 2 as they start to compare and order non-unit fractions. The focus is on comparing and ordering fractions with the same denominator.

Bar models and other representations, such as strips of paper, can be used to support children's understanding of fractions. They should recognise that if the denominator is the same, then the greater the numerator, the greater the fraction or the smaller the numerator, the smaller the fraction.

Children could be encouraged to make links between the two types of comparing and ordering they have explored so far: unit fractions with different denominators, and non-unit fractions with the same denominator.

Things to look out for

- As children have previously compared and ordered fractions with the same numerator, they may believe that the fractions they encounter in this step are equal because the denominators are equal.
- Children may be over-reliant on diagrams rather than thinking about the numbers in the fractions.

Key questions

- Are the numerators the same?
- Are the denominators the same?
- If the denominators are the same, how can you compare the fractions?
- Which fraction is greater? How do you know?
- Which fraction is smaller? How do you know?
- What patterns did you spot when you ordered the fractions?

Possible sentence stems

- When fractions have the same denominator, the ______ the numerator, the ______ the fraction.
- ______ is greater than ______ because …
- ______ is less than ______ because …

National Curriculum links

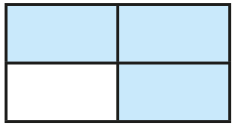
- Compare and order unit fractions, and fractions with the same denominators

Compare and order non-unit fractions

Key learning

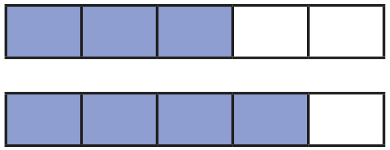
- Write **greater** or **less** to complete the sentences.

$\frac{1}{4}$ is ______ than $\frac{3}{4}$

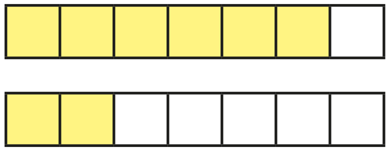


$\frac{3}{4}$ is ______ than $\frac{1}{4}$

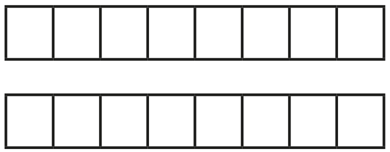
- Write <, > or = to compare the fractions.



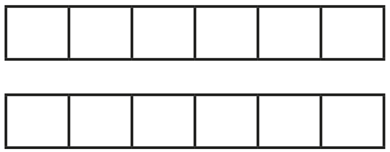
$\frac{3}{5} \bigcirc \frac{4}{5}$



$\frac{6}{7} \bigcirc \frac{2}{7}$



$\frac{7}{8} \bigcirc \frac{3}{8}$



$\frac{1}{6} \bigcirc \frac{6}{6}$

- Write < or > to compare the fractions.

$\frac{3}{10} \bigcirc \frac{7}{10}$ $\quad$ $\frac{5}{6} \bigcirc \frac{4}{6}$ $\quad$ $\frac{0}{5} \bigcirc \frac{3}{5}$

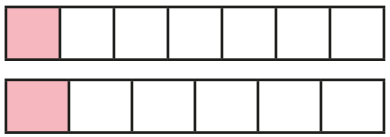
$\frac{8}{9} \bigcirc \frac{1}{9}$ $\quad$ $\frac{5}{23} \bigcirc \frac{1}{23}$ $\quad$ $\frac{5}{7} \bigcirc 1$

- Write each set of fractions in order, starting with the smallest.

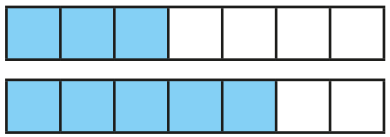
$\frac{7}{7}$ $\quad$ $\frac{6}{7}$ $\quad$ $\frac{1}{7}$ $\quad$ $\frac{5}{7}$ $\quad$ $\frac{4}{7}$

$\frac{4}{9}$ $\quad$ $\frac{7}{9}$ $\quad$ $\frac{2}{9}$ $\quad$ 1 $\quad$ $\frac{8}{9}$

- Use the bar models to compare the fractions.



$\frac{1}{7} \bigcirc \frac{1}{6}$



$\frac{3}{7} \bigcirc \frac{5}{7}$

What is the same? What is different?

Compare and order non-unit fractions

Reasoning and problem solving

Alex is ordering fractions.

She has spilt ink on her work.

$$\frac{2}{7} < \frac{}{7} < 1$$

What could the missing numerator be?

What could the missing numerator **not** be?

Explain your answers.

3, 4, 5, 6

1, 7

Write <, > or = to compare the fractions.

$$\frac{4}{4} \bigcirc \frac{10}{10}$$

Explain your answer.

=

Write the fractions in order, starting with the smallest fraction.

$\frac{1}{7}$ $\frac{2}{3}$ $\frac{1}{3}$

Explain your answer.

$\frac{1}{7}, \frac{1}{3}, \frac{2}{3}$

$\frac{3}{8}$ 1 $\frac{1}{8}$

Which is the greatest fraction?

Which is the smallest fraction?

Explain your answer.

1

$\frac{1}{8}$

Fractions and scales

Notes and guidance

In this small step, children apply the learning from previous steps to explore real-life contexts of measure by interpreting scales.

Children use their understanding of numerators and denominators to determine how many equal parts a scale has been split into, and then what fraction is shown. This is covered in contexts such as mass, volume and length. A small range of fractions is explored, focusing on quarters, halves and thirds, and the whole is always 1, for example 1 metre, 1 litre, 1 kilogram. Children do not need to convert between units, and should record all amounts as fractions, for example $\frac{1}{2}$ metre rather than 50 cm.

Things to look out for

- Children may count the number of lines on a scale rather than thinking about the number of equal sections, resulting in incorrect denominators.
- The size of scales or a container can confuse children. For example, they may think that the capacity of a taller jug must be greater than that of a shorter jug.
- Children may only be familiar with seeing whole parts shaded, so may find some scales challenging, as they often involve an arrow pointing to a specific point on a scale.

Key questions

- Where does the scale start/end?
- How many equal parts are there? What is the denominator of the fraction?
- How far along the scale is the arrow/water? What is the numerator of the fraction?
- What are you measuring? What unit is it measured in?
- Does the height of the container/scale matter?

Possible sentence stems

- The scale has been split into ______ equal parts.
- The arrow is pointing to/water is at the ______ mark.
- The fraction shown is $\frac{\square}{\square}$

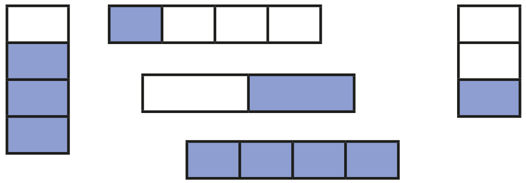
National Curriculum links

- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Fractions and scales

Key learning

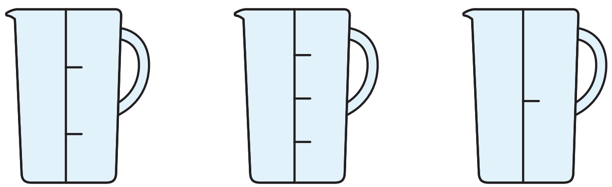
- What fraction of each shape is shaded?



- Whitney is using different metre sticks to measure the lengths of lines.

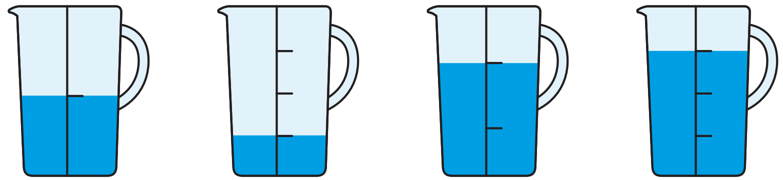
  What fraction of a metre is each line?

- How many equal parts has each jug's scale been split into?



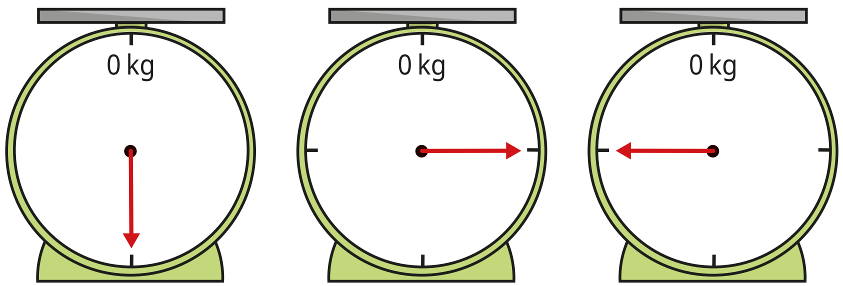
- Each jug has a capacity of 1 litre.

  What fraction of a litre of water is in each jug?



- The weighing scales measure up to 1 kg.

  What fraction of a kilogram is shown on each scale?



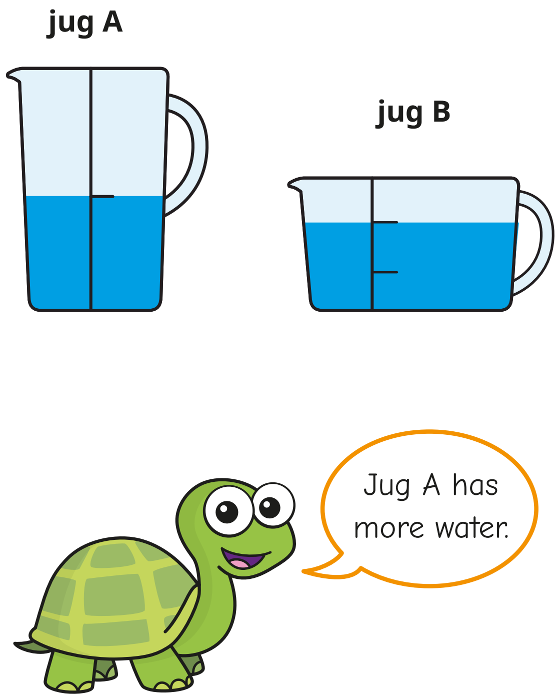
- Write the masses in order, starting with the greatest mass.

$\frac{1}{3}$ kg	$\frac{3}{3}$ kg	$\frac{1}{2}$ kg	$\frac{1}{4}$ kg

Fractions and scales

Reasoning and problem solving

The capacity of each jug is 1 litre.

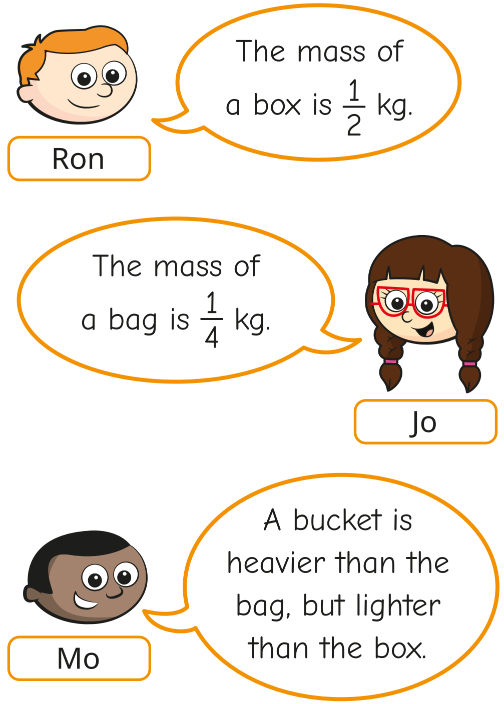


Do you agree with Tiny?

Explain your answer.

No

Some children are measuring the mass of different objects.



What could the mass of the bucket be?

multiple possible answers, e.g. $\frac{1}{3}$ kg

Fractions on a number line

Notes and guidance

Building on the work on scales, in this small step children explore how fractions can be represented on a number line. They have seen some examples of this earlier in the block, where bar models were used above number lines for support, but here they focus on number lines explicitly.

Children identify how many equal parts a number line has been split into. A common error here is counting the number of dividing lines rather than the number of intervals. Once children are confident identifying the number of intervals, they label each one with a fraction. For example, on a number line split into five equal parts, each interval is worth one fifth. At this point, children do not need to count up in fractions (for example, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$ ...), as this comes in the next step; they just need to label each interval as a unit fraction.

Things to look out for

- Children may count the number of divisions on the number line, rather than the number of intervals.
- Children may struggle to draw number lines with accurate intervals, so it is important to allow plenty of practice on this key skill.

Key questions

- What is an interval?
- Are all the intervals equal?
- How do you count the number of intervals?
- Why can you not just count the markers on the number line?
- What is the same and what is different about the number lines?
- What fraction of the whole number line is each interval worth?
- When marking intervals on a number line, where is a helpful place to start?

Possible sentence stems

- The number line has been split into ______ equal parts.
- Each interval is worth $\frac{1}{\square}$

National Curriculum links

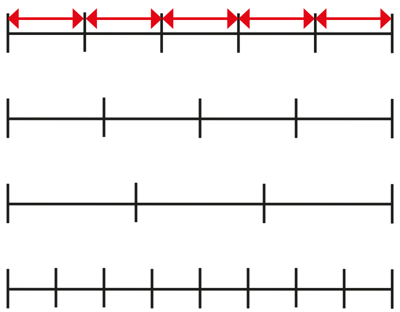
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators

Fractions on a number line

Key learning

- How many equal parts are shown on each number line?

  Kim has completed the first example.



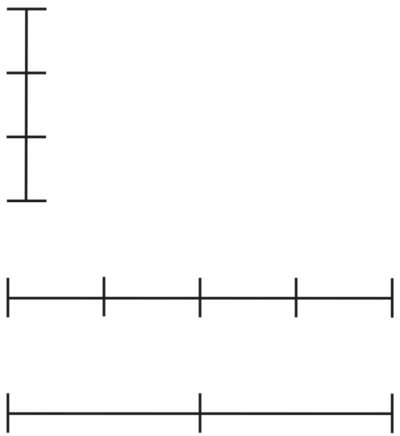
5 parts

_____ parts

_____ parts

_____ parts

- Match the number lines to the number of intervals.



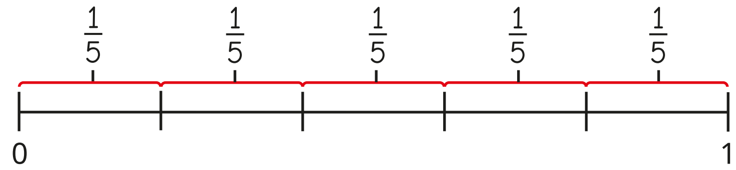
5

3

2

4

- Brett labels a number line to show fractions.

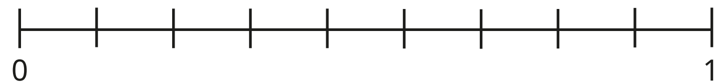


  Complete the sentences.

  The number line has been split into _____ equal parts.

  Each interval is worth $\frac{\square}{\square}$

- Complete the number line and sentences.



  The number line has been split into _____ equal parts.

  Each interval is worth $\frac{\square}{\square}$

- Draw number lines split into the number of equal parts.
  - 2 parts
  - 4 parts
  - 3 parts
  - 8 parts

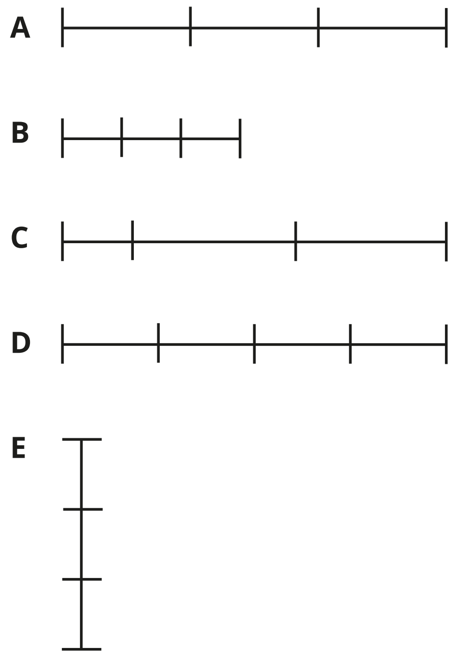
  Which number lines were easiest to draw? Which were hardest?

  What fraction is each interval worth? Label your number lines.

Fractions on a number line

Reasoning and problem solving

Which number line is the odd one out?



Explain your reasons.

multiple possible answers, e.g.

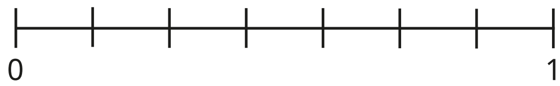
E is the only vertical number line.

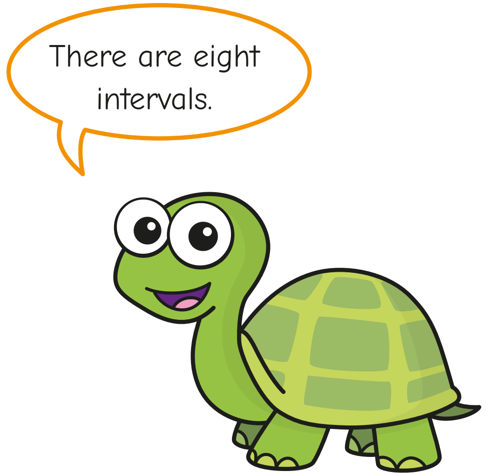
B is shorter than the other lines.

D has 4 intervals.

C has unequal parts.

Tiny is working out how many intervals there are on the number line.





Do you agree with Tiny?

Explain your reasons.

No

Count in fractions on a number line

Notes and guidance

In this small step, children build on their understanding from the previous two steps to count fractions on a number line.

Children count both forwards and backwards in fractions and use this to support them in labelling missing fractions on a number line. None of the fractions that children see in this step exceed 1 whole. Particular attention should be drawn to the fact that these number lines always begin at zero, as a common error is to begin the count at $\frac{1}{\square}$ on the first division. It is important to explore with children how they can label the end point of the number lines in two ways: as 1 or as a fraction where the numerator is equal to the denominator. When confident with labelling number lines, children may begin to estimate the positions of fractions on a blank number line.

Things to look out for

- Children may count the number of divisions rather than the number of intervals, resulting in an incorrect denominator.
- Children may struggle to recognise fractions on a number line, even if they are confident showing fractions as part of a whole in other representations.

Key questions

- What fraction comes next in the count? How do you know?
- What fraction comes before ______? How do you know?
- What do you notice about the start of each number line?
- What do you notice about the end of each number line?
- What is the denominator going to be? How do you know?
- Which fraction is easiest/hardest to estimate? Why?

Possible sentence stems

- The number line starts at ______ and ends at ______
- The number line has been split into ______ equal parts.

  This means that the number line is counting in $\frac{\square}{\square}$s.
- $\frac{\square}{\square}$ is greater/less than $\frac{1}{2}$ so $\frac{\square}{\square}$ will be to the right/left of halfway on the number line.

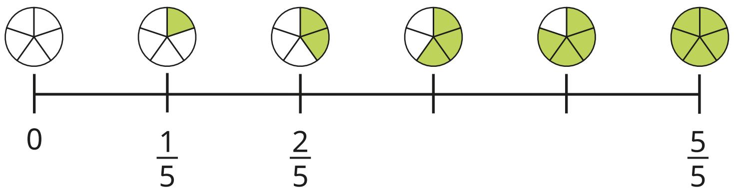
National Curriculum links

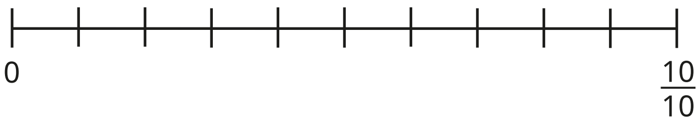
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators

Count in fractions on a number line

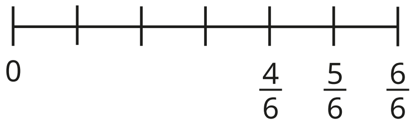
Key learning

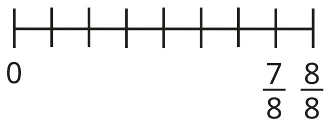
- Count forwards to complete the number lines.



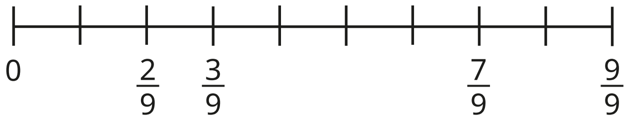


- Count backwards to complete the number lines.



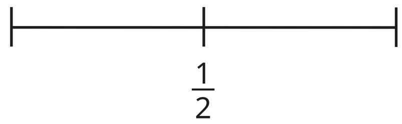


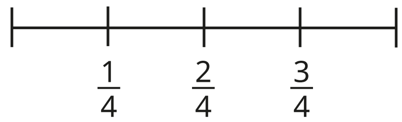
- Fill in the missing fractions.

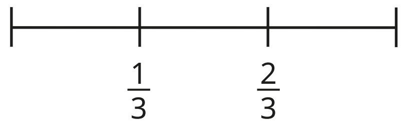


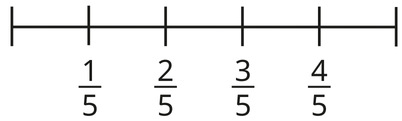
How did you work out each missing fraction?

- Complete the number lines.





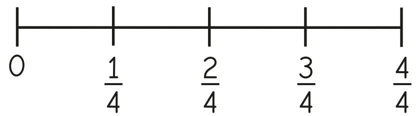




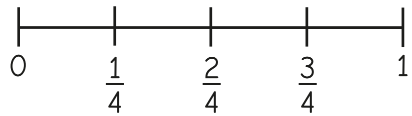
What do you notice?

- Tom and Mo have both correctly labelled the same number line.

Tom



Mo



What is the same about their number lines? What is different?

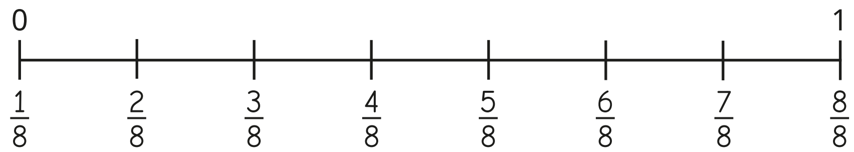
- Draw a number line counting in sixths.

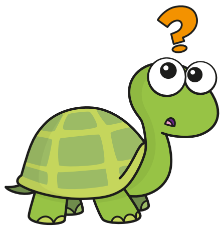
  Label each interval.

Count in fractions on a number line

Reasoning and problem solving

Tiny is labelling fractions on a number line from 0 to 1





What mistake has Tiny made?

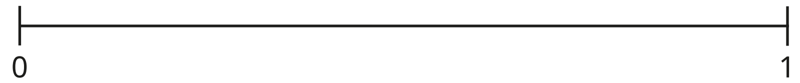
What should the labels be?

Tiny has counted the number of divisions rather than the number of intervals.

0, $\frac{1}{7}$, $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, $\frac{5}{7}$, $\frac{6}{7}$, $\frac{7}{7}$ (or 1)

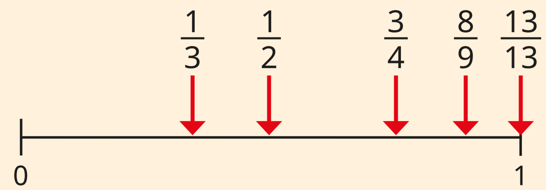
Estimate where the fractions belong on the number line.

$\frac{1}{3}$ $\frac{3}{4}$ $\frac{1}{2}$ $\frac{8}{9}$ $\frac{13}{13}$



How did you decide?

Talk about it with a partner.



Equivalent fractions on a number line

Notes and guidance

In this small step, children explore finding equivalent fractions by comparing multiple number lines and using double number lines.

The focus of this step is on using number lines to find equivalent fractions by looking at fractions that are in line with each other (equal in value), rather than more abstract methods using multiplicative reasoning. A common mistake with this method is drawing bars of unequal length. To avoid this potential error, it can be useful to reinforce one of the key learning points from previous steps: when the numerator and denominator are equal, the fraction can also be shown as 1. Therefore, when drawing multiple number lines to find equivalent fractions, the start and end points (0 and 1) must always be in line with each other.

Children also compare multiple number lines to find families of equivalent fractions, looking for patterns and relationships.

Things to look out for

- If number lines are not drawn so that they are equal in length, then equivalent fractions will not be easy to see.
- Children may need support drawing and labelling number lines accurately.

Key questions

- What other word does "equivalent" remind you of?
- What are equivalent fractions?
- What are the start and end numbers of each number line?
- Which fractions are in line with ______?
- How do you know ______ is equivalent to ______?
- When drawing number lines to show equivalent fractions, why is it important that your number lines are equal in length?
- What do you notice about the numerators and denominators of the fractions that are equivalent to $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ ...?

Possible sentence stems

- The number lines start at ______ and end at ______
- I know ______ is equivalent to ______ because …

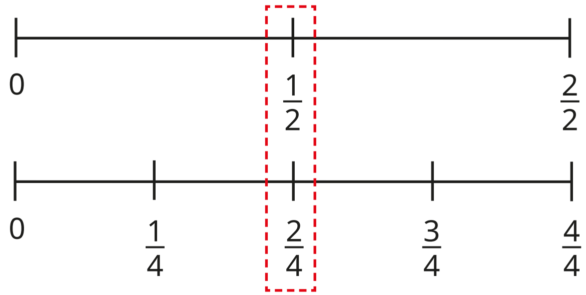
National Curriculum links

- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Recognise and show, using diagrams, equivalent fractions with small denominators

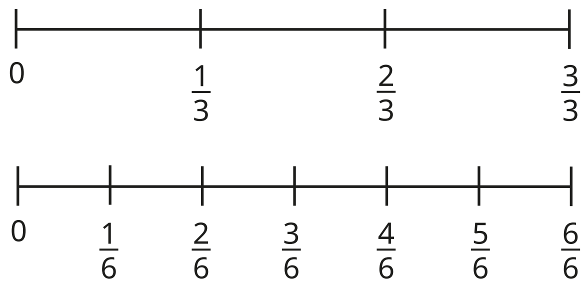
Equivalent fractions on a number line

Key learning

- The number lines show that $\frac{1}{2}$ and $\frac{2}{4}$ are equivalent fractions.



Use these number lines to find a pair of equivalent fractions.

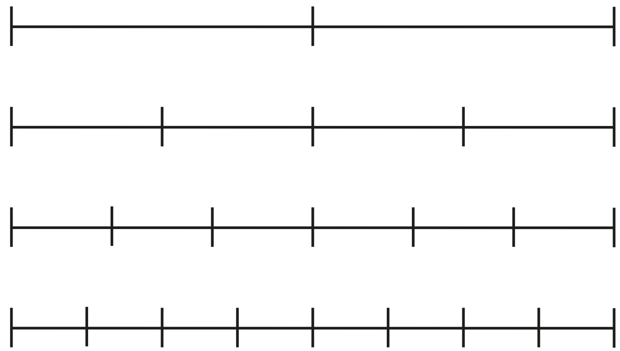


Have you got the same pair of fractions as your partner?

- Draw number lines to complete the equivalent fractions.

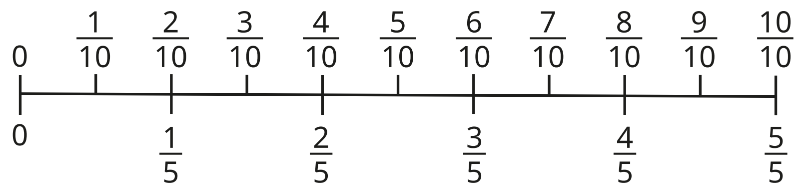
  - $\frac{\square}{4} = \frac{2}{8}$
  - $\frac{2}{4} = \frac{\square}{8}$
  - $\frac{\square}{\square} = \frac{6}{8}$
  - $\frac{4}{4} = \frac{\square}{\square} = 1$

- Label the number lines with the correct fractions.



What equivalent fractions can you find?

- Use the double number line to complete the equivalent fractions.

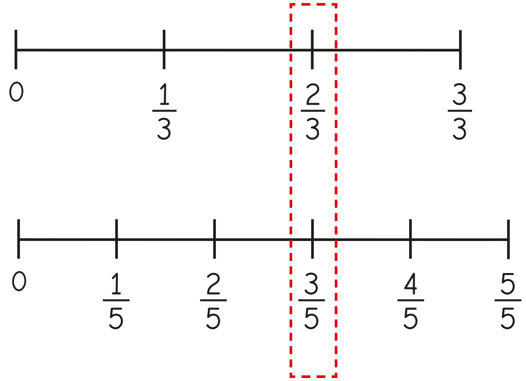


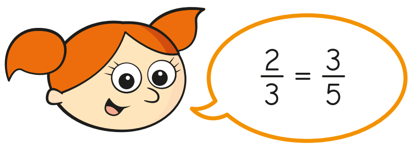
  - $\frac{3}{5} = \frac{\square}{10}$
  - $\frac{\square}{5} = \frac{4}{10}$
  - $\frac{1}{5} = \frac{\square}{\square}$
  - $\frac{8}{\square} = \frac{4}{\square}$
  - $\frac{\square}{5} = \frac{\square}{10} = 1$

Equivalent fractions on a number line

Reasoning and problem solving

Alex is drawing number lines to find equivalent fractions.



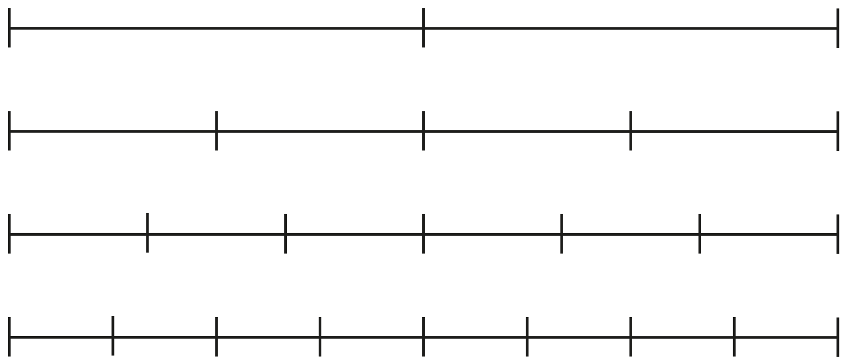


Do you agree with Alex?

Explain your reasons.

No

Use the number lines to complete the equivalent fractions.



$$\frac{1}{2} = \frac{\square}{4} = \frac{\square}{6} = \frac{\square}{8}$$

What do you notice?

Draw a number line or other diagram to help you complete the equivalent fraction.

$$\frac{1}{2} = \frac{\square}{10}$$

2, 3, 4 | 5

Equivalent fractions as bar models

Notes and guidance

In this small step, children deepen their understanding by exploring bar models as another way of representing equivalent fractions.

Children begin by comparing two bar models of equal length divided into different amounts to identify any equivalent fractions. As with the previous step, a common mistake here is drawing bar models of unequal length. Once confident, children progress to comparing multiple bar models to find families of equivalent fractions, again exploring any patterns.

Another strategy for finding equivalent fractions is to use a single bar model and to break up each of the existing parts into smaller ones. A common error is not splitting the existing parts into the same number of smaller equal parts, so this key point must be stressed.

Children may find folding strips of paper useful in supporting their understanding of bar models.

Things to look out for

- If bar models are not drawn so that they are equal in length, then equivalent fractions will not be easy to see.
- Children may need support drawing bar models accurately.

Key questions

- What are equivalent fractions?
- What does each whole bar model show?
- How many equal parts has the bar model been split into? What fraction does this show?
- How do you know ______ is equivalent to ______?
- When drawing bar models to find equivalent fractions, why do the bar models have to be the same length?
- How can splitting each part of the bar model into the same number of smaller parts help you to find equivalent fractions?

Possible sentence stems

- The bar model is split into ______ equal parts.

  The bar model shows ______
- I know ______ is equivalent to ______ because …

National Curriculum links

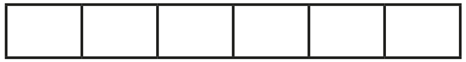
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Recognise and show, using diagrams, equivalent fractions with small denominators

Equivalent fractions as bar models

Key learning

- Shade $\frac{1}{3}$ of the bar model.

Shade $\frac{2}{6}$ of the bar model.

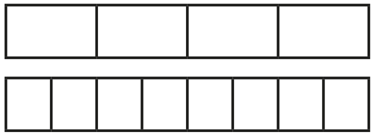


What do you notice?

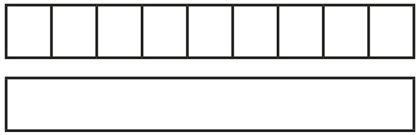
Complete the sentence. $\frac{\square}{\square}$ is equivalent to $\frac{\square}{\square}$

Use the same bar models to find another pair of equivalent fractions.

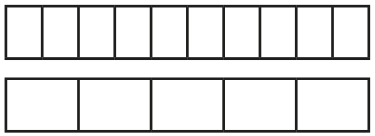
- Use the bar models to find the equivalent fractions.



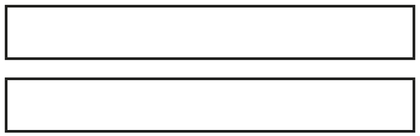
$\frac{1}{4} = \frac{\square}{8}$



$\frac{6}{9} = \frac{\square}{6}$

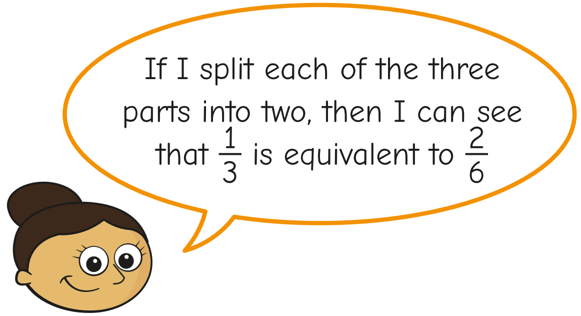


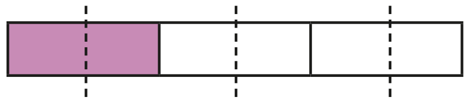
$\frac{8}{10} = \frac{\square}{\square}$



$\frac{3}{4} = \frac{\square}{12}$

- Dora is finding equivalent fractions to $\frac{1}{3}$

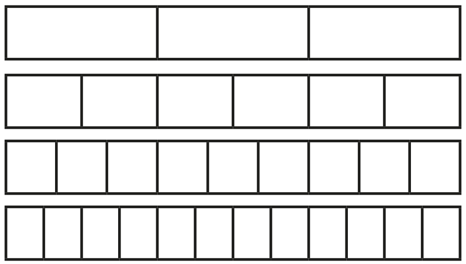




Split each part of this bar model into three equal parts and complete the equivalent fraction.

$\frac{1}{3} = \frac{\square}{9}$

- Use the bar models to find the equivalent fractions.

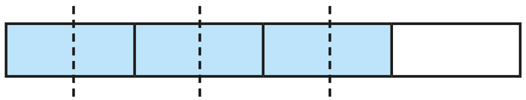


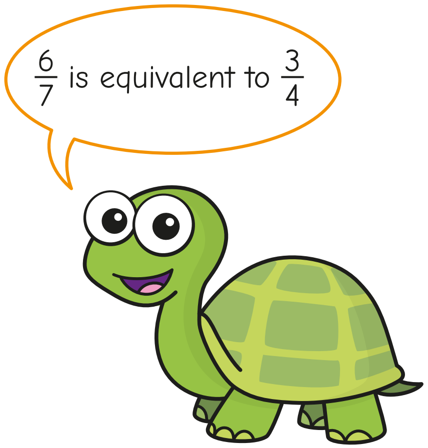
$\frac{2}{3} = \frac{\square}{6} = \frac{6}{\square} = \frac{\square}{\square}$

Equivalent fractions as bar models

Reasoning and problem solving

Tiny is finding equivalent fractions to $\frac{3}{4}$





Do you agree with Tiny?

Explain your reasons.

No

Sort the fraction cards into the table.

$\frac{4}{10}$ $\frac{4}{6}$ $\frac{4}{8}$ $\frac{3}{6}$ $\frac{6}{15}$ $\frac{6}{9}$ $\frac{8}{12}$ $\frac{5}{10}$

Equivalent to $\frac{1}{2}$	Equivalent to $\frac{2}{3}$	Equivalent to $\frac{2}{5}$

How did you do it?

$\frac{1}{2}$: $\frac{4}{8}$, $\frac{3}{6}$, $\frac{5}{10}$ $\frac{2}{3}$: $\frac{4}{6}$, $\frac{6}{9}$, $\frac{8}{12}$ $\frac{2}{5}$: $\frac{4}{10}$, $\frac{6}{15}$

Spring Block 4

Mass and capacity

Small steps

Step 1	Use scales
Step 2	Measure mass in grams
Step 3	Measure mass in kilograms and grams
Step 4	Equivalent masses (kilograms and grams)
Step 5	Compare mass
Step 6	Add and subtract mass
Step 7	Measure capacity and volume in millilitres
Step 8	Measure capacity and volume in litres and millilitres

Small steps

Step 9	Equivalent capacities and volumes (litres and millilitres)
Step 10	Compare capacity and volume
Step 11	Add and subtract capacity and volume

Use scales

Notes and guidance

In Year 2, children began using grams and kilograms when exploring mass. In this block, children continue to explore mass in kilograms and grams before moving on to capacity.

An essential skill in this block is for children to be able to use and understand scales. This small step provides opportunity for children to become more familiar with using scales to read measurements. The focus is on dividing 100 into 2/4/5/10 equal parts using number lines, before applying this skill in various contexts later in the block. By working out what the interval gaps are on a number line, children become more experienced at reading scales in the context of measurement. They learn what size groups are made when 100 is split into equal parts, then extend this learning to other multiples of 100

Things to look out for

- Children may be confused by intervals of different values due to different start and end points on number lines.
- Children may count the number of divisions rather than the number of intervals.
- Some children may not know what 100 or a multiple of 100 divided by 2/4/5/10 is worth.

Key questions

- What is the value at the start of the number line?
- What is the value at the end of the number line?
- How many equal parts is the number line split into?
- What is the value of each interval on the number line?
- What is the value of each part if 100 is divided into ______ equal parts?
- What is the same/different about these two number lines?
- What does this mark on the number line represent? How do you know?

Possible sentence stems

- If 100 is shared into ______ equal parts, then each part is worth ______
- The number line is counting up in ______s.
- When counting up in ______s, the ______ interval is ______

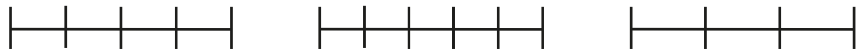
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

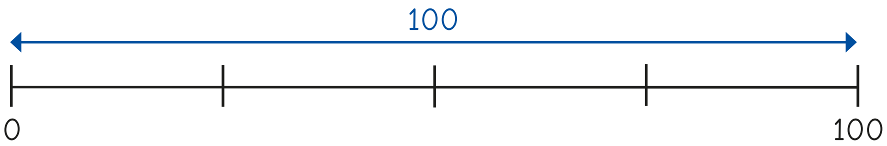
Use scales

Key learning

- How many equal parts has each number line been split into?



- Tommy is labelling this number line.

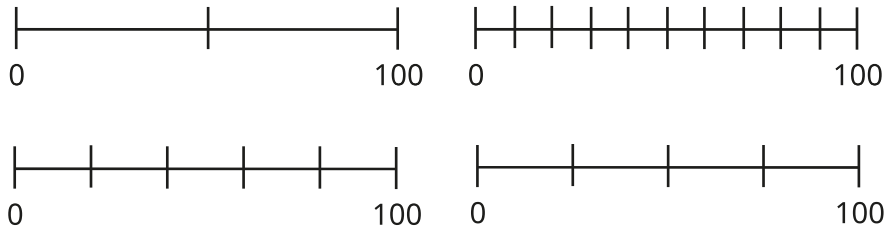


100 ÷ 4 = 25
The number line is counting up in 25s.

Why did Tommy divide 100 by 4?

Label Tommy's number line.

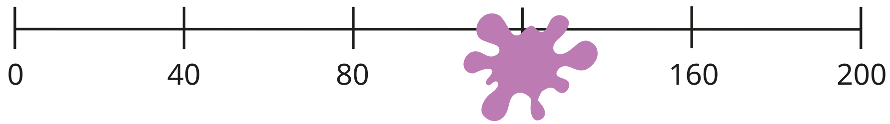
- Label the number lines.



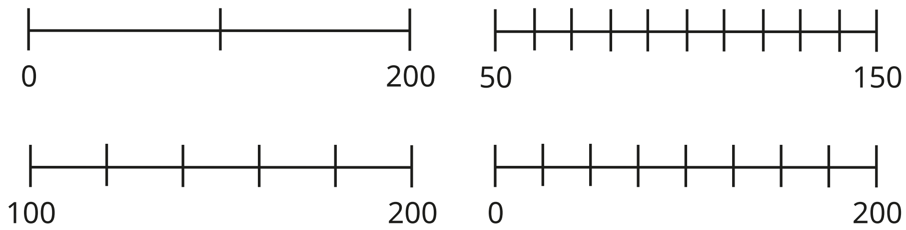
- Dani divides 200 into 5 equal parts on a number line.

  She spills some paint.

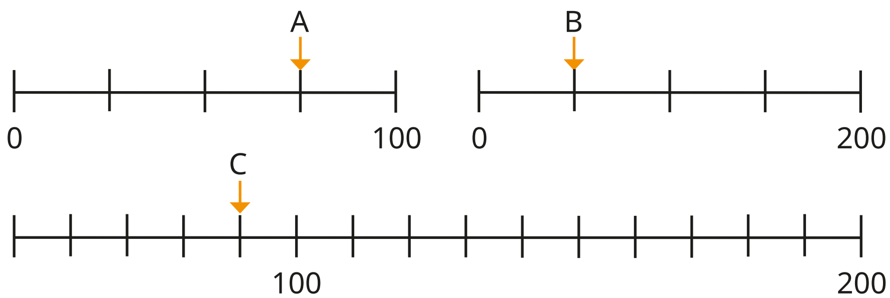
  What number is the paint covering?



- Label the number lines.

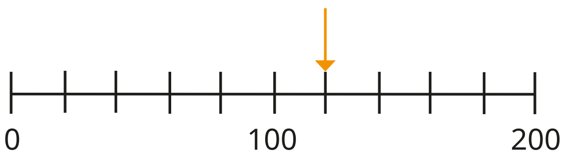


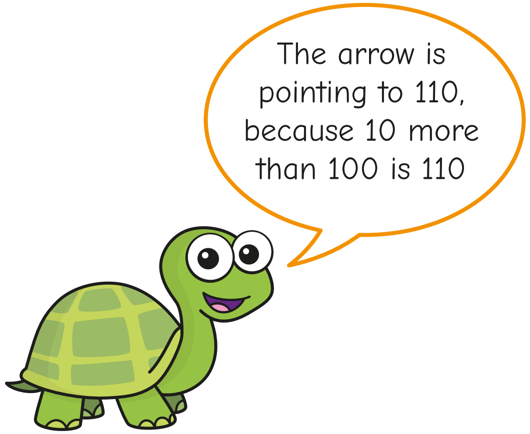
- What number is each arrow pointing to?



Use scales

Reasoning and problem solving



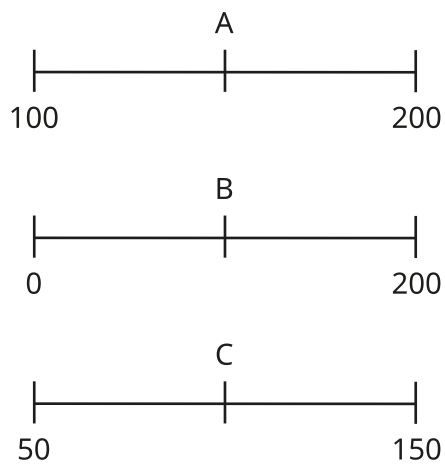


Do you agree with Tiny?

Explain your answer.

No

A, B and C are three numbers on different number lines.



Which number is the greatest?

What number would appear on all three number lines?

What number would only appear on one of the number lines?

Is there more than one answer?

A (150)

B and C: 100

any number 100–150

any number 0–49

Measure mass in grams

Notes and guidance

In this small step, children measure mass in grams only. This builds on their learning from Key Stage 1, but with masses now going up to 1,000 grams.

Give children a variety of objects to weigh using scales, so that they can understand what a given number of grams can look or feel like. This also provides the opportunity to bring in the learning from the previous step, giving children a chance to read a variety of different scales, and compare this to the number lines they used in the last step.

When reading scales, children need to work out missing intervals between numbers. They should recognise that they still need to consider the start and end point, as well as the number of intervals on the scale.

Things to look out for

- Children may be unfamiliar with the approximate mass of objects, and thus unable to identify mistakes.
- When reading scales, children may incorrectly identify the value of the intervals.
- When measuring the mass of an object using balancing scales, children may incorrectly add the masses on the wrong side.

Key questions

- What does "mass" mean?
- What units do you use to measure mass?
- What is the start/end value on the scale?
- How many equal intervals are there on the scale?
- How do you know what the missing numbers are?
- If the measurement is halfway between two marks, how can you work out what it is?

Possible sentence stems

- The start of the scale is ______ grams.
  The end of the scale is ______ grams.
  There are ______ intervals.
  The scale is counting up in ______s.
- The mass of the ______ is ______ grams.

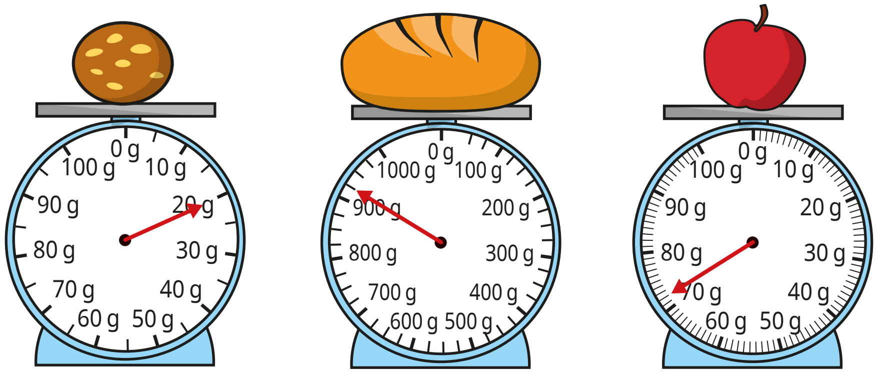
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

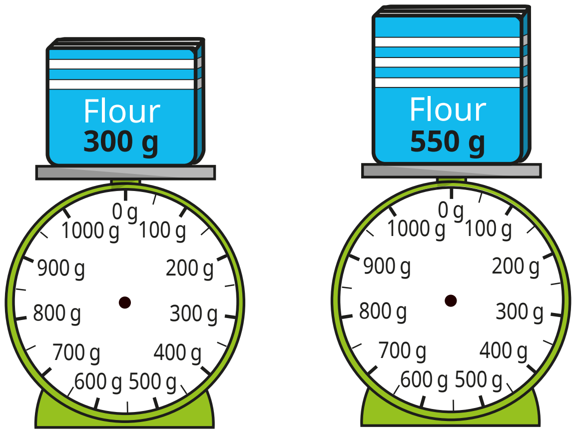
Measure mass in grams

Key learning

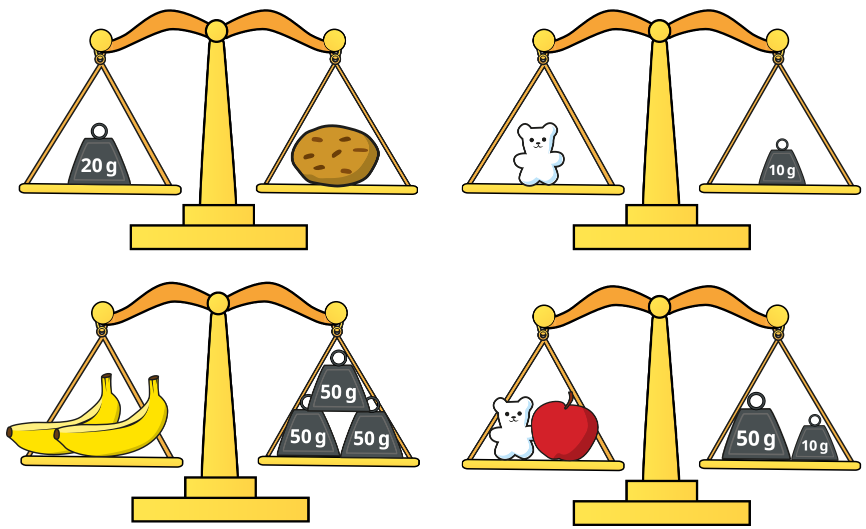
- What is the mass of each object?



- Draw arrows on the scales to show the mass of each box of flour.

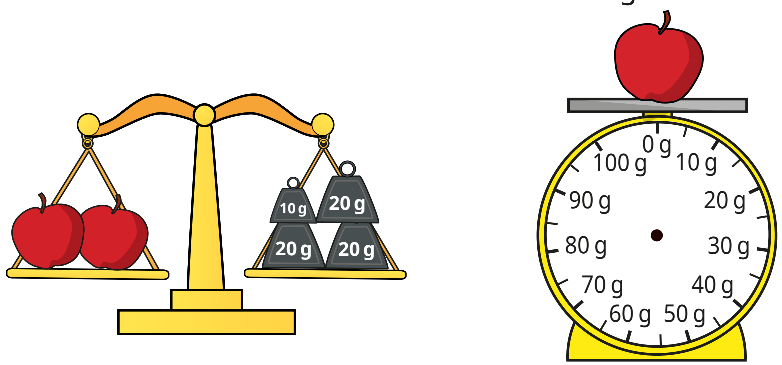


- What is the mass of each object?



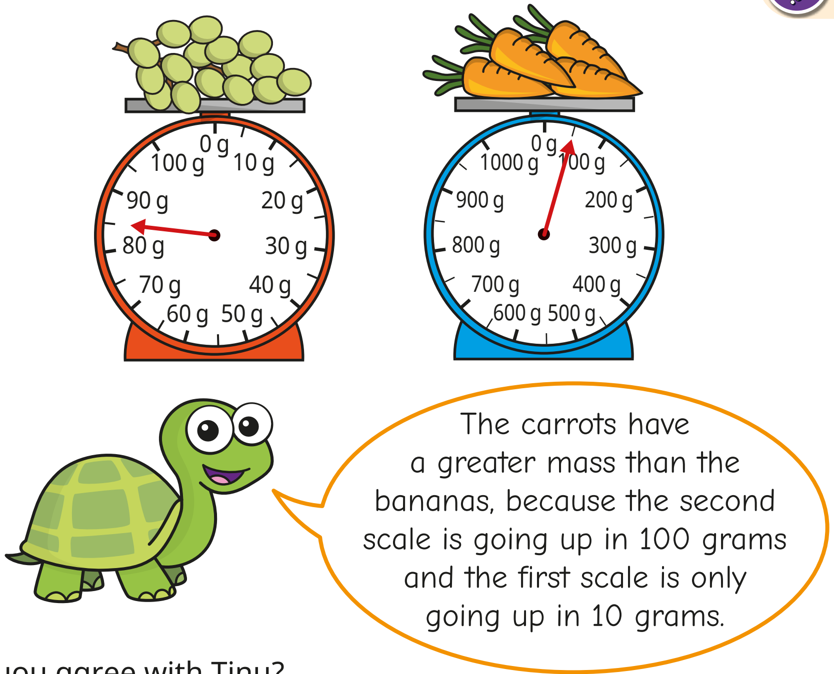
- Work out the mass of one apple.

  Draw an arrow on the scale to show to show your answer.



Measure mass in grams

Reasoning and problem solving



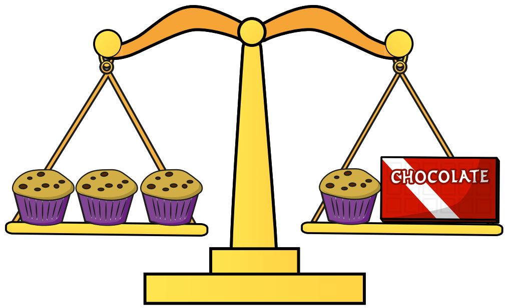
Do you agree with Tiny?

Explain your answer.

No

The chocolate bar has a mass of 100 g.

What is the mass of one muffin?



Nijah takes the muffins and the chocolate bar off the scales.

She puts 10 muffins on one side.

How many chocolate bars will she need to balance the scales?

How did you work it out?

50 g

5

Measure mass in kilograms and grams

Notes and guidance

In Year 2, children measured objects with masses that are whole numbers of kilograms. In this small step, they measure the mass of objects in both kilograms and grams, as well as fractions of kilograms. For example, an object may have a mass of 2 kg and 500 g and children should recognise that this is equivalent to two and a half kilograms. In this block, they always read the measurement as ______ kg and ______ g, not in decimal form, as decimals are not introduced until Year 4

Children use their learning from the previous step alongside the fact that 1,000 g is equivalent to 1 kg to work out amounts of grams on a kilogram scale that is divided into sections.

Things to look out for

- Children may confuse relationships with other units of measure, for example cm and m, and think that there are 100 g in 1 kg.
- Children may assume that the scales always go up in the same intervals, whereas different questions may have different scales.
- Children may mix up the two units, for example writing 2 kg and 300 g as 2 g and 300 kg.

Key questions

- What is mass?
- What are kilograms and grams? What is the same and what is different about them?
- How many grams are there in 1 kg?
- How many grams is half/a quarter of a kilogram?
- If a mass is between two whole kilograms, how can you work out the exact mass?

Possible sentence stems

- The mass is between ______ kg and ______ kg.
  There are ______ intervals.
  Each interval is worth ______ g.
  The mass is ______ kg and ______ g.
- The arrow on the scale is pointing to ______ kg and ______ g.
- The object has a mass of ______ kg and ______ g.

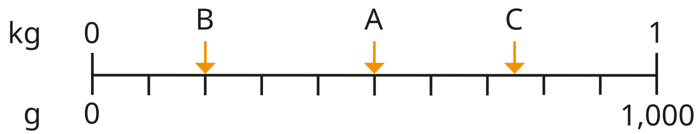
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Measure mass in kilograms and grams

Key learning

- Complete the sentence for each arrow.

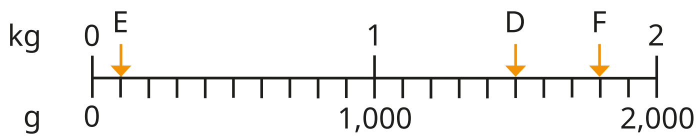


Arrow ______ is pointing to ______ g.

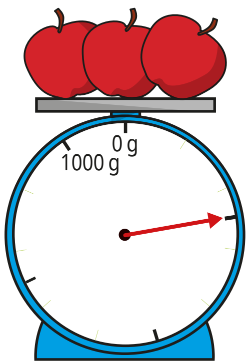
What fraction of a kilogram is each arrow pointing to?

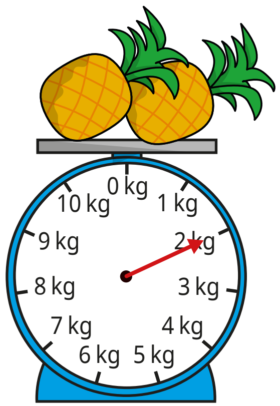
- What mass is each arrow pointing to?

Give your answers in kilograms and grams.

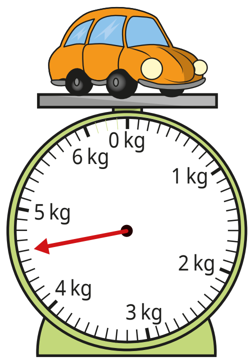


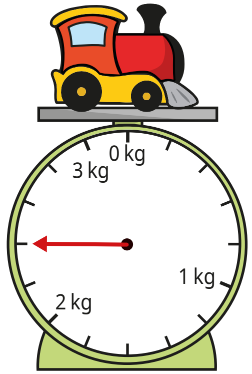
- What is the total mass of the apples and the pineapples?





- Complete the sentences.



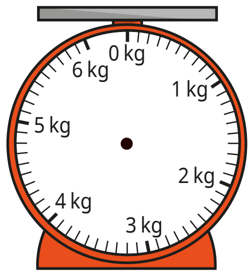


The toy car has a mass of 4 kg and ______ g.

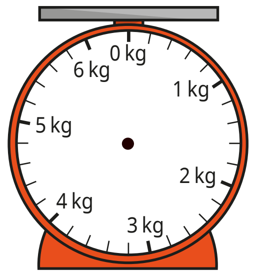
The toy train has a mass of ______ kg and ______ g.

- Draw arrows on the scales to show the mass.

1 kg and 700 g

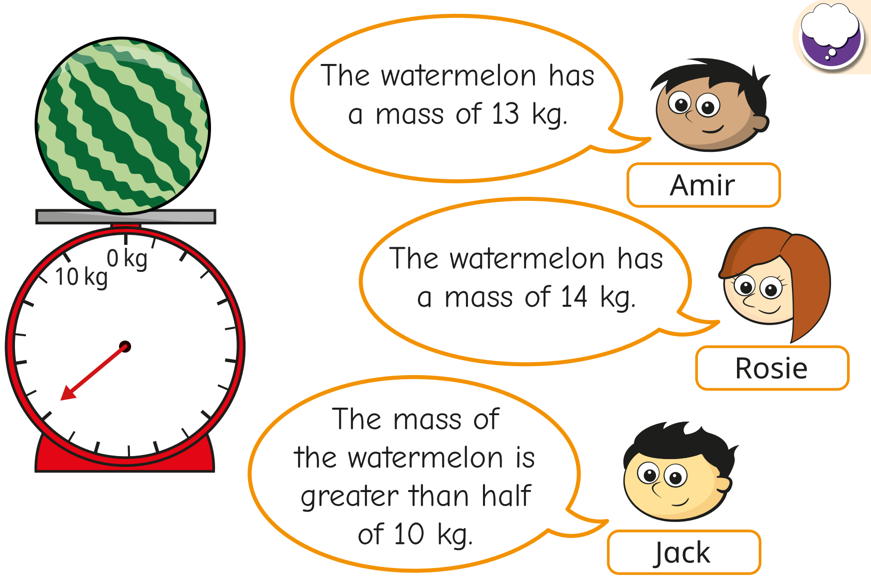


5 kg and 900 g



Measure mass in kilograms and grams

Reasoning and problem solving



Who do you agree with?

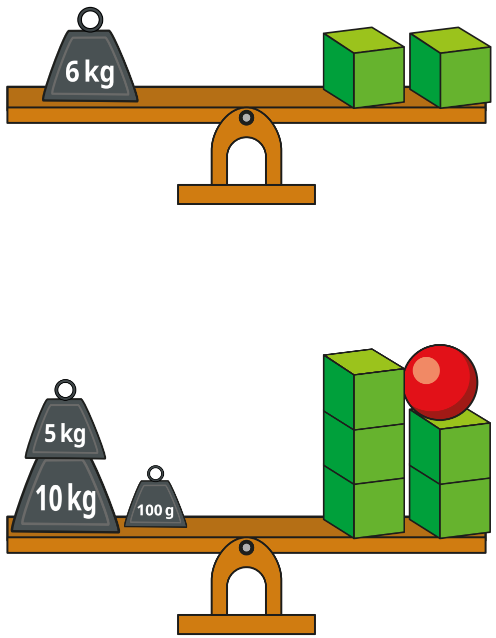
Explain your answer.

Work out the mass of the watermelon.

Show your workings.

Jack 7 kg

Here are some balance scales.



Work out the mass of the sphere.

100 g

Equivalent masses (kilograms and grams)

Notes and guidance

In the previous two steps, children measured objects in both grams and kilograms, and read scales showing both of these units of measure. In this small step, children build on their understanding of 1 kg being equivalent to 1,000 g, and this point will be explored in great depth, so the masses in the questions will not go over 1 kg. Formal conversion between kilograms and grams is taught in Year 5

Children also draw on other previously learnt skills, as they use addition and subtraction to make amounts of grams up to 1 kg. They continue to look at fractions of a kilogram, and should know that $\frac{1}{2}$ of a kilogram is 500 g and $\frac{1}{4}$ of a kilogram is 250 g.

Things to look out for

- Children may use the incorrect units, for example saying that 1,000 kg is the same as 1 g.
- Children may forget to include units with their answer.
- Children may experience difficulties with calculation when dividing 1,000

Key questions

- How many grams are there in a kilogram?
- How many grams are there in half a kilogram?
- How many grams are there in one quarter of a kilogram?
- If a kilogram is split into ______ equal parts, how many grams is each part worth?
- What is ______ equivalent to?
- How many more grams are needed to make 1 kg?

Possible sentence stems

- ______ g is equivalent to ______ kg.
- ______ g + ______ g = 1,000 g = 1 kg
- I need ______ more grams to make a kilogram.
- This mass is/is not equivalent to 1 kilogram because ...

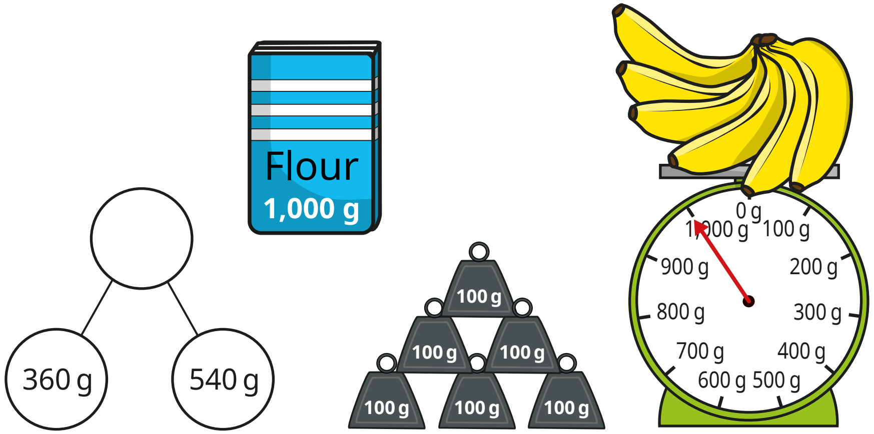
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Equivalent masses (kilograms and grams)

Key learning

- Sort the pictures into the table.



Equivalent to 1 kg	Not equivalent to 1 kg

- Aisha knows that 1,000 g is equivalent to 1 kg.

  She knows that 600 + 400 = 1,000, so 600 g + 400 g = 1 kg.

  Use this information to help you fill in the missing numbers.

  - 400 g + ______ g = 1 kg
  - 350 g + 650 g = ______ kg
  - ______ g + 980 g = 1 kg

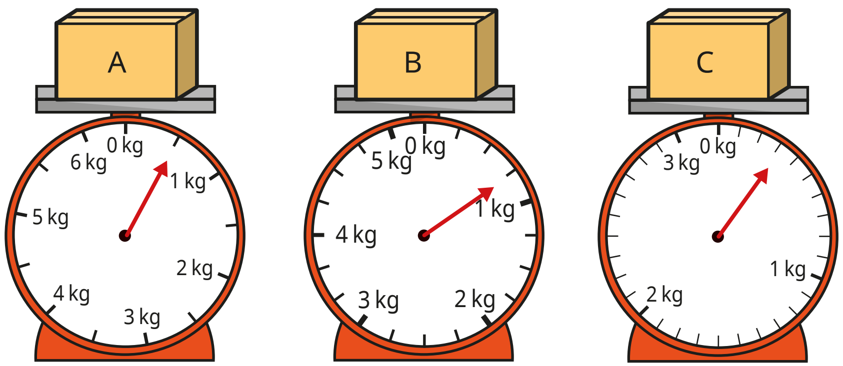
- Scott needs 200 g of flour to bake a cake.

  How many cakes can he bake with 1 kg of flour?

- How many grams is each fraction of a kilogram equivalent to?

  - $\frac{1}{2}$
  - $\frac{1}{4}$
  - $\frac{3}{4}$
  - $\frac{1}{10}$

- Work out the mass of each box.



- Fill in the missing numbers.

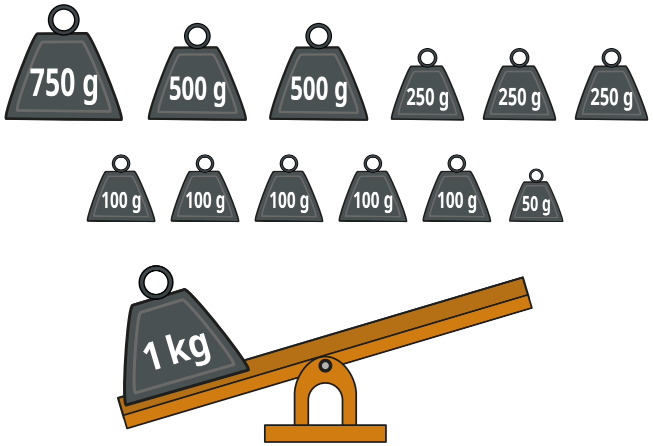
  - 450 g + 550 g = ______ kg
  - ______ g + $\frac{1}{2}$ kg = 1,000 g
  - 635 g + ______ g = 1 kg
  - 1,000 g + ______ g = 1 kg

Equivalent masses (kilograms and grams)

Reasoning and problem solving

Max wants to balance the scale.

What weights could he use?



Find as many possibilities as you can.

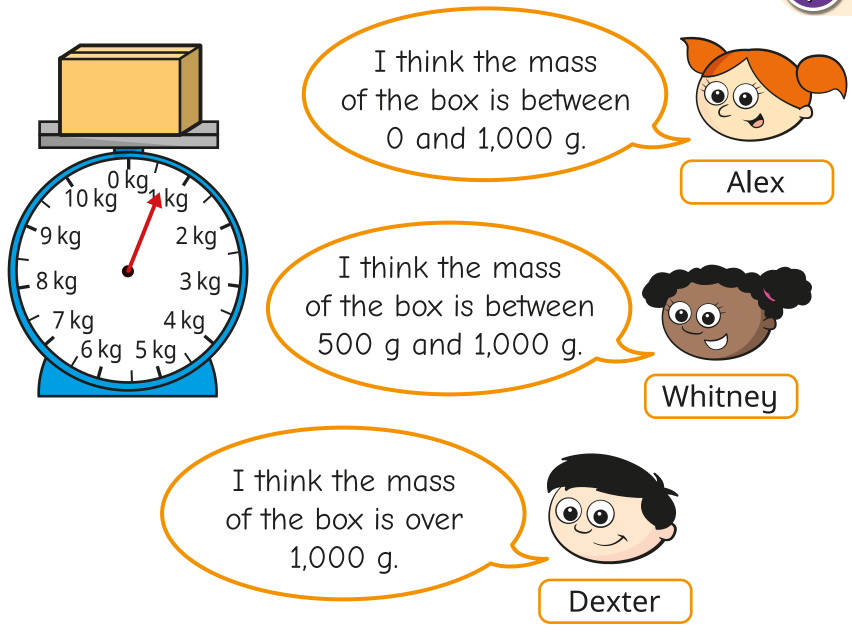
multiple possible answers, e.g.

750 g + 250 g

500 g + 250 g + 250 g

750 g + 100 g + 100 g + 50 g

What is the mass of the box?



Whose answer do you think is the best?

Explain why.

Whitney's

Compare mass

Notes and guidance

In this small step, children compare the masses of different objects using grams and kilograms.

In Year 2, children decided if an object was heavier or lighter by using balance scales. They now use units of measure to work out which object is heavier or lighter. Understanding that kilograms are heavier than grams will help them to compare mass, for example 100 g is lighter than 100 kg. They can also compare using fractions: for example $\frac{1}{2}$ kg is heavier than 400 g.

Children then go on to compare masses that combine kilograms and grams. They should recognise that, because kilograms are heavier than grams, they should compare the kilograms first: for example 1 kg and 300 g is lighter than 3 kg and 300 g. If the kilograms are the same, they then need to compare the grams: for example 1 kg and 300 g is heavier than 1 kg and 100 g.

Things to look out for

- Children may focus more on the number than the unit of measure, for example saying 750 g is greater than 50 kg.
- Children need to be secure in reading scales with different intervals.

Key questions

- Which object is heavier/lighter? How do you know?
- Which is heavier: 1 kg or 100 g?
- Which is heavier: 1 kg and 100 g or 1 kg and 400 g?
- Which is heavier: 500 g or 3 kg and 100 g?
- Which is heavier: 600 g or $\frac{1}{2}$ kg?
- If you know the total mass of two identical items, how can you work out the mass of one of them?
- If 2 ______ have the same mass as 3 ______, which object is heavier?

Possible sentence stems

- ______ kg is heavier/lighter than ______ kg, so ______ kg and ______ g is heavier/lighter than ______ kg and ______ g.
- The number of kilograms is the same so I need to compare the ______
  ______ kg and ______ g is heavier/lighter than ______ kg and ______ g.

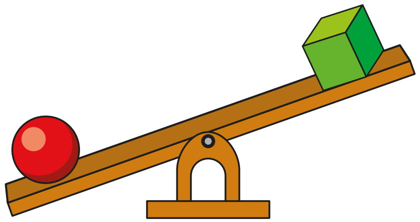
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Compare mass

Key learning

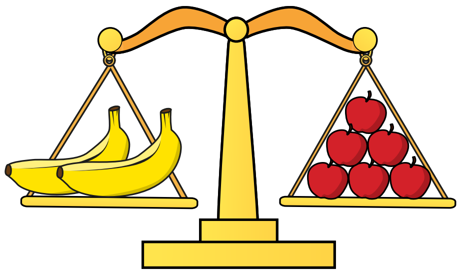
- Write **heavier** or **lighter** to complete the sentences.



The sphere is ______ than the cube.

The cube is ______ than the sphere.

- Complete the sentences.



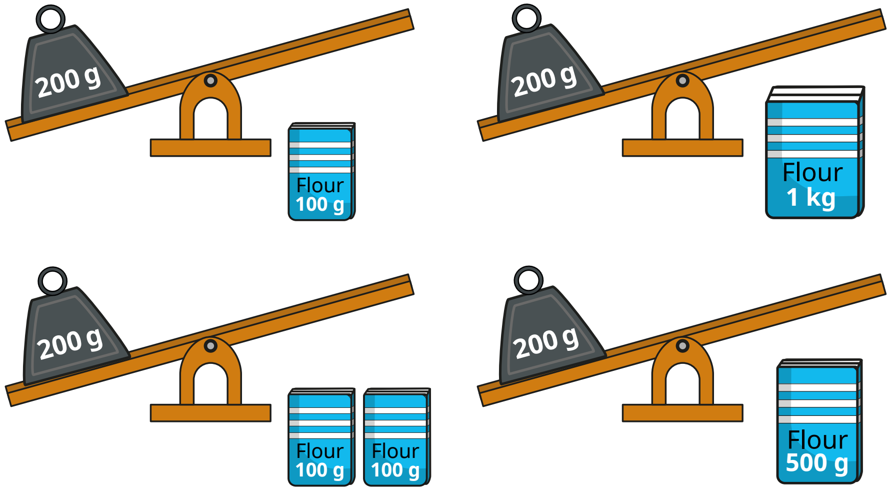
______ bananas have the same mass as ______ apples.

1 banana has the same mass as ______ apples.

The mass of 1 banana is ______ than the mass of 1 apple.

- Rosie puts different amounts of flour onto the scales.

For each scale, say what will happen and why.



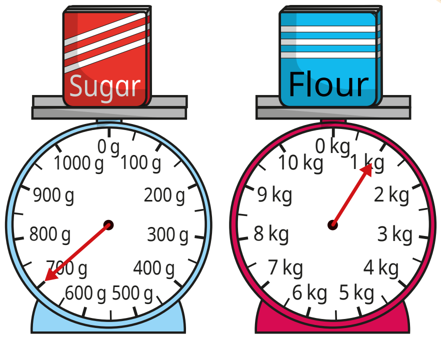
- Write <, > or = to compare the masses.

500 g	◯	500 kg	1 kg and 300 g	◯	3 kg and 300 g
900 g	◯	1 kg	1 kg and 300 g	◯	1 kg and 100 g
210 g	◯	$\frac{1}{5}$ kg	4 kg and 27 g	◯	27 kg and 4 g

Compare mass

Reasoning and problem solving

Which statement is correct?



A The sugar is heavier, because the arrow is further around the scale than the arrow on the flour scale.

B The flour is lighter, because 1 is less than 700

C The flour is heavier, because 1 kg is more than 700 g.

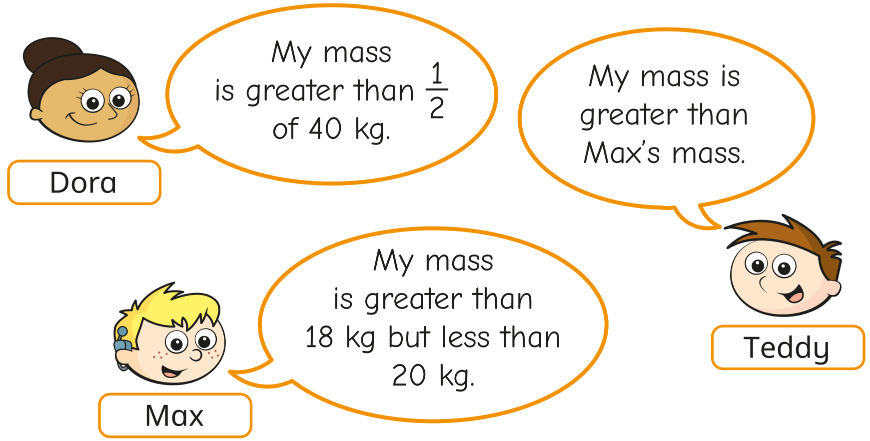
Explain your answer.

C

Here are three masses.

20 kg and 600 g	20 kg	18 kg and 500 g

Match each mass to the correct person.



Dora: 20 kg and 600 g

Teddy: 20 kg

Max: 18 kg and 500 g

Add and subtract mass

Notes and guidance

This step is the final step on mass in this block. In this small step, children add and subtract mass. They transition from writing, for example, 2 kg and 300 g to writing 2 kg 300 g as this makes it easier to read many of the calculations, and makes it easier for children to distinguish between the two quantities.

They use their understanding of kilograms and grams to add and subtract quantities of both. Concrete resources and bar models support their understanding. When a mass that is a mixture of kilograms and grams is added to another mass, the children partition the mass into kilograms and grams, then add the separate parts.

This is a good opportunity for children to practise their mental addition and subtraction, as many of the numbers involved will not necessitate the written method. As children have not yet explored numbers beyond 1,000, there will be no requirement to bridge 1 kg with addition or subtraction.

Things to look out for

- Children may not be clear on which operation is needed.
- Children may ignore the units, for example calculating 300 g + 2 kg = 302 g.
- Children may forget to include units in their answers.

Key questions

- How can you add using kilograms and grams?
- Which part did you work with first? Why?
- What method could you use to add ______ to ______?
- What method could you use to subtract ______ from ______?
- How can you show this question using a bar model?
- What objects can you use to help complete this calculation?
- Do you need to add or subtract to answer this question?

Possible sentence stems

- The total of ______ g/kg and ______ g/kg is ______ g/kg.
- The difference between ______ g/kg and ______ g/kg is ______ g/kg.
- ______ kg add/subtract ______ kg is equal to ______ kg.
  ______ g add/subtract ______ g is equal to ______ g.
  The total/difference is ______ kg ______ g.

National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Add and subtract mass

Key learning

- A jar of cookies has a mass of 800 g.

  The empty jar has a mass of 350 g.

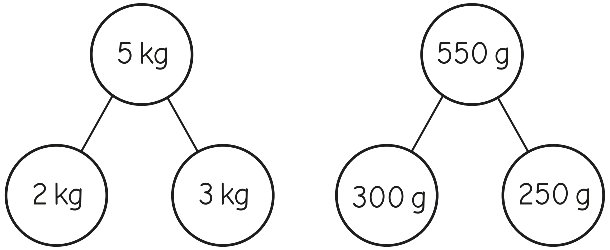
  What is the mass of the cookies?

- Rosie has 600 g of sweets.

  Jack has 1 kg and 200 g of sweets.

  What is the total mass of their sweets?

- Huan uses part-whole models to add 2 kg 300 g to 3 kg 250 g.



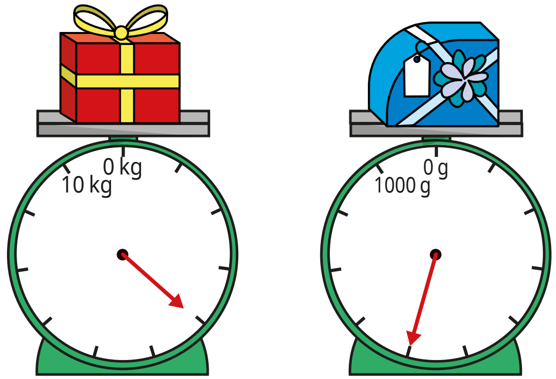
5 kg + 550 g = 5 kg 550 g

Use Huan's method to work out the totals.

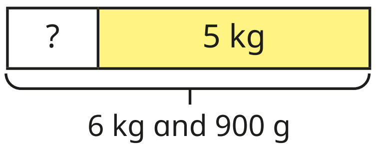
3 kg 450 g + 4 kg 200 g

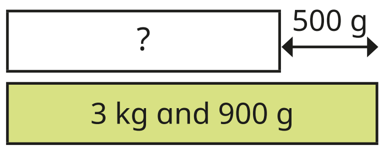
4 kg 105 g + 2 kg 300 g

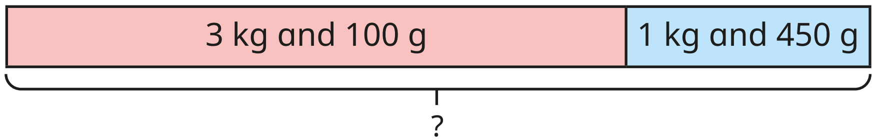
- What is the total mass of the two presents?



- Complete the bar models.







- Brett and Esther each have 1 kg 200 g of pasta.

  They put their pasta together.

  They then cook a meal using 300 g of the pasta.

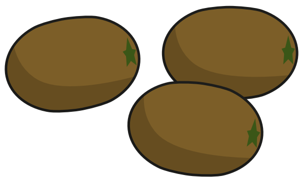
  How much pasta do they have left?

Add and subtract mass

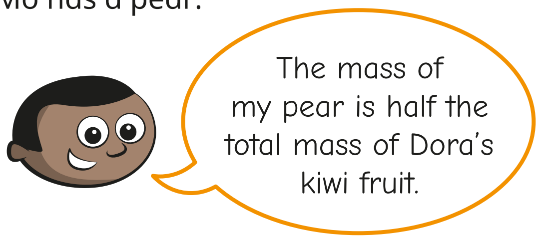
Reasoning and problem solving

Dora has 3 kiwi fruit.

The mass of each kiwi fruit is 70 g.



Mo has a pear.



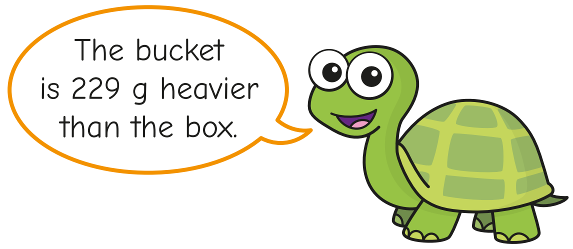
How much heavier is the pear than a kiwi fruit?

How did you work it out?

35 g

A box has a mass of 1 kg.

A bucket has a mass of 230 g.



Explain the mistake that Tiny has made.

Which is heavier, the box or the bucket?

How much heavier is it?

The box is heavier by 770 g.

A bag is 320 g lighter than the box.

What is the total mass of the box, the bucket and the bag?

How did you work it out?

1 kg 910 g

Measure capacity and volume in millilitres

Notes and guidance

In this small step, children begin to explore capacity and volume. They can find the concept of capacity and volume confusing and often use the terms interchangeably. Capacity is the maximum amount of liquid a container can hold when full, whereas volume refers to the specific amount of liquid in a container.

In this step, children only explore millilitres as a measure of capacity or volume.

It is important to address the common misconception that taller containers always have a greater capacity. Giving children time to fill and pour liquids from a range of containers can support them in this, as well as helping them become more confident with estimating capacities.

Things to look out for

- Children may confuse the terms "capacity" and "volume".
- Children may think that taller containers have a greater capacity.
- Children may find interpreting scales difficult, for example working out what the marked increments represent and also halfway between two marks.

Key questions

- What is the difference between capacity and volume?
- What is the capacity of the container? How do you know?
- What is the difference between the start and end values on the scale?
- How many equal intervals are there?
- What is each interval worth?
- How can you work out halfway between two marks?
- What unit is the volume/capacity measured in?

Possible sentence stems

- The scale has been split into ______ equal parts, so each mark represents ______ ml.
- The water is full to the ______ mark, so the volume of water is ______ ml.

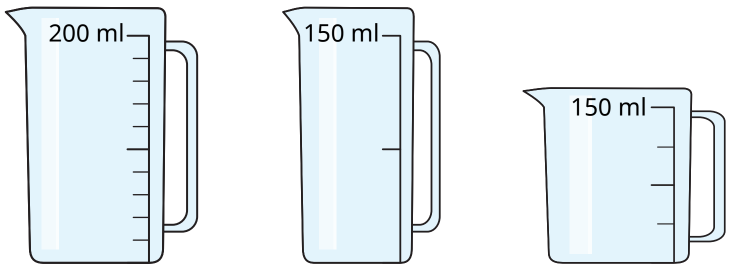
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Measure capacity and volume in millilitres

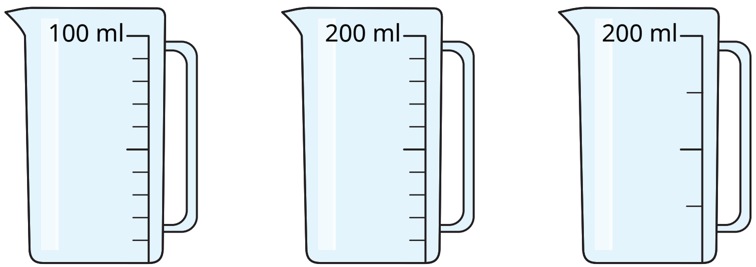
Key learning

- What is the capacity of each jug?



- Label the divisions on the scales of the jugs.

  Complete the sentences to help.

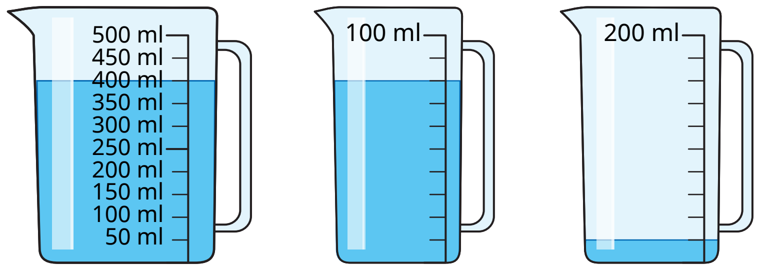


The difference between the start and end values on the scale is ______

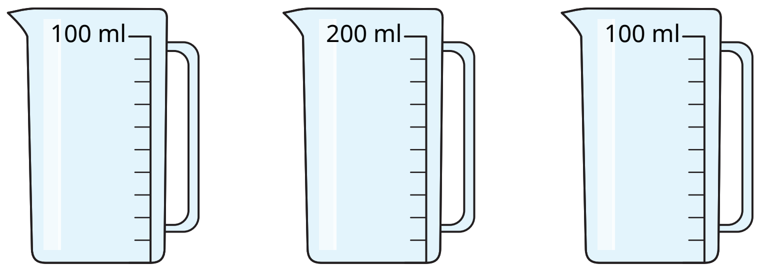
There are ______ equal intervals.

______ ÷ ______ = ______

- What is the volume of water in each jug?

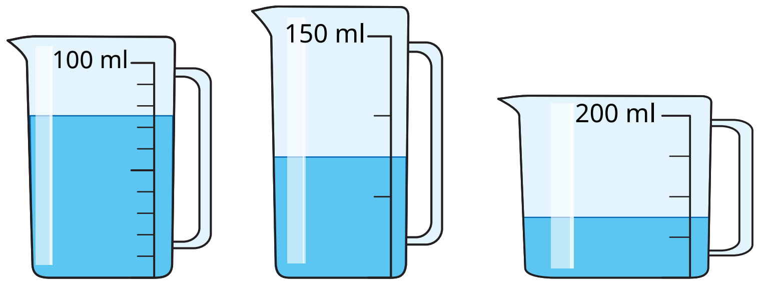


- Colour the jugs to show where the given amount of water will reach.



60 ml   60 ml   35 ml

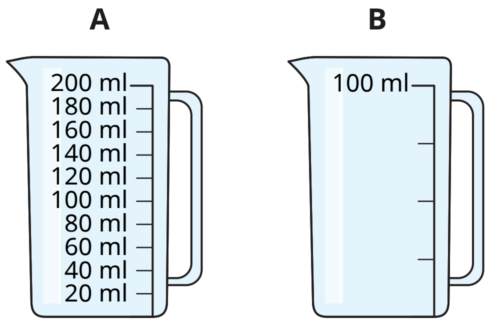
- What is the volume of water in each jug?

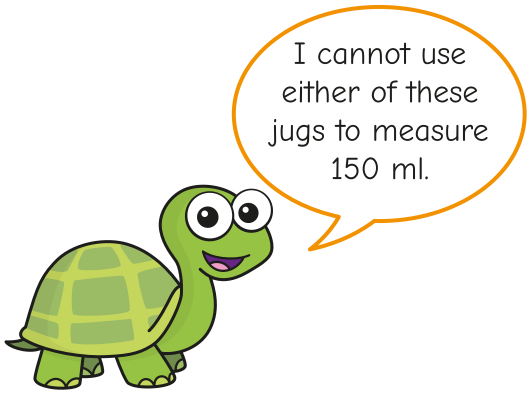


Measure capacity and volume in millilitres

Reasoning and problem solving

Tiny needs 150 ml of water.

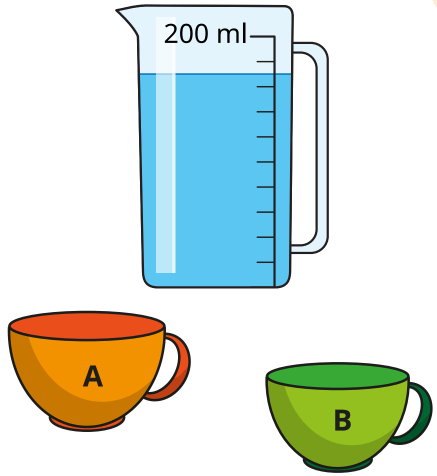




Do you agree with Tiny?

Explain why.

No



Cup A has a capacity of 30 ml.

Cup B has a capacity of 20 ml.

How many cups can be filled so that there is no water left in the jug?

How many different answers can you find?

multiple possible answers, e.g.
1 of cup A and
7 of cup B

Measure capacity and volume in litres and millilitres

Notes and guidance

In this small step, children use the units of litres and millilitres to measure capacity and volume. They describe mixed amounts as "______ litres and ______ millilitres", so do not need to use decimal notation or make conversions such as 2 litres and 400 ml is equal to 2,400 ml.

Children use their learning from the previous small step alongside the fact that 1,000 ml is equal to 1 litre to allow them to interpret different scales. Interpreting scales is a vital skill, so children should be exposed to a range of different-sized containers as well as scales split into a different number of intervals.

Continue to reinforce the difference between capacity and volume.

Things to look out for

- Children may find interpreting scales difficult, for example working out what the marked divisions represent and also halfway between two marks.
- Children may find the relationship between litres and millilitres confusing, leading to statements such as "300 ml is greater than 3 litres."

Key questions

- What is the difference between capacity and volume?
- What is the capacity of the container? How do you know?
- How many millilitres are there in 1 litre?
- How many intervals are there between 0 and 1 litre? What is each interval worth?
- How can you work out halfway between two marks on a scale?
- In this question, what unit is the volume/capacity measured in?

Possible sentence stems

- The arrow on the scale is pointing to ______ l and ______ ml
- The volume is between ______ l and ______ l

  There are ______ intervals.

  Each interval is worth ______ ml.

  The volume is ______ l and ______ ml.

National Curriculum links

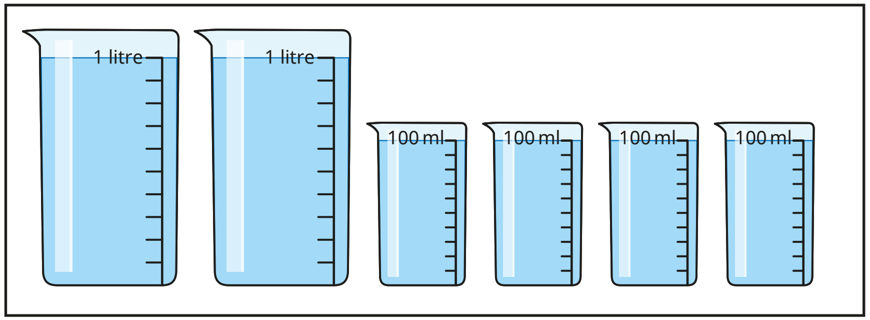
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

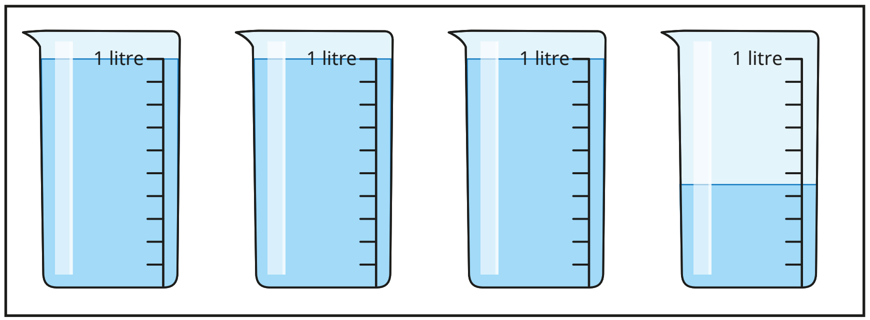
Measure capacity and volume in litres and millilitres

Key learning

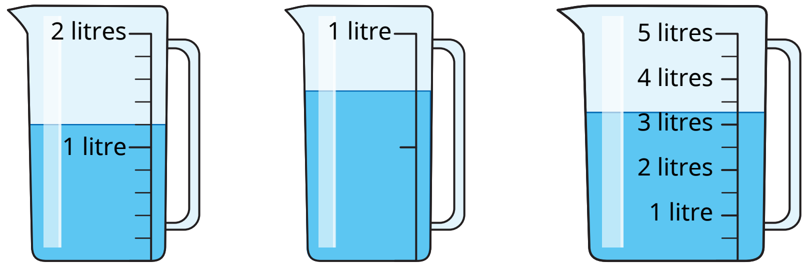
- Label the missing divisions on the jugs.

- How much water is there in total in each set of beakers?



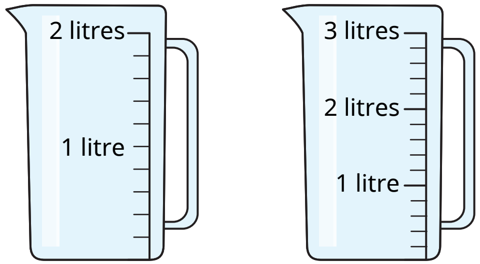


- What is the volume of water in each jug?



How accurate do you think your answers are?

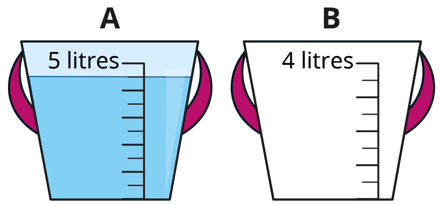
- Shade the jugs to show where the water will reach.



1 l and 400 ml   2 l and 900 ml

- Half of the water from bucket A is poured into bucket B.

  Shade bucket B to show where the water will reach.

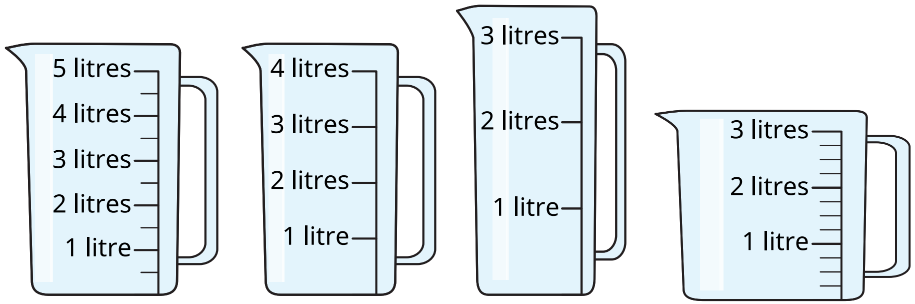


Measure capacity and volume in litres and millilitres

Reasoning and problem solving

Tommy needs to measure 2 litres and 350 ml as accurately as possible using these jugs.

A B C D

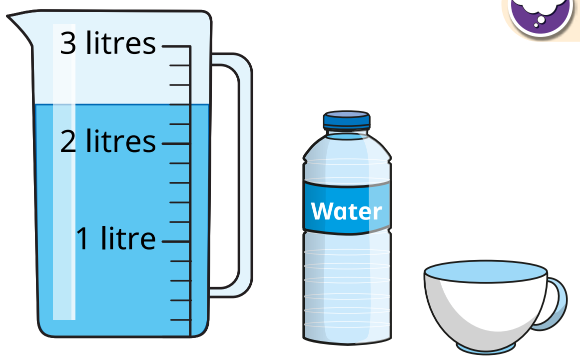


Which jug do you think will be easiest to use?

Which do you think will be hardest?

Explain your reasons.

Compare answers as a class.



3 full cups hold the same amount of water as a bottle.

4 full bottles were used to put the water into the jug.

What is the capacity of a cup?

How many cups and bottles can be filled from the jug, so that there is no water left in the jug?

Is there more than one answer?

200 ml

multiple possible answers, e.g.
3 bottles + 3 cups

Equivalent capacities and volumes (litres and millilitres)

Notes and guidance

In the previous two steps, children measured capacity and volume in both litres and millilitres, and read scales using both of these units of measure. In this small step, they build on their understanding of 1 litre being equivalent to 1,000 ml, and this point will be explored in great depth, so the volumes and capacities in the questions will not go over 1 litre.

Children also draw on other previously learnt skills, as they use addition and subtraction to make amounts of millilitres up to 1 litre. They continue to look at fractions of a litre, and should know that $\frac{1}{2}$ of a litre is 500 ml and $\frac{1}{4}$ of a litre is 250 ml.

Things to look out for

- Children may confuse relationships with other units of measure, for example cm and m, and think that there are 100 ml in 1 litre.
- Children may experience difficulties with calculation when dividing 1,000

Key questions

- How many 100 ml containers full of water fill a 1 litre container?
- How many millilitres are equivalent to 1 litre?
- How many equal parts are there?
- What is each interval worth?
- Do you always need to count up the scale to find out how much there is?
- How can you use number bonds to 100 to help?

Possible sentence stems

- There are ______ ml in 1 litre.
- ______ ml + ______ ml = 1,000 ml = 1 litre

  I need ______ more millilitres to make 1 litre.
- The capacity/volume is/is not equivalent to 1 litre because …

National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Equivalent capacities and volumes (litres and millilitres)

Key learning

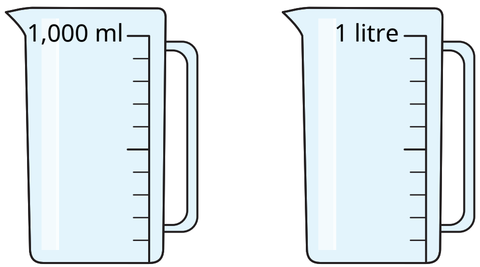
- Give children a 100 ml container, a 1 litre container and some water.

  Ask them to use the 100 ml container to fill the 1 litre container.

  How many times did they need to fill the 100 ml container?

  What does this tell them?

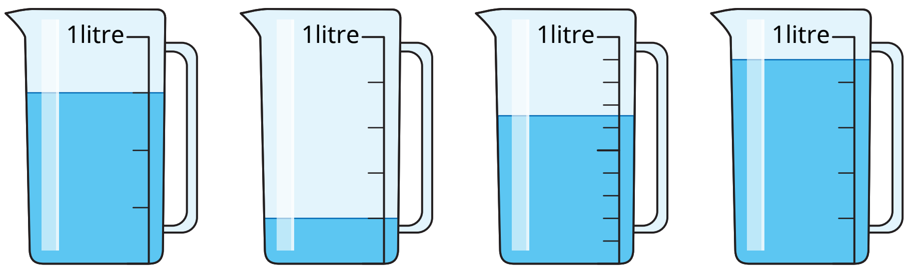
- What is the same and what is different about these jugs?



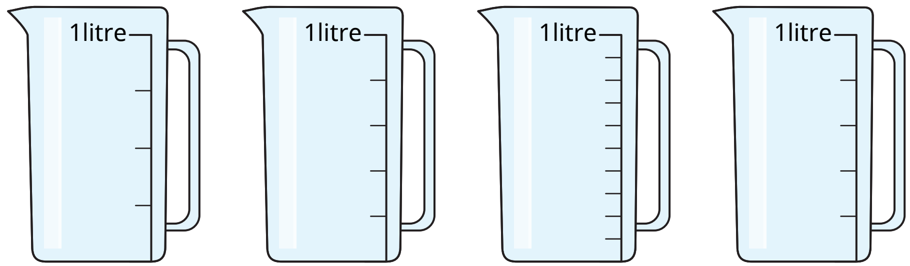
  Label the missing divisions on each jug.

- What is the volume of liquid in each jug?

  Give your answers in millilitres.



- Shade the jugs to show where the water will reach.



500 ml 700ml 150 ml 1,000 ml

- Complete the number sentences.
  - 30 ml + 70 ml = ____ ml
  - 45 ml + 55 ml = ____ ml
  - 100 ml – 38 ml = ____ ml
  - 21 ml + ____ ml = 100 ml
  - ____ ml + 340 ml = 1,000 ml
  - 300 ml + 700 ml = ____ ml
  - 450 ml + 550 ml = ____ ml
  - 1,000 ml – 380 ml = ____ ml
  - 210 ml + ____ ml = 1,000 ml
  - ____ ml + 340 ml = 1 litre

- Tom has a 1 litre bottle of water.

  He drinks 350 ml.

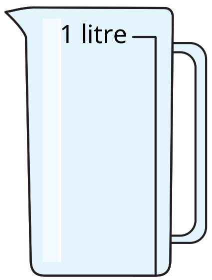
  How much water is left in the bottle?

Equivalent capacities and volumes (litres and millilitres)

Reasoning and problem solving

Jo has these bottles.

She uses the bottles to fill this 1 litre jug.



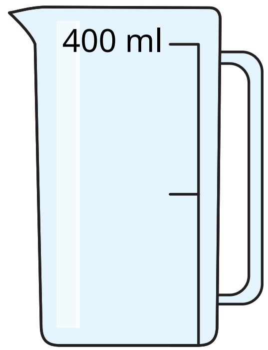
How many different ways can it be done?

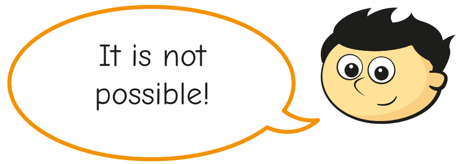
Jo can use each bottle more than once.

multiple possible answers, e.g.

500 ml, 2 × 200 ml, 100 ml

Jack is trying to measure 1 litre using this container.





Do you agree with Jack?

Explain your answer.

No

Compare capacity and volume

Notes and guidance

Building on their understanding of litres and millilitres, in this small step children compare capacities and volumes.

Children first compare capacities or volumes purely by visual estimation, for example a bath must have a greater capacity than a cup. They also use language such as "full", "nearly full", "half full" and "nearly empty" to compare volumes without measuring. They then progress to using "greater than" and "less than" as well as the inequality symbols (<, >, =) to compare capacities and volumes that can be measured.

It is important to explore the common misconceptions that a taller container must have a greater capacity, and that if the level of liquid is higher up a scale, the volume must be greater. Initially, children compare the same units of measure, but then move on to comparing litres to millilitres, building on the work done in Step 8

Things to look out for

- Children may find the relationship between litres and millilitres confusing, leading to statements such as "300 ml is greater than 3 litres."

Key questions

- What is the difference between capacity and volume?
- Which container do you think has the greater capacity? Why?
- Which container do you think has the greater volume of liquid in? Why?
- How can you work out the actual capacity of each container?
- What is each interval worth?
- How can you work out halfway between two marks?
- What unit is the volume/capacity measured in?
- How many millilitres are there in ______ litres?

Possible sentence stems

- The capacity of the first container is ______ than the capacity of the second container because …
- The volume of liquid in the first container is ______ than the volume in the second container because …
- There are ______ millilitres in ______ litre.

National Curriculum links

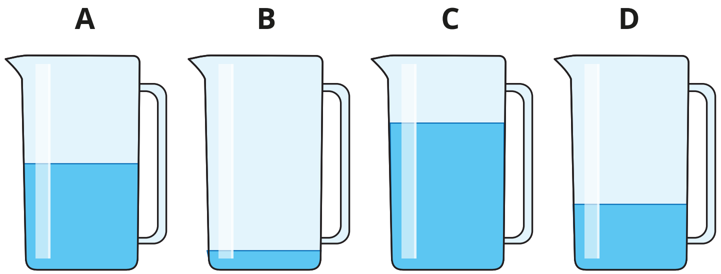
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

White Rose Maths

Compare capacity and volume

Key learning

- Each container has the same capacity.

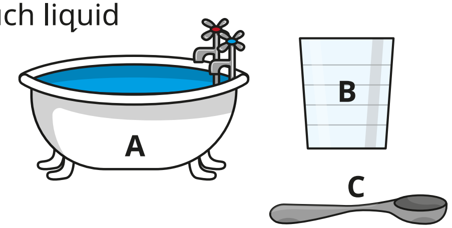


Put the containers in order of the volume of liquid they contain.

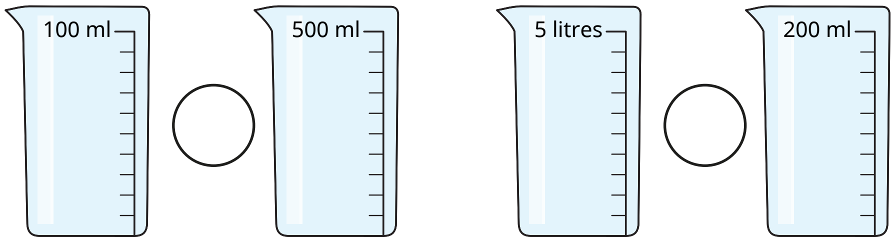
Start with the container with the greatest volume.

- Put the objects in order of how much liquid they can contain.

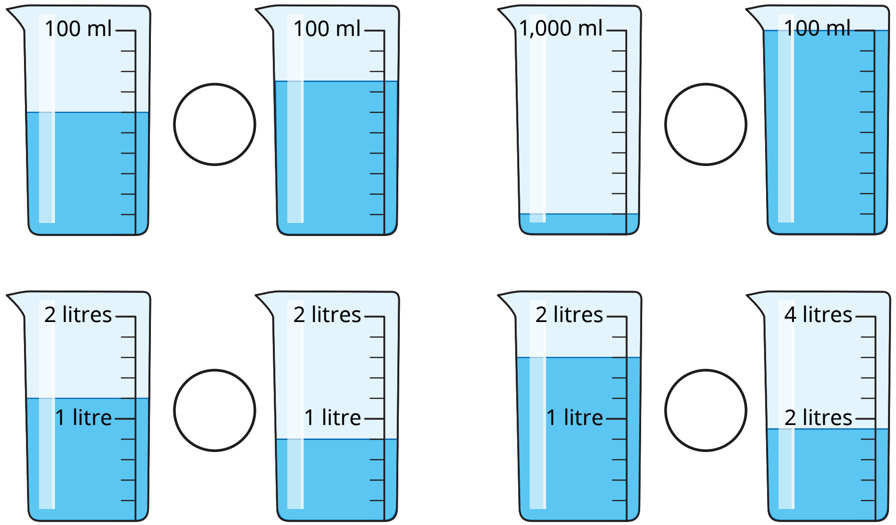
Start with the greatest capacity.



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

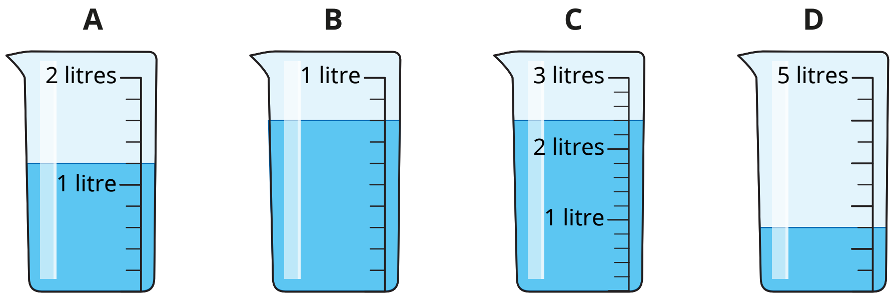


- Write <, > or = to compare the volumes.



- Put the containers in order of the volume of liquid they contain.

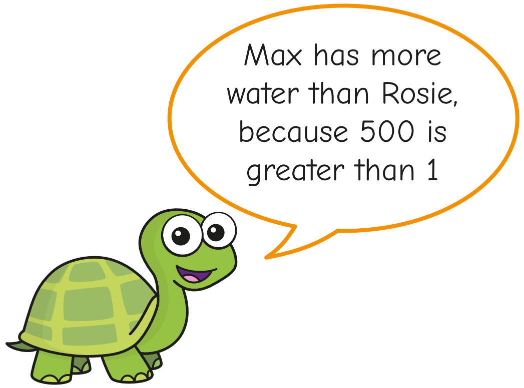
Start with the smallest volume.



Compare capacity and volume

Reasoning and problem solving

Rosie's water **Max's water**



Do you agree with Tiny?

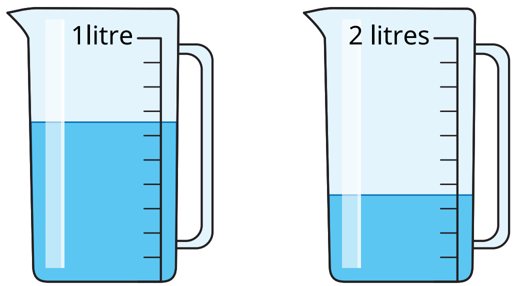
Explain your answer.

No

Is the statement true or false?

The volume of water in jug A is greater than the volume of water in jug B.

A **B**



Explain your answer.

False

jug A: approximately 650 ml

jug B: approximately 700 ml

Add and subtract capacity and volume

Notes and guidance

In this small step, children explore adding and subtracting capacities and volumes.

Children use mixed units, adding the litres and millilitres separately. Use of part-whole models can support this. This is a good opportunity for children to practise their mental addition and subtraction, as many of the numbers involved will not necessitate the written method. As children have not yet explored numbers beyond 1,000, there will be no requirement to cross 1 litre with addition or subtraction, but children will use their knowledge of 1,000 ml being equivalent to 1 litre to subtract from whole litres.

Things to look out for

- Children may mix units incorrectly, for example 300 ml + 2 l = 302 ml.
- Children may struggle with subtracting from a whole litre if they do not first convert to millilitres.
- Children may make errors in interpreting scales.

Key questions

- What units are being used? Can you add/subtract them?
- How many litres are there altogether? How many millilitres are there?
- What volume do you need to add to reach 1 litre? How much more liquid is still left to add?
- How could you work out the difference?
- In what order are you going to do the calculations? Do you have to do them in a certain order or is there a more efficient method?

Possible sentence stems

- ______ litres add/subtract ______ litres is equal to ______ litres.

  ______ ml add/subtract ______ ml is equal to______ ml.

  So the total/difference is ______ l ______ ml.

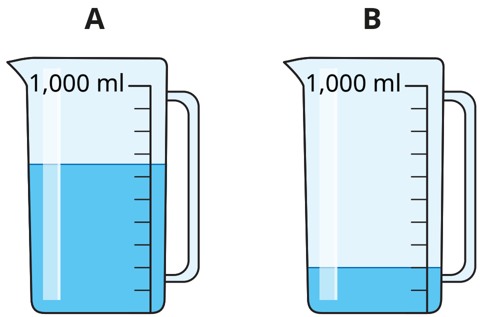
National Curriculum links

- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

Add and subtract capacity and volume

Key learning

- Whitney has some jugs of water.



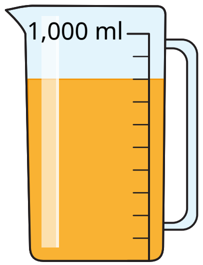
She pours all the water from jug A into jug B.

How much water is now in jug B?

- Alex has this orange juice in a jug.

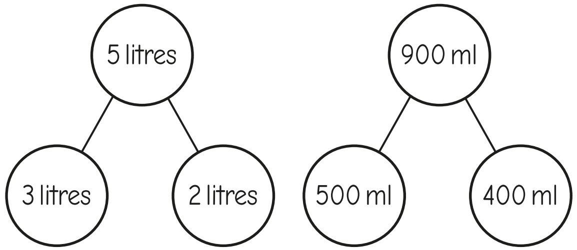
She drinks 300 ml.

How much orange juice is left in the jug?



- Work out the calculations.
  - 200 ml + 320 ml
  - 5 l + 7 l
  - 450 ml – 100 ml
  - 720 ml – 510 ml
  - 100 l – 63 l
  - 1 l – 310 ml

- Amir uses part-whole models to add 3 l 500 ml and 2 l 400 ml.



3 litres + 2 litres = 5 litres
500 ml + 400 ml = 900 ml
So the total is 5 litres 900 ml.

Use Amir's method to work out the totals.

1 l 300 ml + 2 l 450 ml	3 l 400 ml + 500 ml
3 l 600 ml + 400 ml	4 l 150 ml + 3 l 800 ml

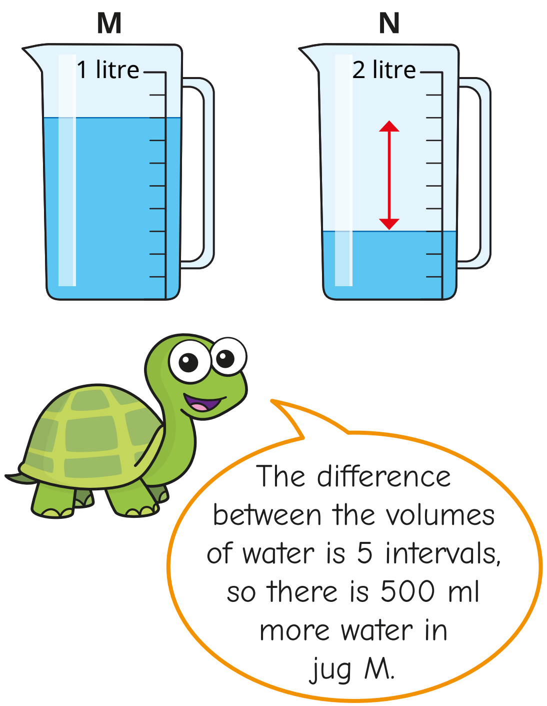
- Work out the subtractions.

3 l 400 ml – 2 l	10 l 195 ml – 8 ml
10 l 195 ml – 3 l	3 l 400 ml – 400 ml

Add and subtract capacity and volume

Reasoning and problem solving

Tiny is finding how much more water is in jug M than jug N.

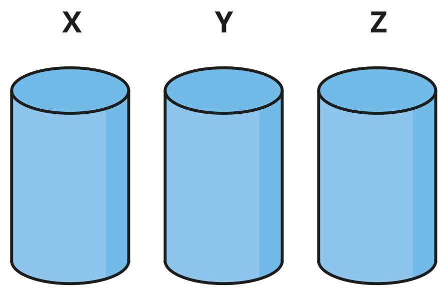


Do you agree with Tiny?

Explain your reasons.

No

Here are some measuring cylinders.



The total liquid in all three cylinders is 400 ml.

Cylinder X has half of the total amount in it.

Cylinder Y has 67 ml less than cylinder X.

How much liquid does each cylinder contain?

X: 200 ml

Y: 133 ml

Z: 67 ml