Spring
Scheme of learning

Year 3

White Rose MATHS

#MathsEveryoneCan

Spring Block 1

Multiplication and division B

© White Rose Education 2022

White Rose MATHS

Small steps

Step 1	Multiples of 10
Step 2	Related calculations
Step 3	Reasoning about multiplication
Step 4	Multiply a 2-digit number by a 1-digit number – no exchange
Step 5	Multiply a 2-digit number by a 1-digit number – with exchange
Step 6	Link multiplication and division
Step 7	Divide a 2-digit number by a 1-digit number – no exchange
Step 8	Divide a 2-digit number by a 1-digit number – flexible partitioning

© White Rose Education 2022

Small steps

Step 9 Divide a 2-digit number by a 1-digit number – with remainders

Step 10 Scaling

Step 11 How many ways?

© White Rose Education 2022

White Rose MATHS

Multiples of 10

Notes and guidance

Children learnt the 10 times-table in Year 2 and revisited multiples of 10 in the Autumn term. In this small step, they further develop their understanding of multiples of 10 by looking at greater multiples.

Children reinforce their earlier work on place value and use a range of representations, such as ten frames, Gattegno charts and place value charts. They recognise that multiples of 10 end in a zero and use this fact to solve basic multiplication and division problems beyond the 10 times-table.

Understanding multiples of 10 is crucial for the next step, when children explore multiplying by 20, 30 and so on. This is the foundation of multiplying other 2-digit numbers using the expanded method later in this block and for more formal methods in Year 4 and beyond.

Things to look out for

- Children may think that multiplying by 10 is always equivalent to adding a zero, rather than considering place value, which could lead to misconceptions in later years when they multiply decimals.
- Children may need support to recognise when to multiply and when to divide by 10

Key questions

- What is the multiple of 10 before _____?
- What is the multiple of 10 after _____?
- Is _____ a multiple of 10? How can you tell?
- How many tens are there in _____?
- How can you use a Gattegno chart/place value chart to help multiply or divide a number by 10?
- What is the same about all multiples of 10? What is different?

Possible sentence stems

- I know _____ is a multiple of 10 because ...
- _____ multiplied by 10 is equal to _____
- _____ is 10 times the size of _____
- There are _____ tens in _____

National Curriculum links

- Recall and use multiplication facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers (Y2)

© White Rose Education 2022

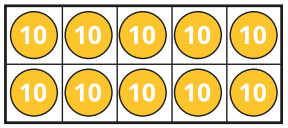
Multiples of 10

Key learning

- Complete the number track.

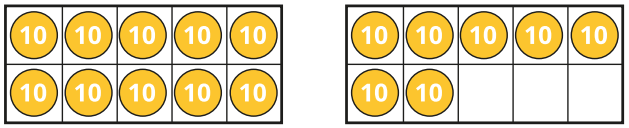
10	20		40		60			90	100

- Use the ten frame to complete the sentence.



10 tens are equal to _____

Use the ten frames to complete the calculation.



17 × 10 = 10 × 10 + 7 × 10 = _____ + _____ = _____

- Work out the multiplications.

14 × 10	19 × 10	23 × 10	10 × 26

- Dexter has 13 bags of marbles.

  There are 10 marbles in each bag.

  How many marbles does Dexter have altogether?

- Which of these numbers are multiples of 10?

50	150	65	98	450	150	805	25	340

Explain how you know.

- A bush is 4 m tall.

  A tree is 10 times as tall as the bush.

  How tall is the tree?

- Fill in the missing numbers.

  - 23 × 10 = _____
  - _____ × 10 = 280
  - 64 × _____ = 640
  - _____ × 10 = 420

- A ribbon is 270 cm long.

270 cm

Ron wants to cut the ribbon into 10 cm pieces.

How many pieces can he cut?

© White Rose Education 2022

Multiples of 10

Reasoning and problem solving

Teddy saves £10 a week.

How many weeks will it take him to save £120?

How do you know?

12 weeks

Mr Trent has a piece of wood.

Mr Trent cuts it into three parts, A, B and C.

- Part A is 10 times as long as part C.
- Part B is 4 times as long as part C.
- Part A is 100 cm long.

How long was the piece of wood before Mr Trent cut it?

150 cm

Here is a Gattegno chart and a place value chart.

100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9

Hundreds	Tens	Ones

Show each number on both charts.

21 **14** **32** **40** **26**

Multiply each number by 10

Show the results on the charts.

What is the same and what is different?

210, 140, 320, 400, 260

© White Rose Education 2022

Related calculations

Notes and guidance

This small step builds on the previous step and children's existing knowledge of times-tables to explore calculations related to known facts.

Children explore scaling facts by 10, for example using 3 × 4 = 12 to derive 3 × 40 = 120 and 30 × 4 = 120. A range of representations are used to expose the link between multiples of 1 and multiples of 10. Children begin by using base ten, before moving on to the slightly more abstract representation of place value counters. Children go on to explore this relationship with division, for example using 12 ÷ 3 = 4 to derive 120 ÷ 3 = 40. This will be revisited later in the block.

Care should be taken to ensure that children do not also think that 12 ÷ 30 = 40. This is a good opportunity to remind them that multiplication is commutative while division is not.

Things to look out for

- Children may derive incorrect division facts by using the rules they have learnt about related multiplication facts.
- Children may try to find results by calculation rather than recognising the relationship between one fact and another.

Key questions

- What is the same and what is different about the two calculations?
- How can you represent the calculation using place value counters/base 10?
- How is multiplying by 10s different from multiplying by 1s?
- What is the connection between the two calculations?

Possible sentence stems

- _____ × _____ ones is equal to _____ ones,
  so _____ × _____ tens is equal to _____ tens.
- _____ ÷ _____ is equal to _____,
  so _____ tens ÷ _____ is equal to _____ tens.

National Curriculum links

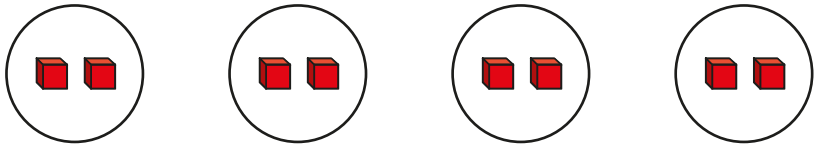
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

© White Rose Education 2022

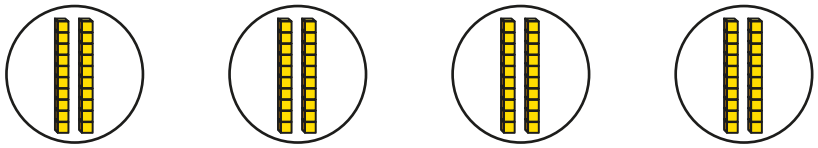
Related calculations

Key learning

- Complete the number sentences to match the pictures.

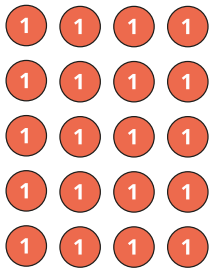


4 × 2 ones = _____ ones 4 × 2 = _____

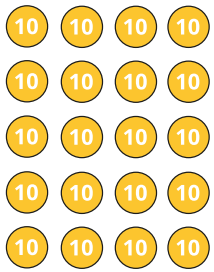


4 × 2 tens = _____ tens 4 × 20 = _____

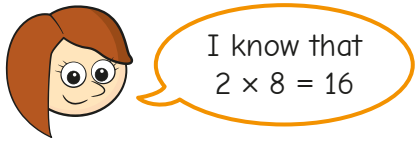
- Complete the multiplication facts.



_____ × 4 = _____



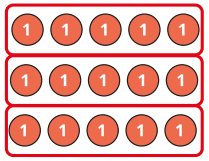
_____ × 40 = _____

- 

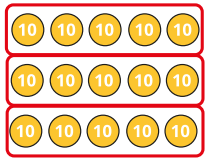
Use Rosie's fact to complete the multiplications.

2 × 80 = _____ 20 × 8 = _____ 8 × 20 = _____

- Use the place value counters to complete the divisions.



15 ÷ 3 = _____



15 tens ÷ 3 = _____

- Use place value counters to help complete the calculations.

27 ÷ 9 = _____ 54 ÷ 6 = _____ 48 ÷ 4 = _____

270 ÷ 9 = _____ 540 ÷ 6 = _____ 480 ÷ 4 = _____

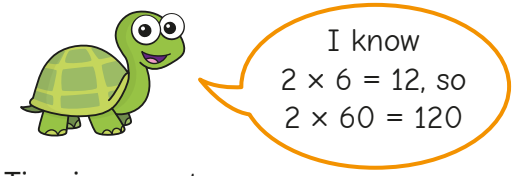
- 4 family tickets to a theme park cost £240 in total.

How much does 1 family ticket cost?

© White Rose Education 2022

Related calculations

Reasoning and problem solving



Tiny is correct.

Write the fact family for this multiplication.

60 × 2 = 120

120 ÷ 2 = 60

120 ÷ 60 = 2

Use the number cards to complete the calculations.

9	9	10	10	100	900	900

You can use each card only once.

900 ÷ ☐ = 100

☐ ÷ ☐ = 9

☐ × ☐ = ☐ ÷ ☐

900 ÷ 9 = 100

900 ÷ 100 = 9

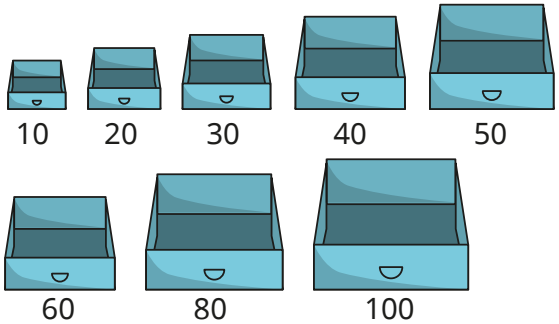
9 × 10 = 900 ÷ 10

Scott has 240 cakes to sell.

He chooses one size of box and puts the same number of cakes in each box.

He has no cakes left over.

Which of these boxes could he use?



10, 20, 30, 40, 60 or 80

Is the statement true or false?

5 × 30 = 3 × 50

Explain your answer.

True

© White Rose Education 2022

Reasoning about multiplication

Notes and guidance

In this small step, children develop their knowledge and understanding of the structure of multiplication.

Children begin by recapping what multiplication looks like with objects, and gradually use more abstract representations. These include cubes, base 10, arrays and number sentences. They use the symbols <, > and = to compare groups using multiplication and division structures, both in context and within number sentences. Children are encouraged to realise that, for example, 6 × 3 > 6 × 2 without doing any calculation, but by recognising the relationship between the calculations and that the first must give an answer greater than the second because the same number is being multiplied by 3 and 2

Things to look out for

- When comparing number sentences, children may find it difficult to recognise which digit is referring to the size of the group and which digit is referring to the number of groups.
- Children may try to work out the calculations to make comparisons, rather than using their understanding of the multiplicative structure.

Key questions

- What number sentences are shown by the array?
- What is the same and what is different about 8 × 3 and 8 × 4?
- Which digit represents the size of the group?
- Which digit refers to the number of groups?
- What happens if you increase/decrease the number of groups?
- What happens if you increase/decrease the size of the groups?
- Do you need to complete the calculations to compare them?

Possible sentence stems

- _____ lots of _____ is greater than _____ lots of _____
- _____ lots of _____ is less than _____ lots of _____
- I know that _____ is greater because ...

National Curriculum links

- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

© White Rose Education 2022

Reasoning about multiplication

Key learning

- Complete the number sentences to match the pictures.

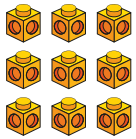
6 × 3 = _____

6 × 5 = _____

Write > or < to complete the statement.

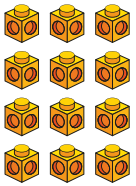
6 × 3 ◯ 6 × 5

- Complete the number sentences and write <, > or = to compare the arrays.



_____ × _____ = _____

◯



_____ × _____ = _____

- Write <, > or = to complete the statement.

2 × 30 ◯ 4 × 30

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

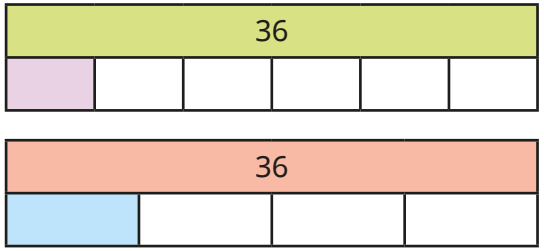
8 × 3 ◯ 7 × 4

8 × 2 ◯ 6 × 4

80 × 3 ◯ 70 × 4

8 × 20 ◯ 6 × 40

- How do the bar models show that 36 ÷ 6 < 36 ÷ 4?



Draw bar models to compare the pairs of calculations.

12 ÷ 6 ◯ 12 ÷ 4

15 ÷ 5 ◯ 15 ÷ 3

27 ÷ 3 ◯ 24 ÷ 3

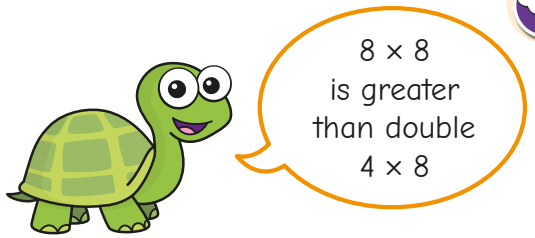
20 ÷ 5 ◯ 20 ÷ 4

© White Rose Education 2022

Reasoning about multiplication

White Rose MATHS

Reasoning and problem solving



Do you agree with Tiny?

Use counters to show your answer.

No

8 × 8 = double 4 × 8

Use all the cards to complete the statements.

4 × 5	3 × 8	3 × 4
5 × 5	4 × 8	3 × 5

_____ < _____

_____ > _____

_____ < _____

various possible answers, e.g.

3 × 5 < 4 × 5

4 × 8 > 3 × 8

3 × 4 < 5 × 5

Is each statement true or false?

6 × 7 < 6 + 6 + 6 + 6 + 6 + 6 + 6

7 × 6 = 7 × 3 + 7 × 3

2 × 3 > 5 × 3

False

True

False

Find three different ways to complete each number sentence.

_____ × 3 + _____ × 3 < _____ × 3

_____ × 4 < _____ × 4 < _____ × 4

_____ × 8 > _____ × 8 > _____ × 8

multiple possible answers, e.g.

1 × 3 + 2 × 3 < 5 × 3

2 × 4 < 8 × 4 < 12 × 4

7 × 8 > 2 × 8 > 1 × 8

© White Rose Education 2022

Multiply a 2-digit number by a 1-digit number – no exchange

White Rose MATHS

Notes and guidance

In this small step, children explore multiplying 2-digit numbers by 1-digit numbers. At this stage, none of the multiplication calculations require exchanges.

Children apply their understanding of partitioning to represent and solve calculations using the expanded method. The 2-digit number is partitioned into tens and ones, both are multiplied by the 1-digit number and then the partial products are added to find the total product. This is explored through a progression of representations from base 10 to place value counters and part-whole models, alongside number sentences.

The expanded method allows children to gain a deep understanding of the structure of the calculation before progressing to formal short multiplication in Year 4

Things to look out for

- Children may partition a 2-digit number into single digits rather than tens and ones, for example $48 \times 8 = 4 \times 8 + 8 \times 8$
- Errors may occur if partial products are lined up incorrectly.

Key questions

- How can you partition a 2-digit number into tens and ones?
- What is the product of the tens and the single digit?
- What is the product of the ones and the single digit?
- What do you need to do to find the final answer?

Possible sentence stems

- _____ tens and _____ ones multiplied by _____ is equal to _____ tens multiplied by _____ and _____ ones multiplied by _____
- _____ tens multiplied by _____ is equal to _____
  _____ ones multiplied by _____ is equal to _____
  _____ multiplied by _____ is equal to _____
- _____ × _____ = _____ tens × _____ + _____ × _____

National Curriculum links

- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

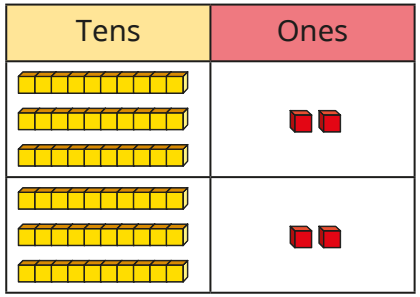
© White Rose Education 2022

Multiply a 2-digit number by a 1-digit number – no exchange

Key learning

- Complete the number sentences.

  Use the place value chart to help you.



3 tens × 2 = _____ tens

2 ones × 2 = _____ ones

_____ + _____ = _____

32 × 2 = _____

- A minibus has space for 21 people.

  How many people can fit on 3 minibuses?

  Use a place value chart and base 10 to help you.

- Use the place value chart and counters to work out 21 × 4

2 tens × 4 = _____ tens

1 one × 4 = _____ ones

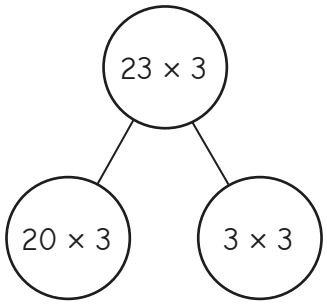
_____ + _____ = _____

21 × 4 = _____

- Work out the multiplications.

32 × 3	23 × 2	12 × 4	41 × 2

- Ron has used a part-whole model to multiply 23 by 3



20 × 3 = 60
3 × 3 = 9
23 × 3 = 69

Use a part-whole model to help you work out the multiplications.

21 × 5	42 × 2	52 × 2	21 × 6

- Complete the number sentences.

  ▸ 32 × 4

  = ___ tens × 4 + ___ ones × 4

  = ___ + ___

  = ___

  ▸ 42 × 3

  = ___ tens × 3 + ___ ones × 3

  = ___ + ___

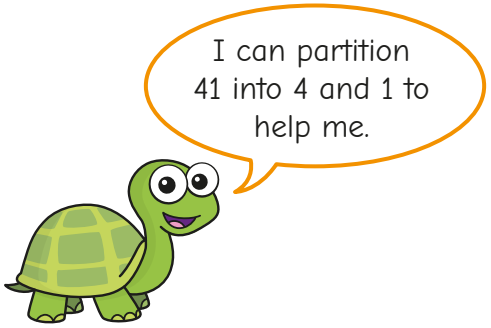
  = ___

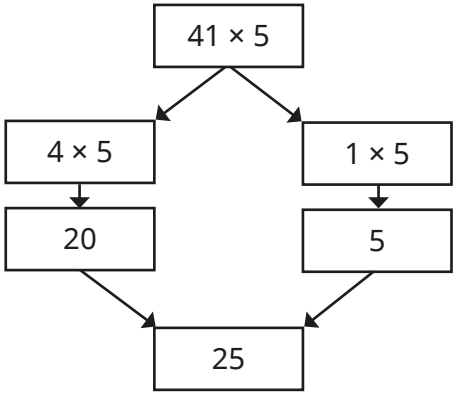
© White Rose Education 2022

Multiply a 2-digit number by a 1-digit number – no exchange

Reasoning and problem solving

Tiny is working out 41 × 5





What has Tiny done wrong?

Work out the correct answer.

205

Whitney is comparing calculations.

Is Whitney correct?

How does she know this?

Yes

Ron multiplies a 2-digit number by a 1-digit number.

What might Ron's numbers be?

48 and 1

24 and 2

12 and 4

© White Rose Education 2022

Multiply a 2-digit number by a 1-digit number – with exchange

White Rose MATHS

Notes and guidance

In this small step, children continue to explore multiplying 2-digit numbers by 1-digit numbers, now looking at calculations that involve an exchange.

As in the previous step, children apply their understanding of partitioning to represent and solve calculations using the expanded method. This involves partitioning the 2-digit number into tens and ones, multiplying separately, then adding the partial products together. Children use the same representations as in the previous steps to provide familiarity and focus their attention on the new aspect of making an exchange.

Use of the expanded method allows children to gain a deep understanding of the structure of the calculation before progressing to formal short multiplication in Year 4

Things to look out for

- Children may partition a 2-digit number into single digits rather than tens and ones, for example $48 \times 8 = 4 \times 8 + 8 \times 8$
- Children may not line up partial products correctly.
- Children may struggle when making an exchange, including forgetting to add on any exchanges.

Key questions

- How can you partition a 2-digit number into tens and ones?
- What is the product of the tens and the single digit?
- What is the product of the ones and the single digit?
- What do you need to do to find the final answer?
- What do you do if you have ten or more ones?

Possible sentence stems

- _____ tens and _____ ones multiplied by _____ is equal to _____ tens multiplied by _____ and _____ ones multiplied by _____
- _____ ones is _____ tens and _____ ones.
- _____ × _____ = _____ tens × _____ + _____ × _____

National Curriculum links

- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

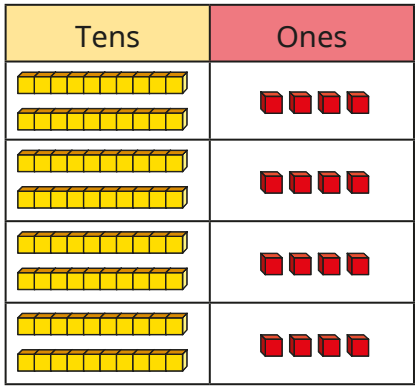
© White Rose Education 2022

Multiply a 2-digit number by a 1-digit number – with exchange

Key learning

- Complete the number sentences.

  Use the place value chart to help you.



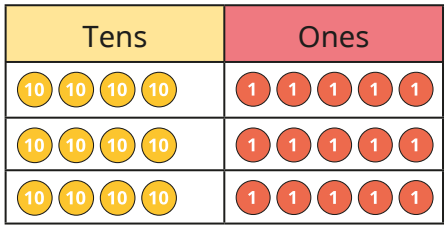
2 tens × 4 = _____ tens

4 ones × 4 = _____ ones

24 × 4 = _____ + _____ = _____

24 × 4 = _____

- Use the place value chart and counters to work out 45 × 3



4 tens × 3 = _____ tens

5 ones × 3 = _____ ones

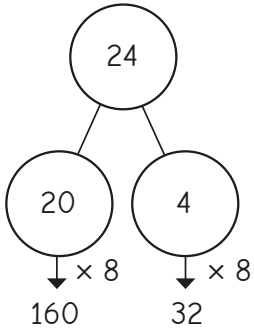
_____ + _____ = _____

45 × 3 = _____

- Use a place value chart and base 10 to work out the multiplications.

13 × 4	23 × 4	14 × 8	25 × 3

- Mo uses a part-whole model to work out 24 × 8



160 + 32 = 192
24 × 8 = 192

Use Mo's method to work out the multiplications.

18 × 4	73 × 5	42 × 5	28 × 8

- Complete the workings.

  - 64 × 3

    = ___ tens × 3 + ___ ones × 3

    = ___ + ___

    = ___

  - 24 × 8

    = 20 × 8 + 4 × 8

    = ___ + ___

    = ___

© White Rose Education 2022

Multiply a 2-digit number by a 1-digit number – with exchange

White Rose MATHS

Reasoning and problem solving

Is the statement always true, sometimes true or never true?

A 2-digit number multiplied by a 1-digit number has a 2-digit answer.

Explain your answer.

sometimes true

Aisha is sorting out two cupboards.

In the first cupboard, there are 4 boxes with 34 pencils in each box.

In the second cupboard, there are 5 boxes with 28 pencils in each box.

Which cupboard has more pencils?

second cupboard

Here are some digit cards.

2	3	4

Use each digit card once to create a multiplication.

☐☐ × ☐

Which multiplication gives an answer closest to 100?

23 × 4 = 92

Use the fact to compare the multiplications. Write < or > to make the statement correct.

8 × 44 = 352

8 × 45 ◯ 9 × 44

How did the fact help you?

<

© White Rose Education 2022

Link multiplication and division

Notes and guidance

In this small step, children develop their understanding of related facts from earlier in the block, with a focus on linking multiplication and division facts.

In particular, children explore what happens when a number within a calculation is multiplied by 10 and how this affects the answer. They use these facts by unitising in tens, for example using 8 ÷ 2 = 4 to derive 8 tens ÷ 2 = 4 tens, so 80 ÷ 2 = 40. A range of representations are used to make the link between multiples of one and ten, which will be familiar from the multiplication steps earlier in the block.

This step will support children to work out divisions in the next few steps of the block.

Things to look out for

- Children may try to find results by calculation, rather than recognising the relationship between two facts.
- In examples such as 240 ÷ 80, children may think the answer is 30 because they know 24 ÷ 8 = 3 and they assume that they need to add a zero.

Key questions

- What is the same and what is different about the two calculations?
- How can you show the calculation using place value counters/ base 10?
- How is multiplying by 10s different from multiplying by 1s?
- What division facts do you know by using the fact _____ × _____ = _____?

Possible sentence stems

- _____ × _____ ones is equal to _____ ones, so _____ × _____ tens is equal to _____ tens.
- _____ ÷ _____ is equal to _____, so _____ tens ÷ _____ is equal to _____ tens.

National Curriculum links

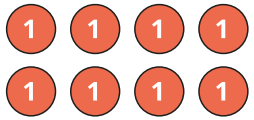
- Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects

© White Rose Education 2022

Link multiplication and division

Key learning

- What multiplication and division facts does the array show?



_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

What multiplication and division facts does the array show?

_____ × _____ = _____

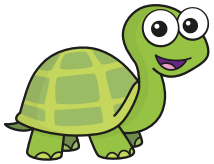
_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

What is the same and what is different about these arrays?

- Tiny is working out 60 ÷ 3



I know 6 ones ÷ 3 is equal to 2 ones.
So 6 tens ÷ 3 is equal to 2 tens.
60 ÷ 3 = 20

Use Tiny's method to work out the divisions.

80 ÷ 4	90 ÷ 3	60 ÷ 2	70 ÷ 7

- Fill in the missing numbers.

  - 2 × 6 = _____
    2 × 60 = _____
  - 3 × 8 = _____
    3 × _____ = 240
  - _____ = 5 × 3
    150 = 5 × _____

- 1 ticket to the zoo costs £20

  How much do 4 tickets cost?

  How many tickets can you buy for £180?

- There are 80 children in Year 3

  The children are put into pairs.

  How many pairs are there altogether?

© White Rose Education 2022

Link multiplication and division

Reasoning and problem solving

Eight friends go to a theme park for the day.

- Tickets to the theme park cost £20 each.
- Lunch costs £10 each.

Four of the friends share the cost between them.

How much do they each pay?

£60

Write <, > or = to compare the statements.

8 ÷ 2	◯	80 ÷ 2
80 ÷ 2	◯	80 ÷ 4
60 × 3	◯	60 ÷ 3
4 × 80	◯	8 × 40

<
>
>
=

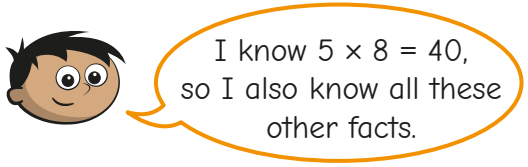
Work out the divisions.

320 ÷ 2	320 ÷ 20
320 ÷ 4	320 ÷ 40
320 ÷ 8	320 ÷ 80

What do you notice?

160	16
80	8
40	4

Amir is finding related calculations.



5 × 80 = 400	400 ÷ 5 = 80
50 × 8 = 400	400 ÷ 8 = 50

Which facts are correct?

They are all correct.

© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – no exchange

Notes and guidance

In this small step, children build on their knowledge of times-tables and division facts, using these to support them when dividing a 2-digit number by a 1-digit number. This step focuses on partitioning a number into tens and ones and sharing into equal groups, dividing numbers that do not involve exchanging or remainders. For example, 63 ÷ 3 can be partitioned into 60 and 3 and then shared into three equal groups: 60 ÷ 3 = 20 and 3 ÷ 3 = 1, therefore 63 ÷ 3 = 21

Children use part-whole models and place value counters to represent the calculations and support their understanding. It is important that children divide the tens first and then the ones. While it would not have an impact on their answers in this particular step, getting used to dividing in this way is beneficial for when they move on to dividing numbers involving exchanging and remainders in future steps.

Things to look out for

- Children may be used to working out a calculation starting with the ones column as this is what they have done with addition, subtraction and multiplication.
- Children may need support partitioning numbers into tens and ones.

Key questions

- What is _____ partitioned into tens and ones?
- What is _____ shared into _____ equal groups?
- How can the place value counters help you divide _____ by _____?
- How can you use the part-whole model to work out the division?
- What is _____ divided by _____?

Possible sentence stems

- _____ partitioned into tens and ones is _____ tens and _____ ones.
- _____ divided by _____ is equal to _____

National Curriculum links

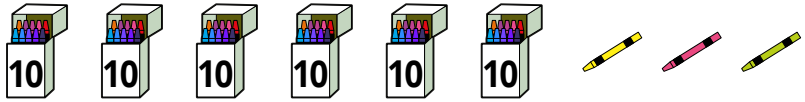
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – no exchange

Key learning

- There are 63 crayons.



  - Share the crayons into three equal groups.

    Use a place value chart and some counters to help you.
  - Complete the sentences.

    6 tens ÷ 3 = _____ tens

    3 ones ÷ 3 = _____ one

    63 ÷ 3 = _____

- Dani uses place value counters to work out 39 ÷ 3

Tens	Ones
10	1 1 1
10	1 1 1
10	1 1 1

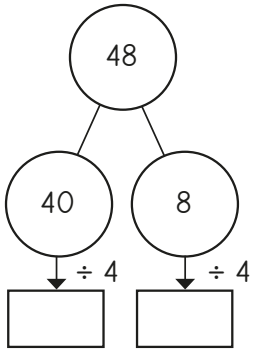
39 ÷ 3 = 13

Use Dani's method to work out the divisions.

84 ÷ 4 | 66 ÷ 2 | 66 ÷ 3 | 69 ÷ 3

- Eva uses a part-whole model to work out 48 ÷ 4

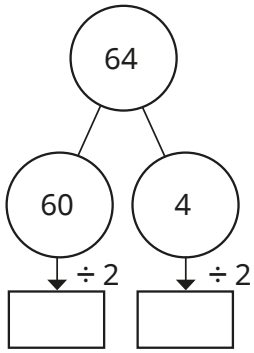
  Complete Eva's workings.



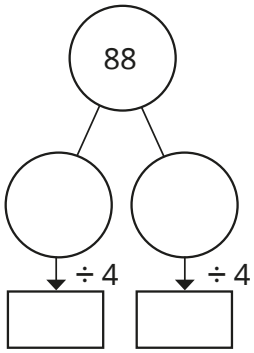
48 ÷ 4 = _____

- Work out the divisions.

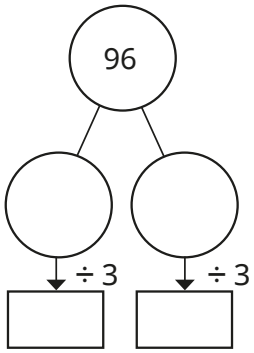
64 ÷ 2 = _____



88 ÷ 4 = _____



96 ÷ 3 = _____



© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – no exchange

Reasoning and problem solving

Tommy has 3 jars of buttons.

He shares all the buttons equally between 4 people.

How many buttons will each person get?

21

Write <, > or = to compare the calculations.

24 ÷ 2 ◯ 36 ÷ 3

84 ÷ 2 ◯ 84 ÷ 4

Explain your answers.

=

>

Tiny uses place value counters to work out 44 ÷ 4

Tens	Ones
10 10	1 1
10 10	1 1

Is Tiny correct?

How do you know?

No

Huan thinks that 88 sweets can be shared equally between 8 people.

Is he correct?

How do you know?

Yes

© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – flexible partitioning

White Rose MATHS

Notes and guidance

In this small step, children continue to divide a 2-digit number by a 1-digit number. They now begin to look at calculations that involve exchanging between the tens and the ones.

Children use their previous learning on flexible partitioning to support them with this. For example, to calculate 42 ÷ 3, they need to identify multiples of 3 that 42 can be partitioned into. Children use their knowledge of times-tables facts to partition the number into multiples of the number they are dividing by. For this example, they can partition 42 into 30 and 12, and then use 30 ÷ 3 = 10 and 12 ÷ 3 = 4 to find that 42 ÷ 3 = 14

Children can use place value counters to support their understanding and part-whole models to show what calculations have been done.

Things to look out for

- Children may be used to working out a calculation starting with the ones column as this is what they have done with addition, subtraction and multiplication.
- Children may not be confident with their times-table facts, which means they may find it difficult to partition the number into multiples of the number they are dividing by.

Key questions

- How can you flexibly partition _____ so that the tens and ones are both multiples of the number you are dividing by?
- What is _____ shared into _____ equal groups?
- How can the place value counters help you divide _____ by _____?
- How can you use the part-whole model to work out the division?
- What is _____ divided by _____?

Possible sentence stems

- _____ can be partitioned into _____ and _____, as these numbers are both multiples of _____
- _____ divided by _____ is equal to _____

National Curriculum links

- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – flexible partitioning

White Rose MATHS

Key learning

- Ron uses place value counters to work out 42 ÷ 3

  First, he shares the tens into 3 equal groups.

  He has 1 ten and 2 ones left over.

Tens	Ones
10	
10	
10	

1
10
1

Ron exchanges the remaining ten for 10 ones.

Then he shares the ones into 3 equal groups.

Tens	Ones
10	1 1 1 1
10	1 1 1 1
10	1 1 1 1

42 ÷ 3 = 14

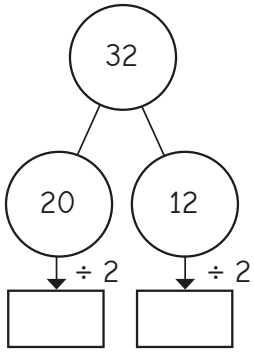
Use Ron's method to work out the divisions.

48 ÷ 3 | 52 ÷ 4 | 65 ÷ 5 | 72 ÷ 6

- Use place value counters to divide 54 by 3

  What do you notice?

- Annie uses a part-whole model to work out 32 ÷ 2



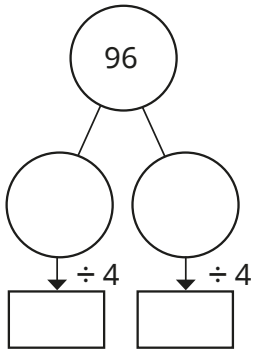
32 ÷ 2 = _____

Why did Annie partition 32 into 20 and 12?

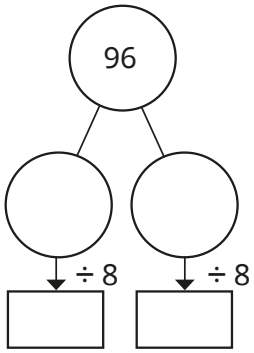
Complete Annie's workings.

- Use part-whole models to work out the divisions.

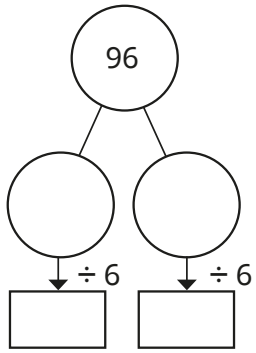
96 ÷ 4 = _____



96 ÷ 8 = _____



96 ÷ 6 = _____

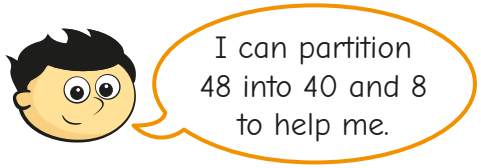


© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – flexible partitioning

Reasoning and problem solving

Jack is working out 48 ÷ 3



Is there a way to improve Jack's method?

partition 48 into 30 and 18, as these are both divisible by 3

Write <, > or = to complete the statements.

48 ÷ 4 ◯ 45 ÷ 3

52 ÷ 4 ◯ 42 ÷ 3

54 ÷ 3 ◯ 60 ÷ 4

Did you need to work out all of the divisions?

<

<

>

Tiny uses the place value chart to work out 54 ÷ 3

Tens	Ones
10 10	1 1
10 10	1
10	1

Explain the mistake Tiny has made.

Work out the correct answer.

18

© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – with remainders

Notes and guidance

In this small step, children continue to divide a 2-digit number by a 1-digit number. They apply their knowledge from the previous small steps and also make links between division and repeated subtraction, building on earlier learning.

Children look at calculations that may involve exchanging between the tens and ones, and that have a remainder. This will be the first time children have encountered remainders, so they will need to be explicitly taught the notation, for example 43 ÷ 3 = 14 remainder 1 or 14 r1

Practical equipment, such as lolly sticks and place value counters, can be used to support children's understanding.

Things to look out for

- Children may be used to working out a calculation starting with the ones column, as this is what they have done with addition, subtraction and multiplication.
- Children may miscount when using repeated subtraction.
- Children may end up with a remainder that is greater than the number they are dividing by and need support to complete the calculation.

Key questions

- Do you need to exchange any tens for ones?
- Is there a remainder?
- How can place value counters help you divide _____ by _____?
- How do you know _____ divided by _____ will have a remainder?
- Can a remainder ever be greater than the number you are dividing by?

Possible sentence stems

- There are _____ groups of _____

  There are _____ remaining.

  So _____ ÷ _____ = _____ r_____

National Curriculum links

- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for 2-digit numbers times 1-digit numbers, using mental and progressing to formal written methods

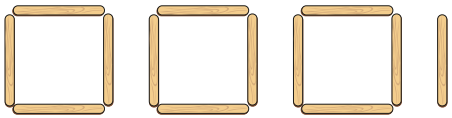
© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – with remainders

Key learning

- Esther has 13 lolly sticks.

  She uses them to make squares.

  Complete the sentences.

  There are _____ lolly sticks.

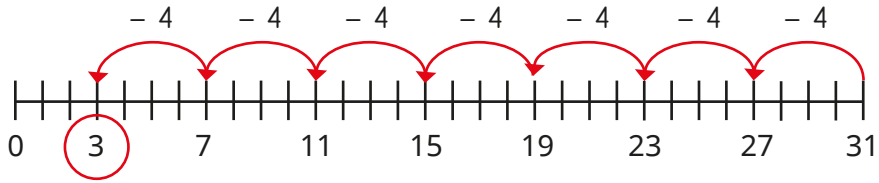
  There are _____ groups of 4

  There is _____ lolly stick remaining.

  13 ÷ 4 = _____ remainder _____

  Esther can make _____ squares.

- Tommy uses repeated subtraction to work out 31 ÷ 4

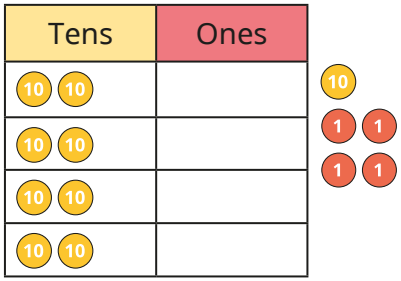


31 ÷ 4 = 7 r3

Use Tommy's method to work out 38 ÷ 3

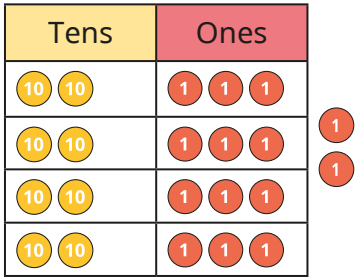
- Alex uses place value counters to work out 94 ÷ 4

  First, she shares the tens into 4 equal groups.



She needs to exchange the remaining ten for 10 ones.

Alex shares as many of the ones as possible into 4 equal groups.



94 ÷ 4 = 23 r2

Use Alex's method to work out the divisions.

76 ÷ 3 | 62 ÷ 5 | 58 ÷ 4 | 83 ÷ 6

© White Rose Education 2022

Divide a 2-digit number by a 1-digit number – with remainders

Reasoning and problem solving

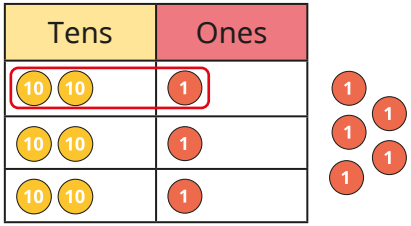
Which division is the odd one out?

64 ÷ 8	77 ÷ 4
49 ÷ 6	65 ÷ 3

How do you know?

various possible answers, e.g. 64 ÷ 8, as it is the only calculation without a remainder

Tiny uses place value counters to work out 68 ÷ 3



Tiny's answer is 21 r5

What mistake has Tiny made?

Work out the correct answer.

22 r2

Teddy has some buttons.

- There are more than 30, but fewer than 50
- Teddy shares the buttons equally into 5 bowls. There is 1 button left over.
- Teddy shares the buttons equally into 4 bowls. There are no buttons left over.

How many buttons has Teddy got?

36

Dora and Tom are planting bulbs.

They have 76 bulbs altogether.

Dora plants her bulbs in rows of 8 and has 4 left over.

Tom plants his bulbs in rows of 10 and has 2 left over.

How many bulbs do they each have?

Dora: 44

Tom: 32

© White Rose Education 2022

Scaling

Notes and guidance

In this small step, children develop their understanding of multiplication by focusing on scaling as opposed to repeated addition.

Building on concepts such as "3 times as many", children use language such as "3 times the size of" when comparing, for example, lengths. It is important that children see this type of multiplication as well as repeated addition, as it will help them in their later study of ratio and scales. They can relate this to their knowledge of place value and understanding that the value of the column directly to the left of another is 10 times the value.

Bar models can be useful to represent the concept. String can be used to illustrate the idea of, for example, "twice as long as" and be related to a bar model representation.

Things to look out for

- Children may not be familiar with models of multiplication other than those involving repeated addition.
- Children who are unfamiliar with the vocabulary may think that "3 times as many" means they need to add another three lots, resulting in a scale factor of 4 instead of 3

Key questions

- What number is 10 times the size of _____?
- What number is _____ times the size of _____?
- What length is _____ times as long as _____?
- What time is _____ times as long as _____?
- Which is the larger object? How many times larger is it?
- How can you show the problem as a bar model?

Possible sentence stems

- _____ is _____ times the length of _____
- _____ multiplied by _____ is equal to _____
- _____ times the size of _____ is _____

National Curriculum links

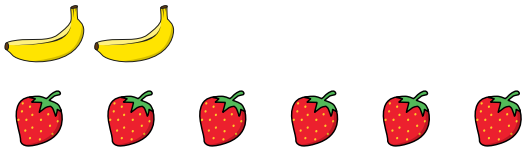
- Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects

© White Rose Education 2022

Scaling

Key learning

- Complete the sentences to describe the fruit.

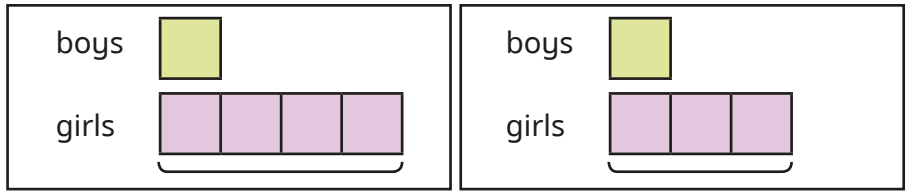


There are _____ bananas.

There are _____ strawberries.

There are _____ times as many strawberries as bananas.

- In a playground, there are 3 times as many girls as boys.



Which bar model shows the number of boys and girls?

Explain your choice.

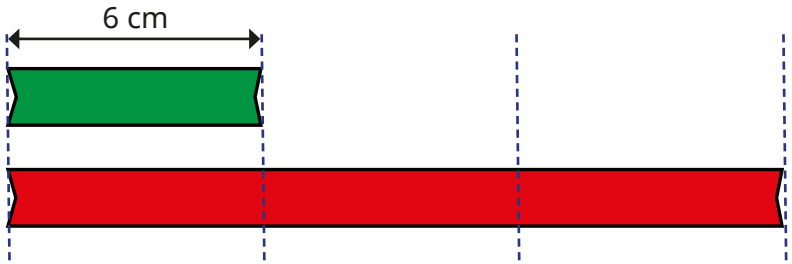
- Dexter has 2 pencils.

Kim has 5 times as many pencils as Dexter.

How many pencils has Kim got?

- The green ribbon is 6 cm long.

The red ribbon is 3 times as long as the green ribbon.



How long is the red ribbon?

Complete the number sentence.

6 cm × _____ = _____ cm

- Rosie has a red pencil and a blue pencil.

The red pencil is 2 cm long.

The blue pencil is 4 times as long as the red pencil.

How long is the blue pencil?

- Whitney runs 25 m in 7 seconds.

Filip takes 5 times as long as Whitney to run 25 m.

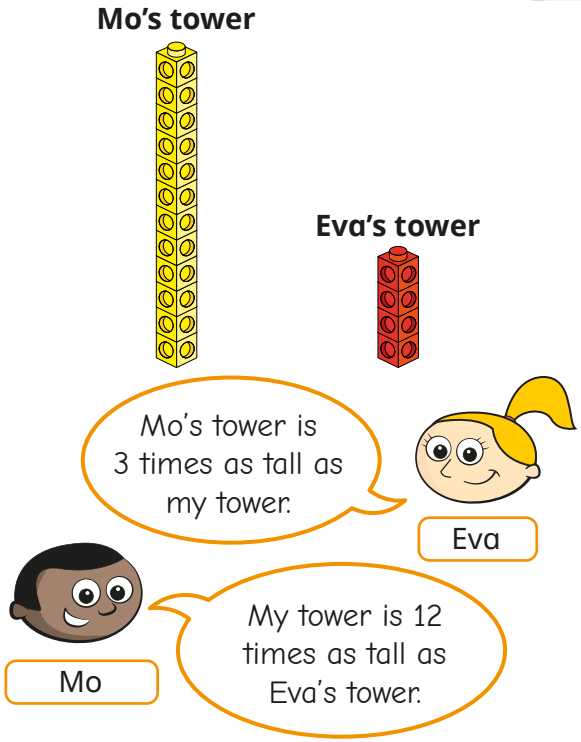
How long does it take Filip to run 25 m?

© White Rose Education 2022

Scaling

Reasoning and problem solving

Mo and Eva build towers of cubes.



Who do you agree with?

Explain your answer.

Eva

Annie has some green and pink counters.

- There are twice as many green counters as pink counters.
- There are 18 counters altogether.

How many green counters are there?

12

Dani, Amir and Jack are baking.

- Dani needs 40 g of butter.
- Amir needs 3 times as much butter as Dani.
- Jack needs twice as much butter as Dani.

How much butter do they need altogether?

240 g

© White Rose Education 2022

How many ways?

Notes and guidance

This small step focuses on correspondence problems.

Children start by systematically listing all the possible combinations resulting from combining two groups of objects. For example, if there are three buckets and four spades, children can explore how many different combinations of bucket and spade they can make.

The use of practical equipment to model a question can support children's understanding. Drawing a table helps children to take a systematic approach to ensure that they have found all the possible combinations. By the end of this step, children should be able to use multiplication to calculate the total number of possibilities, as a more efficient strategy than listing them all.

Things to look out for

- When writing lists, unless working systematically, children may omit some possibilities and/or count some possibilities more than once.
- Children may not recognise the link between listing the number of possibilities and the multiplication calculation that can be done.

Key questions

- How can you show the possibilities in a table?
- In what order should you list the possibilities?
- Starting with _____, how many combinations can you make?
- How do you know you have found all the ways?
- How many combinations are there if you have _____ and _____?

Possible sentence stems

- For every _____, there are _____

  There are _____ × _____ = _____ possibilities altogether.
- For each _____, there are _____ choices of _____

  There are _____ ways altogether.
- I know that I have found them all because ...

National Curriculum links

- Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects

© White Rose Education 2022

How many ways?

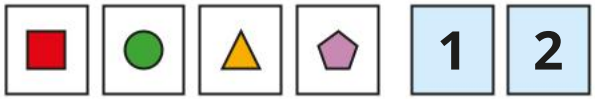
Key learning

- Huan has three T-shirts and four pairs of shorts.

  Complete the table to show how many different outfits he can make.

T-shirt	Shorts
white	blue
white	white
white	spotty
white	stripy

- Alex has four shape cards and two digit cards.



She chooses a shape and a digit.

Use a table to find all the different ways that she can do this.

How many different ways can you find?

How do you know that you have found them all?

- Ron has three hats and two scarves.

He chooses a hat and a scarf.

List all the possible combinations he can wear.

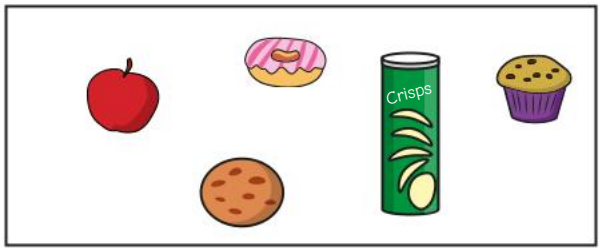
Use a multiplication to work out the number of combinations.

How many combinations are there if Ron buys four more scarves?

- Aisha is choosing a snack and a drink.

  How many possible combinations are there?

snacks



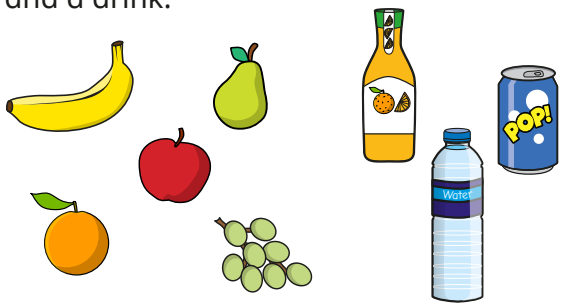
drinks

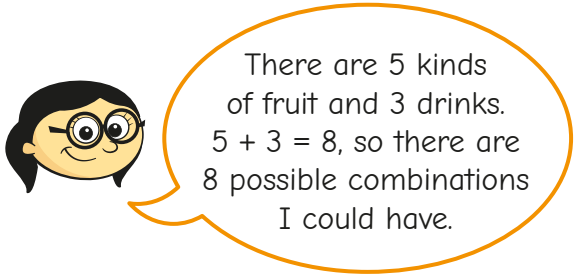
© White Rose Education 2022

How many ways?

Reasoning and problem solving

Annie chooses a piece of fruit and a drink.





Explain why Annie is wrong.

How many possible combinations are there altogether?

How many possible combinations include a bottle of drink?

15

10

Brett is choosing an ice cream.

He chooses one flavour of ice cream and one sauce.

There are 6 ice cream flavours.

There are 24 possible combinations of ice cream and sauce.

How many sauces are there?

4

Tommy has some jumpers and pairs of trousers.

He has more jumpers than pairs of trousers.

He can make 15 different outfits.

How many jumpers could he have?

How many pairs of trousers could he have?

Compare answers with a partner.

5 jumpers and 3 pairs of trousers

15 jumpers and 1 pair of trousers

© White Rose Education 2022

Spring Block 2

Length and perimeter

© White Rose Education 2022

White Rose MATHS

Small steps

Step 1	Measure in metres and centimetres
Step 2	Measure in millimetres
Step 3	Measure in centimetres and millimetres
Step 4	Metres, centimetres and millimetres
Step 5	Equivalent lengths (metres and centimetres)
Step 6	Equivalent lengths (centimetres and millimetres)
Step 7	Compare lengths
Step 8	Add lengths

© White Rose Education 2022

Small steps

Step 9	Subtract lengths
Step 10	What is perimeter?
Step 11	Measure perimeter
Step 12	Calculate perimeter

© White Rose Education 2022

Measure in metres and centimetres

Notes and guidance

In Year 2, children used either metres or centimetres to measure the length of objects. In this small step, they revise these skills, initially using a ruler to measure objects in centimetres. They then combine both units of measurement, such as 1 m and 20 cm, for example by measuring the lengths of desks or the heights of children in the class.

Children do not need to convert between metres and centimetres at this stage, and as they have not yet been introduced to decimals, lengths should remain in the format _____ m and _____ cm.

Provide opportunities for children to use different measuring equipment, including rulers, tape measures, metre sticks and trundle wheels.

Things to look out for

- Children may measure from the end of the ruler or measuring tape rather than measuring from zero.
- When using more than one ruler to measure, children may place them end to end, rather than lining up zero with the end point of the previous ruler.
- Children may measure using the non-metric side of a ruler.

Key questions

- Where should you start measuring from on your ruler?
- What is the length of _____ in centimetres?
- What is the length of _____ in metres?
- What is the length of _____ in metres and centimetres?
- Would you measure the length of the classroom in centimetres or metres? Why?
- What equipment would you use to measure the length of _____?

Possible sentence stems

- The _____ is _____ cm long.
- The _____ is _____ m long.
- The _____ is _____ m and _____ cm long.

National Curriculum links

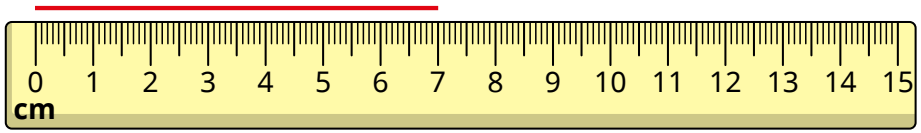
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

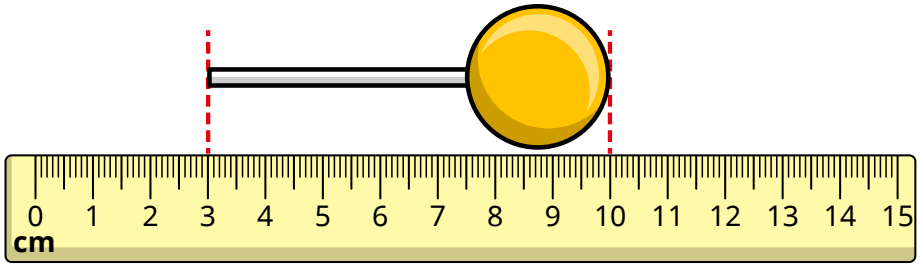
Measure in metres and centimetres

Key learning

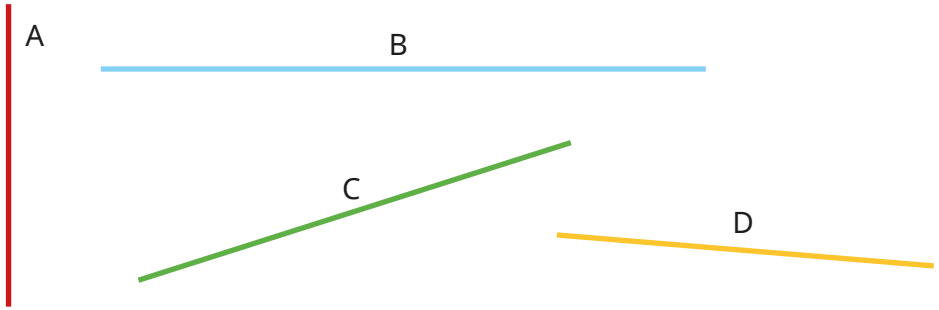
- What is the length of the line?



- What is the length of the lollipop?

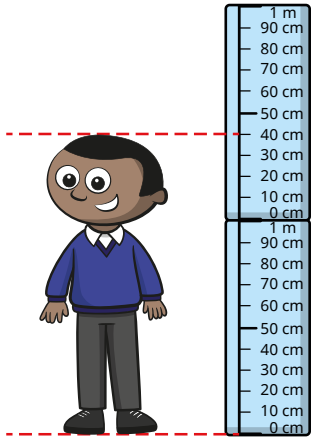


- Use a ruler to measure the lines.

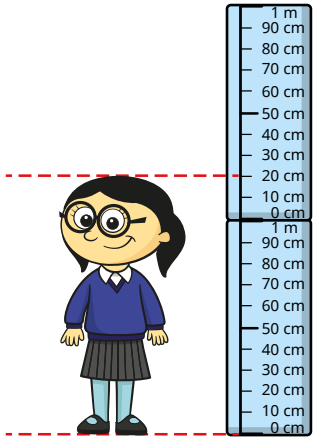


- Mo and Annie use metre sticks to measure their height.

  How tall are they?



_____ m and _____ cm



_____ m and _____ cm

- Measure your classroom to complete the sentences.

  The classroom is _____ m and _____ cm long.

  The classroom is _____ m and _____ cm wide.

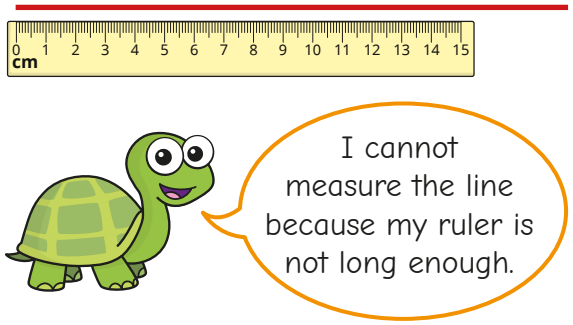
  - Use a metre ruler to measure some other items in your classroom.
  - Use a metre ruler to measure some items outside.

© White Rose Education 2022

Measure in metres and centimetres

Reasoning and problem solving

Tiny is trying to measure the length of the line.



Do you agree with Tiny?

Why?

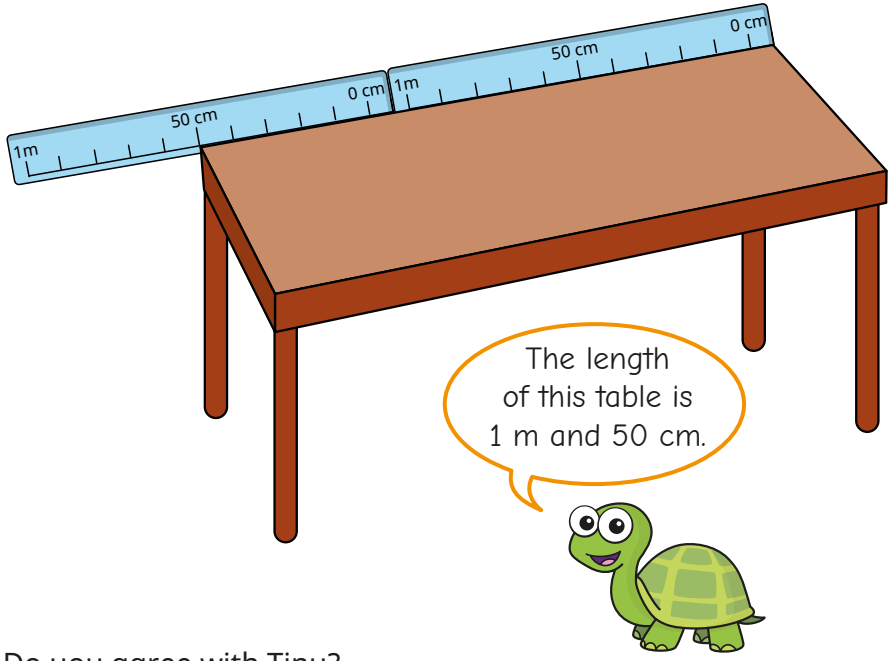
No

Dani draws a circle in chalk on the playground.

How could she measure the distance round the circle?

She could, for example, use a piece of string, wrap it round then measure the string.

Tiny is measuring the table top.



Do you agree with Tiny?

Explain your answer.

No

© White Rose Education 2022

Measure in millimetres

Notes and guidance

This small step builds on children's understanding from the previous step by introducing millimetres as another unit of measurement.

Children need to understand that 1 mm is smaller than 1 cm and that millimetres can be used to measure lengths that are not an exact number of centimetres. Allow children time to explore a ruler with millimetre markings to see that there are 10 mm in 1 cm. Children could be encouraged to count in 10s and add on the remaining 1s when finding lengths. For example, when measuring a line that is 8 cm and 3 mm long, they can count in 10s to 80 mm and then add on the extra 3 mm to give a total length of 83 mm. However, at this stage children are not required to formally convert between centimetres and millimetres.

Children may find measuring oblique lines more difficult than horizontal or vertical lines. Model how rotating the page can make it easier to measure.

Things to look out for

- Children may measure from the end of the ruler or measuring tape rather than measuring from zero.
- Children may give answers to the nearest centimetre rather than counting the millimetre intervals.

Key questions

- Why is it important to start measuring from zero on your ruler?
- How many intervals are there between 0 and 1 cm? So how many millimetres are there in 1 cm?
- Where is the 5 mm mark on your ruler?
- What is the same and what is different about measuring a length in centimetres and measuring a length in millimetres?
- What is the length of _____ in millimetres?
- Would you measure the height of the door in millimetres?

Possible sentence stems

- The _____ is _____ mm long.
- 1 mm is _____ than 1 cm.
- 1 mm is _____ than 1 m.

National Curriculum links

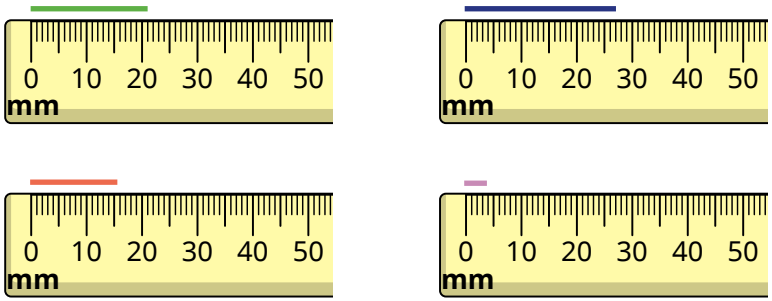
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

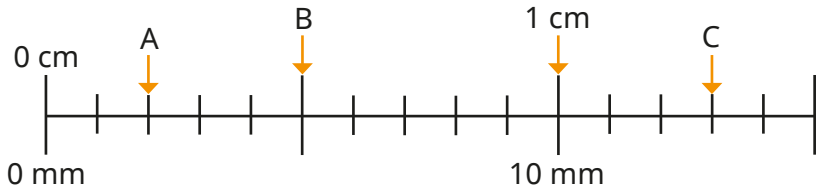
Measure in millimetres

Key learning

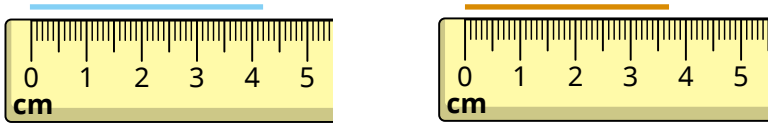
- What are the lengths of the lines in millimetres?



- What lengths are the arrows pointing to?



- What are the lengths of the lines in millimetres?

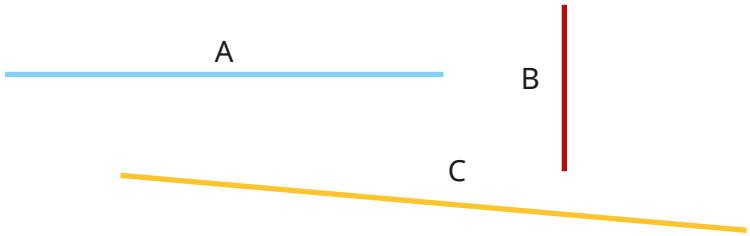


- Choose a phrase to complete each sentence.

  less than greater than

  - 1 mm is _____ 1 cm.
  - 1 m is _____ 1 mm.

- Measure these lines to the nearest millimetre.



- Find five things in your pencil case that you can measure in millimetres.

  List them in order of size, starting with the smallest.

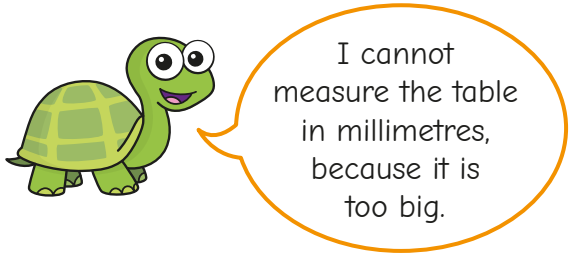
- Use a ruler to draw lines with these lengths.
  - 80 mm
  - 25 mm
  - 51 mm
  - 30 mm
  - 75 mm
  - 67 mm

© White Rose Education 2022

Measure in millimetres

Reasoning and problem solving

Tiny is thinking about measuring a table.

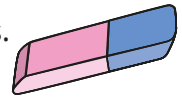


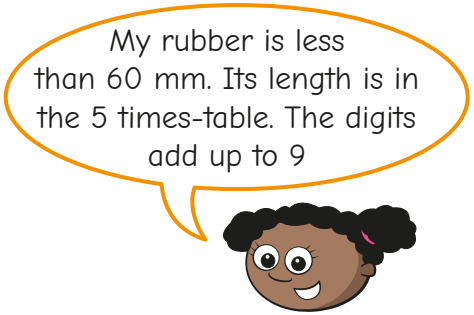
Do you agree with Tiny?

Explain your answer.

Tiny could measure the table in millimetres, but it is not the most efficient unit to use.

Whitney measures her rubber in millimetres.





Work out the length of Whitney's rubber.

45 mm

Measure these two lines in millimetres.

Which line did you find easier to measure? Why?

lines measured accurately

Is the statement true or false?

> A length measured in millimetres is always shorter than a length measured in centimetres.

Talk about it with a partner.

False

© White Rose Education 2022

Measure in centimetres and millimetres

Notes and guidance

In this small step, children combine learning from the previous steps to measure objects in centimetres and millimetres. Measurements should be recorded in the form "4 cm and 3 mm", and encourage children to record their measurements as centimetres and millimetres, not the other way around.
If possible, show children a ruler that has a centimetre scale on the top and a millimetre scale on the bottom to allow them to see the relationship between centimetres and millimetres.

If children are finding it difficult to measure using millimetre intervals, support them to identify the 5 mm interval on their ruler and count forwards or backwards. After sufficient practice, children's measurements should be accurate to within 2 mm.

As well as measuring lengths, children also practise drawing lengths accurately.

Things to look out for

- Children may inaccurately measure the millimetre part of a length, due to the intervals on the ruler being very close together.
- Children may record a length as, for example, 5 cm and 0 mm, rather than just 5 cm.

Key questions

- Which is greater in length, 1 mm or 1 cm?
- What are the main things to remember in order to measure accurately using a ruler?
- Is the _____ an exact number of centimetres long?
- How many millimetres past the last centimetre interval does the _____ reach?
- How do you write a length that is not an exact number of centimetres?
- How does the 5 mm interval help you to measure the length?

Possible sentence stems

- _____ cm _____ mm = _____ cm and _____ mm
- The _____ is _____ cm and _____ mm long.

National Curriculum links

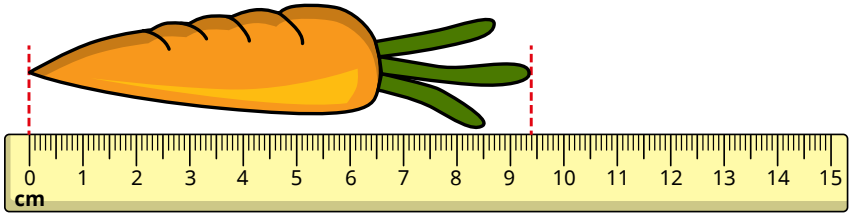
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

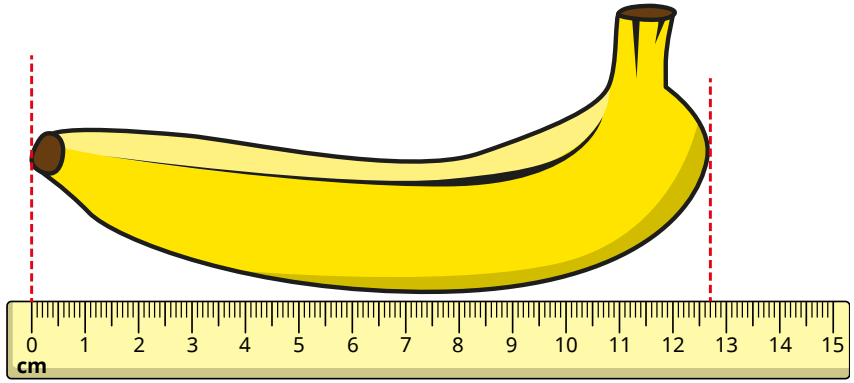
© White Rose Education 2022

Measure in centimetres and millimetres

Key learning

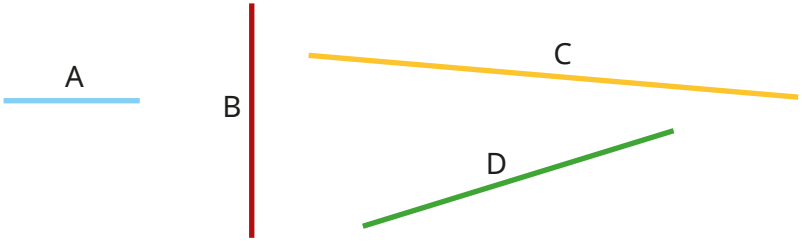
- What is the length of each object in centimetres and millimetres?





- Measure the lines.

  Give your answers in centimetres and millimetres.



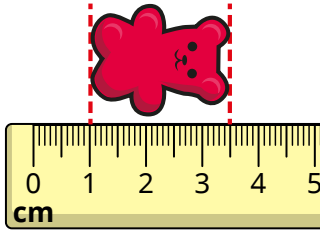
- Measure the length of some items in the classroom.
  Record the lengths in centimetres and millimetres.

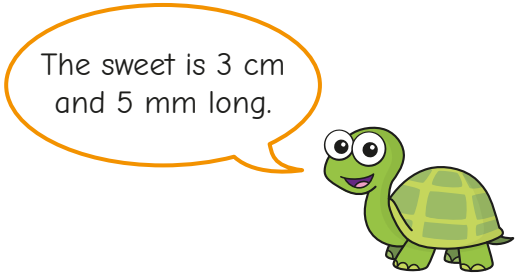
  Compare answers with a partner.
  Are your answers exactly the same?

- Use a ruler to draw lines that measure:
  - between 4 cm and 5 cm
  - between 65 mm and 80 mm
  - between 10 mm and 2 cm
  - between 3 cm 4 mm and 3 cm 9 mm

  Ask a partner to measure and label each line.

- Tiny measures the sweet.





Do you agree with Tiny?

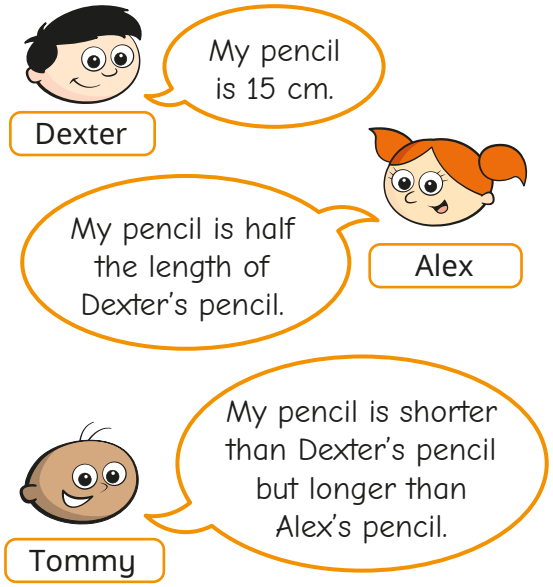
Explain your answer.

© White Rose Education 2022

Measure in centimetres and millimetres

Reasoning and problem solving

Dexter, Alex and Tommy are comparing the lengths of their pencils.

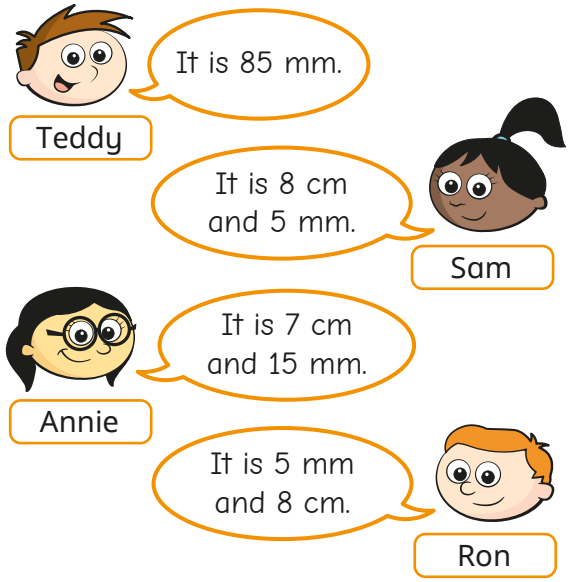


What could be the length of Tommy's pencil?

Compare answers with a partner.

between 7 cm and 5 mm and 14 cm and 9 mm

Four children measure the height of a carton of juice.



What is the same about their measurements?

What is different?

Talk about your answer with a partner.

All the children have given the same measurement, but they have expressed it differently.

© White Rose Education 2022

Metres, centimetres and millimetres

Notes and guidance

In this small step, children compare and consider the appropriateness of different units of measurement.

Children need to understand that although, for example, metres are used to measure longer distances, it is still possible to measure these distances in centimetres or millimetres. Encourage discussion about why it is important to choose the appropriate unit or measuring equipment before measuring an object or length.

Children make simple comparisons of lengths that do not require them to understand equivalent units of measurement, for example, comparing 3 m with 3 cm. By this stage, however, they should know how many centimetres are in 1 m and how many millimetres are in 1 cm.

Things to look out for

- Children may focus on the number when comparing lengths, rather than considering the unit of measurement.
- Children may not have understood the relationship between millimetres, centimetres and metres.
- Children may need reminding of the meaning of the symbols <, > and =.

Key questions

- How many millimetres are there in a centimetre?
- How many centimetres are there in a metre?
- Which is longer, 1 m or 1 cm?
- Which is shorter, 1 cm or 1 mm?
- Which is longer, 3 m or 60 cm?
- Which is shorter, 4 cm or 20 mm?
- What unit would you use to measure the length of _____?

Possible sentence stems

- _____ m is shorter/longer than _____ cm.
- _____ mm is shorter/longer than _____ cm.
- There are _____ mm in 1 cm.
- There are _____ cm in 1 m.

National Curriculum links

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

© White Rose Education 2022

Metres, centimetres and millimetres

White Rose MATHS

Key learning

- Which unit would you use to measure each item?

  Sort the items into the table.

length of a car	length of a pencil
length of a fingernail	length of a garden
length of a playground	height of a water bottle

Metres	Centimetres	Millimetres

  Compare answers with a partner.

- Write the lengths in order.

  Start with the shortest length.

10 m	10 mm	10 cm

- Scott has 4 m of ribbon.

  Aisha has 40 cm of ribbon.

  Who has the longer piece of ribbon?

- Brett and Huan each draw a straight line.

  Brett's line is 18 cm.

  Huan's line is 30 mm.

  Whose line is longer?

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

8 cm ◯ 10 mm

50 mm ◯ 2 m

14 m ◯ 98 cm

3 m and 87 cm ◯ 4 m

6 m and 20 cm ◯ 20 cm and 6 m

14 m and 5 cm ◯ 14 m and 5 mm

- Write the measurements in order.

  Start with the longest measurement.

2 m	87 cm	3 cm	12 mm

© White Rose Education 2022

Metres, centimetres and millimetres

Reasoning and problem solving

Use the digit cards to complete the statement.

1	2	3	4	5

1 m and 34 cm < ☐ ☐ ☐ cm < 2 m

Find all the possible answers.

135 cm, 142 cm, 143 cm, 145 cm, 152 cm, 153 cm, 154 cm

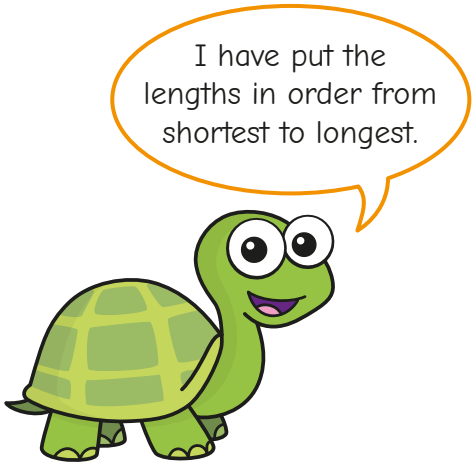
Is the statement always true, sometimes true or never true?

> A length measured in metres will be longer than a length measured in centimetres.

Explain your answer.

sometimes true

Tiny is putting lengths in order.



1 m	13 mm	29 cm	121 cm

What mistake has Tiny made?

Put the lengths in the correct order.

13 mm, 29 cm, 1 m, 121 cm

© White Rose Education 2022

Equivalent lengths (metres and centimetres)

Notes and guidance

In this small step, children use the fact that 1 m is equivalent to 100 cm. They use this to convert multiples of 100 cm into metres and metres into multiples of 100 cm. At the beginning of this step, it might be helpful to practise counting in 100s as a class.

Encourage children to partition the measurement into metres and centimetres when converting lengths that are not multiples of 100, for example 134 cm = 1 m and 34 cm. Part-whole models, bar models and double number lines are useful representations to support children in these conversions.

Children may also be encouraged to find and use common fractions to convert between metres and centimetres, for example $\frac{1}{2}$ m is equivalent to 50 cm, so $4\frac{1}{2}$ m is equivalent to 450 cm.

Things to look out for

- Children may partition centimetres according to place value, which is inefficient when converting centimetres into metres. For example, 163 cm = 100 cm + 60 cm + 3 cm rather than 100 cm + 63 cm.
- When converting multiples of 100 cm, such as 400 cm, children may write 4 m and 0 cm.

Key questions

- How many centimetres are there in 1 m?
- How can you work out how many centimetres there are in 6 m?
- What is _____ centimetres in metres?
- How many centimetres are there in _____ m and _____ cm?
- How can you partition 430 cm to help you to write the measurement in metres and centimetres?
- How many centimetres are there in $\frac{1}{2}$ m?
  So how many centimetres are there in $4\frac{1}{2}$ metres?

Possible sentence stems

- There are _____ cm in 1 m.
- 1 m = 100 cm, so _____ m = _____ cm
- I can partition _____ cm into _____ cm and _____ cm.
- There are 100 cm in 1 m, so _____ cm = _____ m and _____ cm.
- $\frac{1}{2}$ m = _____ cm

National Curriculum links

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

© White Rose Education 2022

Equivalent lengths (metres and centimetres)

Key learning

- Use the bar models to complete the sentences.
  -

1 m	1 m	1 m	1 m
100 cm			

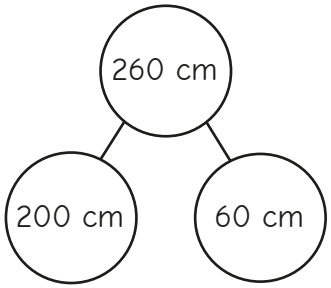
4 m = _____ cm

  -

100 cm	100 cm	100 cm

_____ m = 300 cm

- Esther uses a part-whole model to find equivalent lengths.



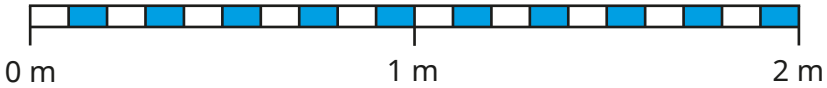
200 cm = 2 m
260 cm = 2 m and 60 cm

Use Esther's method to convert the lengths into metres and centimetres.

120 cm	125 cm	367 cm	542 cm

- Where do the measurements belong on the measuring stick?

110 cm	80 cm	190 cm	$\frac{1}{2}$ m	10 cm	100 cm



- Complete the bar models.

230 m	
m	cm

cm	
15 cm	1 m

198 cm	
m	cm

cm	
3 m	75 cm

- Complete the sentences.
  - 3 m and 52 cm = _____ cm
  - 2 m and 19 cm = _____ cm
  - 483 cm = _____ m and _____ cm
  - 501 cm = _____ m and _____ cm

© White Rose Education 2022

Equivalent lengths (metres and centimetres)

Reasoning and problem solving

Is the statement true or false?

413 cm > 4 m and 31 cm

Explain your answer.

False

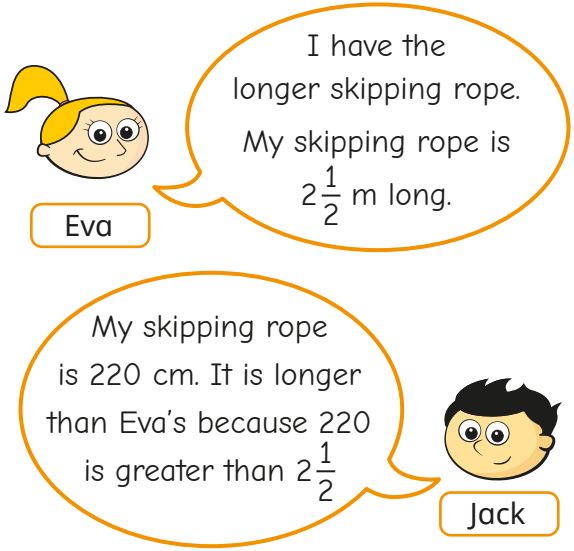
Which measurement is the odd one out?

250 cm	25 cm
$2\frac{1}{2}$ m	2 m 50 cm

Explain your choice.

25 cm

Eva and Jack each have a skipping rope.



Who is correct?

Explain your answer.

Eva

Her skipping rope is 250 cm long, which is 30 cm longer than 220 cm.

© White Rose Education 2022

Equivalent lengths (centimetres and millimetres)

Notes and guidance

In this small step, children use the fact that 1 cm is equivalent to 10 mm. They use this to convert millimetres into centimetres and centimetres into millimetres. Recapping previous knowledge of multiples of 10 from Spring Block 1 may be useful prior to teaching this new content.

As children have not yet formally explored multiplying and dividing by 10, they should be encouraged to partition measurements into centimetres and millimetres when converting lengths that are not multiples of 10, for example 34 mm = 30 mm + 4 mm = 3 cm and 4 mm.

As in previous steps, children do not need to use decimal notation in this step. Bar models, part-whole models and double number lines are also useful representations to explore the connection between units of measurement.

Things to look out for

- Once a length has been partitioned, children may convert the incorrect part, for example 52 mm = 2 cm and 5 mm.
- Children may convert centimetres to millimetres, but then forget to add on the remaining millimetres, for example 6 cm 7 mm = 60 mm.

Key questions

- How many millimetres are there in 1 cm?
- How can you work out how many millimetres there are in 4 cm?
- How many millimetres are there in _____ cm and _____ mm?
- How do you know _____ mm and _____ cm are equivalent?
- How can you partition 47 mm to help you convert into centimetres and millimetres?
- How many millimetres are there in $\frac{1}{2}$ cm?

Possible sentence stems

- 1 cm = 10 mm, so _____ mm = _____ cm
- 1 cm = 10 mm, so _____ cm = _____ mm
- _____ mm = _____ mm + _____ mm = _____ cm and _____ mm
- _____ cm and _____ mm = _____ mm + _____ mm = _____ mm

National Curriculum links

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

© White Rose Education 2022

Equivalent lengths (centimetres and millimetres)

Key learning

- Use the bar models to complete the sentences.

1 cm	1 cm	1 cm	1 cm	1 cm	1 cm
10 mm					

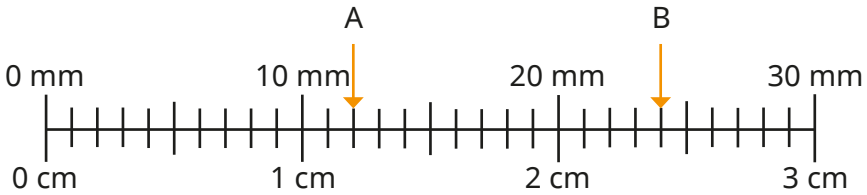
6 cm = _____ mm

10 mm	10 mm	10 mm

30 mm = _____ cm

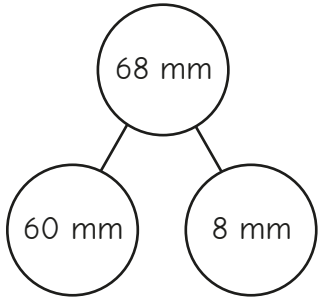
- What measurements are the arrows pointing to?

  Complete the sentences.



- A = _____ cm and _____ mm A = _____ mm
- B = _____ cm and _____ mm B = _____ mm

- Whitney uses a part-whole model to find an equivalent length.

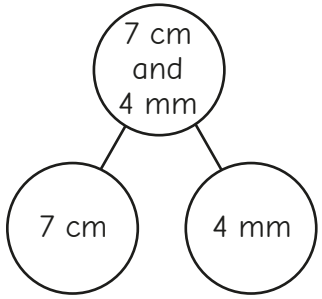


60 mm = 6 cm
68 mm = 6 cm and 8 mm

Use Whitney's method to convert the lengths into centimetres and millimetres.

- 24 mm
- 35 mm
- 91 mm
- 88 mm

- Ron uses a part-whole model to find an equivalent length.



7 cm = 70 mm
7 cm and 4 mm = 74 mm

Use Ron's method to convert the lengths into millimetres.

- 6 cm and 8 mm
- 8 cm and 6 mm
- 1 cm and 9 mm

© White Rose Education 2022

Equivalent lengths (centimetres and millimetres)

Reasoning and problem solving

Mo, Rosie and Kim are finding equivalent lengths.

Mo

40 cm and 7 mm is equivalent to 47 mm.

Rosie

4 cm and 7 mm is equivalent to 47 mm.

Kim

7 mm and 4 cm is equivalent to 47 mm.

Whose conversion is incorrect?

Whose conversion could be improved?

Talk about your answers with a partner.

Mo

Kim

Dexter is thinking of a measurement.

In millimetres, my measurement is a multiple of 2

It is greater than 81 mm.

It can be partitioned as 8 cm and _____ mm.

What measurement could Dexter be thinking of?

82 mm, 84 mm, 86 mm or 88 mm

Which measurement is the odd one out?

500 mm	50 cm
$\frac{1}{2}$ m	500 cm

Explain your choice.

500 cm

© White Rose Education 2022

Compare lengths

Notes and guidance

In this small step, children compare and order lengths using comparison language and inequality symbols. Building on the previous two steps, they need to convert all the measurements to the same unit of length before comparing.

Children can use practical equipment to justify decisions, measuring and comparing lengths of objects inside and outside the classroom to practise their measuring skills.

Children may need reminding of the meaning of the inequality symbols, < and >. Recapping how many millimetres are in a centimetre and how many centimetres are in a metre will also be useful.

Ensure children are aware that while they use the words shorter/longer when comparing lengths, they should use shorter/taller when talking about height.

Things to look out for

- If children attempt to compare lengths without converting into the same unit of measurement, they may make mistakes.
- Children need very secure place value understanding when comparing a length in metres with a length in millimetres.

Key questions

- How can you compare lengths given in different units?
- Why does finding equivalent lengths with the same unit make it easier to compare lengths?
- Does it matter which unit of measurement you use to compare?
- Is the unit of measurement or the size of the number more important?
- How many mm/cm are there in _____ cm/m?

Possible sentence stems

- _____ m _____ cm is equal to _____ cm.
- _____ cm is _____ than _____ cm, so the greater length is _____ cm.
- _____ cm is equal to _____ mm.
- _____ mm is _____ than _____ mm, so the greater length is _____ mm.

National Curriculum links

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

© White Rose Education 2022

Compare lengths

White Rose MATHS

Key learning

- Jack is comparing 34 mm and 3 cm 6 mm.

  Complete the sentences.

  - 3 cm 6 mm = _____ mm
  - 34 mm is _____ than _____ mm.

  Is there another way to compare the measurements?

- Amir and Dora measure their heights.
  - Amir's height is 127 cm.
  - Dora's height is 1 m and 30 cm.

  Write **taller** or **shorter** to complete the sentences.

  - Amir is _____ than Dora.
  - Dora is _____ than Amir.

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

101 cm ◯ 1 m 10 cm

80 mm ◯ 8 cm

90 cm ◯ 90 mm

500 mm ◯ 1 m 50 cm

- Write the lengths in order.

  Start with the shortest length.

230 cm	750 mm	2 m 25 cm
2 m	1 m 75 cm	170 cm

- Fill in the missing numbers to make the statements correct.
  - 4 cm < _____ mm
  - _____ m < 378 cm
  - 245 mm = _____ cm + _____ mm
  - 5 m > _____ m and 99 cm

- Four friends are building towers.
  - Filip's tower is 22 cm and 7 mm tall.
  - Tom's tower is 22 cm tall.
  - Nijah's tower is 215 mm tall.
  - Dani's tower is 260 mm tall.

  Complete the statement to put the towers in height order.

  _____ < _____ < _____ < _____

© White Rose Education 2022

Compare lengths

Reasoning and problem solving

Brett has put some lengths in order from shortest to longest.

170 mm
74 cm 7 mm
$1\frac{1}{2}$ m

Fill in the missing measurement.

Find three possible answers.

between
74 cm 8 mm and
1 m 49 cm

Sort the lengths into the table.

1 m 65 cm	165 mm
165 m	165 cm
160 cm 5 mm	16 cm 5 mm

Longer than a metre	Shorter than a metre

Are any of the lengths equivalent?

longer than a metre:
1 m 65 cm, 165 m, 165 cm,
160 cm 5 mm

shorter than a metre:
165 mm,
16 cm 5 mm

equivalent lengths:
1 m 65 cm and 165 cm
165 mm and 16 cm 5 mm

© White Rose Education 2022

Add lengths

Notes and guidance

In this small step, children add lengths. They begin by adding lengths that are measured in the same unit of measurement, before adding lengths that have different units.

When measurements have different units, children should find equivalent lengths with the same unit to allow them to add the two lengths. It is important to explore with children that this can be done in two ways, for example 38 mm + 2 cm 1 mm could be added as 38 mm and 21 mm or as 3 cm 8 mm and 2 cm 1 mm. Encourage children to discuss the different strategies available when adding lengths, before choosing the most efficient method.

This step provides an opportunity to revisit addition both with and without exchanges as covered in Autumn Block 2

Children will use skills learnt in this step when adding lengths to find the perimeter later in the block.

Things to look out for

- If children are not secure with converting units of measurement, they may make errors when adding lengths.
- Children may add lengths without converting the units of measurement, for example 14 cm + 24 mm = 38 cm.

Key questions

- How many centimetres are there in 1 m?
- How many millimetres are there in 1 cm?
- Why is it important the lengths have the same unit of measurement before adding them?
- Which unit of measurement will you use to find equivalent lengths before adding them? Why?
- How did you find the total length?
- Does it matter in which order you add the lengths?

Possible sentence stems

- _____ cm + _____ mm = _____ mm + _____ mm = _____ mm
- _____ m + _____ cm = _____ cm + _____ cm = _____ cm
- I am going to convert all of the units of measurement to _____ because ...

National Curriculum links

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

© White Rose Education 2022

Add lengths

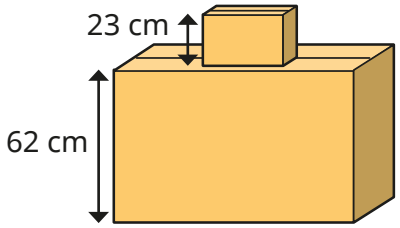
Key learning

- Dora builds this tower out of boxes.
  - How tall is Dora's tower?

  Dora puts a third box on the tower.

  The box is 30 cm tall.
  - How tall is Dora's tower now?

  Can you write your answer another way?



- Teddy and Kim are working out 350 cm + 1 m 20 cm.

Teddy's method	Kim's method
350 cm + 1 m 20 cm 350 cm + 120 cm = 470 cm	350 cm + 1 m 20 cm 3 m 50 cm + 1 m 20 cm 3 m + 1 m = 4 m 50 cm + 20 cm = 70 cm 4 m and 70 cm

Talk about their methods with a partner.

Use both methods to work out the additions.

3 m 65 cm + 240 cm	135 cm + 5 m and 20 cm

- Complete the additions.
  - 7 cm + 30 mm = 7 cm + _____ cm = _____ cm
  - 22 mm + 4 cm = 22 mm + _____ mm = _____ mm
  - _____ cm = $\frac{1}{2}$ m + 28 cm

- Complete the bar models.

cm	
11 cm	20 mm

m		cm
90 cm	20 cm	2 m

- Sam, Ron and Esther take part in a standing jump competition.

  Complete the table to show their total jump distances.

Child	Jump 1	Jump 2	Jump 3	Total
Sam	90 cm	65 cm	1 m 10 cm	
Ron	85 cm	85 cm	80 cm	
Esther	75 cm	1 m	1 m 25 cm	

Who jumped the greatest total distance?

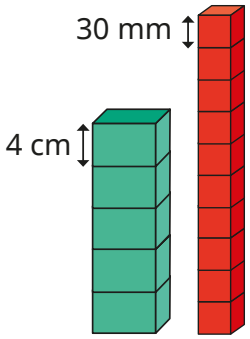
© White Rose Education 2022

Add lengths

Reasoning and problem solving

Red cubes are 30 mm tall.
Green cuboids are 4 cm tall.

Tommy builds these towers.



Work out the height of each tower.

Give your answer in centimetres and in millimetres.

How much taller is the red tower than the green tower?

Draw a tower of red cubes that is between 12 cm and 24 cm tall.

Draw a tower of green cuboids that is between 12 cm and 24 cm tall.

How many answers can you find?

green tower:
20 cm, 200 mm

red tower:
30 cm, 300 mm

10 cm, 100 mm

4 to 8 red cubes

3 to 6 green cuboids

Work out the missing length.

234 cm + 1 m 83 cm = 2 m + ☐ cm

217 cm

Compare methods with a partner.

Which is the odd one out?

4 m + 30 cm + 70 cm

245 cm + 255 cm

50 mm + 4 m + 95 cm

$3\frac{1}{2}$ m + $1\frac{1}{2}$ m

All calculations add up to 5 m.

Possible answers may refer to units of measurement, fractions, number of digits.

Explain your choice.

© White Rose Education 2022

Subtract lengths

Notes and guidance

In this small step, children begin by subtracting lengths that are measured in the same unit of measurement. They then look at subtracting milllimetres from a whole number of centimetres as well as centimetres from a whole number of metres using simple conversions, for example 1 m – 35 cm and 4 cm – 3 mm. They then explore more complex examples where the lengths have different units of measurement and therefore equivalent lengths need to be found, for example 4 m 36 cm – 112 cm. This can be a useful opportunity to also revisit subtraction where there is a need for exchange, for example 2 m 43 cm – 118 cm.

Children should be exposed to the different structures of subtraction through word problems: partitioning, reduction and difference. Bar models can be a useful pictorial representation to highlight these different structures.

Things to look out for

- If children are not secure with converting between units of measurement, they may make errors when subtracting lengths.
- Children may subtract lengths without converting the units of measurement, for example 71 cm – 5 mm = 66 cm.

Key questions

- How many centimetres are there in _____ m and _____ cm?
- Why is it important that the lengths have the same unit of measurement before you subtract them?
- Which unit of measurement will you use to find equivalent lengths before you subtract them? Why?
- What is the difference in length between the two objects?
- How can you check that you have the correct answer?

Possible sentence stems

- _____ mm/cm = 1 cm/1 m
- _____ cm – _____ mm = _____ mm – _____ mm = _____ mm
- _____ m – _____ cm = _____ cm – _____ cm = _____ cm
- I am going to convert all of the units of measurement to _____ because …

National Curriculum links

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

© White Rose Education 2022

Subtract lengths

Key learning

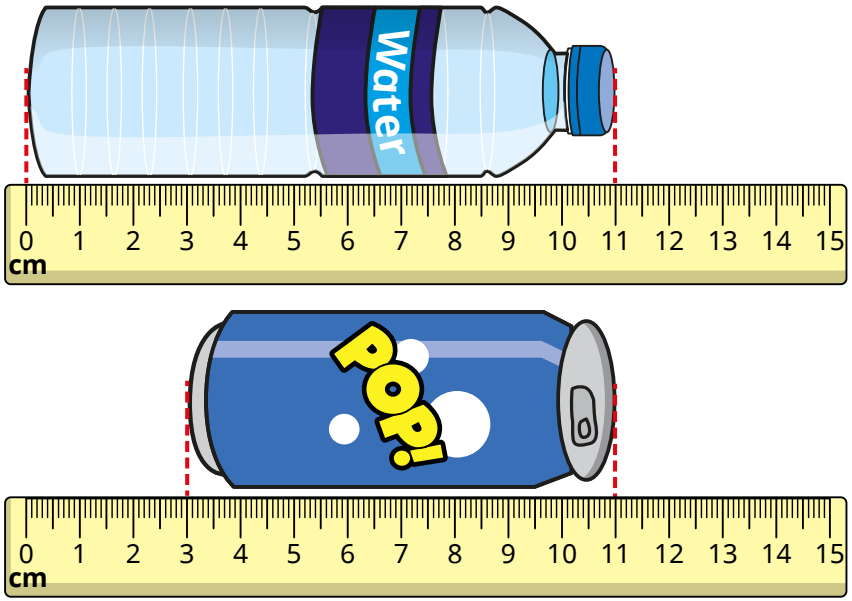
- Complete the bar models.

78 mm	
70 mm	mm

365 cm	
cm	65 cm

- What is the difference in length between the bottle of water and the can of fizzy drink?

  Write your answer in centimetres.



- Complete the subtractions.
  - 1 m – 42 cm = _____ cm
  - 5 cm – 3 mm = _____ mm
  - 3 m – 42 cm = _____ m _____ cm
  - 88 mm = 10 cm – _____ mm

- Tommy and Eva are working out 3 m 85 cm – 120 cm.

  Here are their workings.

Tommy's method

3 m 85 cm – 120 cm
120 cm = 1 m 20 cm
3 m – 1 m = 2 m
85 cm – 20 cm = 65 cm
3 m 85 cm – 120 cm = 2 m 65 cm

Eva's method

3 m 85 cm – 120 cm
3 m = 300 cm
3 m 85 cm = 385 cm
385 cm – 120 cm = 265 cm
3 m 85 cm – 120 cm = 265 cm

Whose method do you prefer?

- Kim has 5 m of rope.

  She uses 1 m and 54 cm to make a skipping rope.

  How much rope does she have left?

© White Rose Education 2022

Subtract lengths

Reasoning and problem solving

A bike race is 950 m long.

Dora cycles 243 m and stops for a break.

She cycles another 459 m and stops for another break.

How much further does she need to cycle to complete the race?

248 m

A train engine is 20 metres long.

A car is $15\frac{1}{2}$ m shorter than the train.

A bike is 250 cm shorter than the car.

Work out the length of the car.

Work out the length of the bike.

How much longer is the train than the bike?

$4\frac{1}{2}$ m

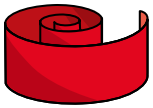
200 cm or 2 m

18 m

Tom has a 3 m roll of ribbon.

He is cutting it up into 10 cm lengths.

How many lengths can he cut?



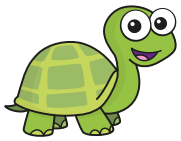
Tom gives 240 cm of his ribbon to Nijah.

How much ribbon does he have left?

How many 10 cm lengths does Tom have left?

30

60 cm, 6 lengths



Tiny has worked out
3 m 20 cm – 2 m 56 cm.

3 m 20 cm – 2 m 56 cm
= 1 m 36 cm

What mistake has Tiny made?

What is the correct answer?

64 cm

© White Rose Education 2022

What is perimeter?

Notes and guidance

In this small step, children are introduced to perimeter for the first time.

Children learn that perimeter is the distance around the outside of a closed 2-D shape. Children explore what perimeter is, and what it is not, by deciding whether they can find the perimeter of a group of open and closed 2-D shapes.

Provide children with practical opportunities to understand perimeter, such as walking around the perimeter of the playground or using their finger to trace the perimeter of 2-D shapes.

At the end of this step, children start to find the perimeter of shapes on squared grids by counting along the edges. Encourage children to mark as they count to ensure they do not miscount.

Things to look out for

- Children may think that it is possible to find the perimeter of open shapes.
- When children are finding the perimeter of a shape on a squared grid, they may miscount by counting all of the squares around the shape rather than along the edge of the shape.
- Children may trace or count some sides more than once.

Key questions

- What does "perimeter" mean?
- When might someone need to find the perimeter in real life?
- Why are you unable to find the perimeter of this shape?
- How would you use your finger to trace the perimeter of this piece of paper?
- Which of the shapes has the greater perimeter? How do you know?
- How does the squared grid help you to find the perimeter?

Possible sentence stems

- The perimeter of a shape is ...
- This shape does/does not have a perimeter because ...
- I can find the perimeter of this shape by ...

National Curriculum links

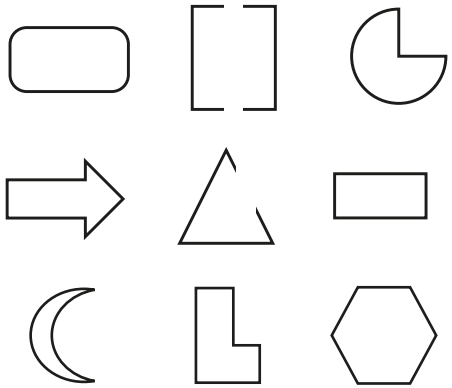
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- Measure the perimeter of simple 2-D shapes

© White Rose Education 2022

What is perimeter?

Key learning

- Which shapes have a perimeter?

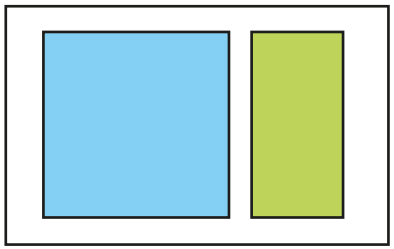


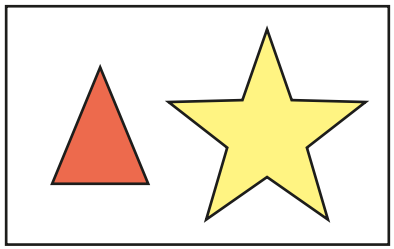
Why do some of the shapes not have a perimeter?

Compare answers with a partner.

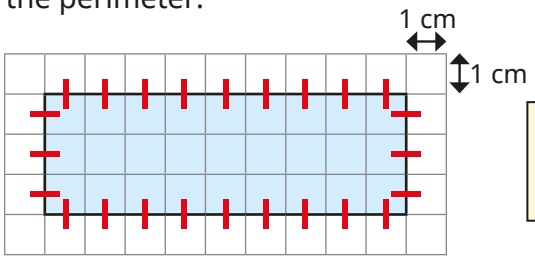
- Which shape has the greater perimeter in each pair?

How do you know?



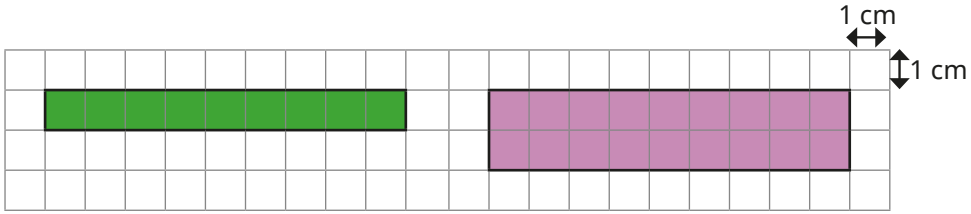


- Scott counts around the edge of the rectangle to find the perimeter.



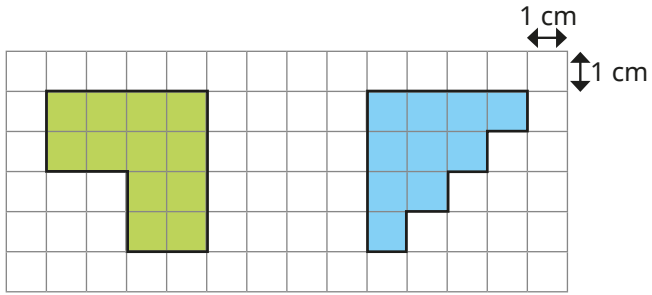
9 + 3 + 9 + 3 = 24
The perimeter is 24 cm.

Use Scott's method to find the perimeter of each rectangle.



What do you notice?

- Work out the perimeters of the shapes.

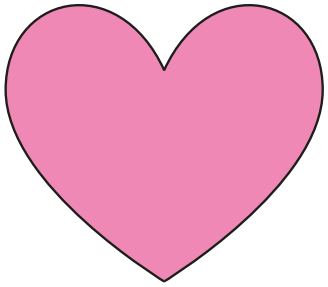


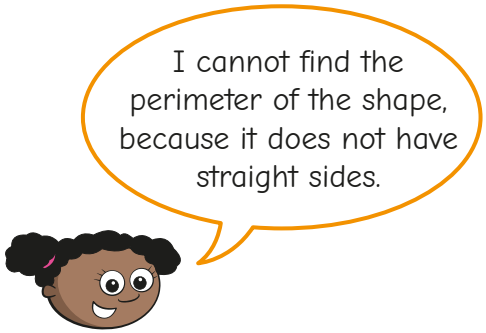
© White Rose Education 2022

What is perimeter?

Reasoning and problem solving

Whitney wants to find the perimeter of this shape.



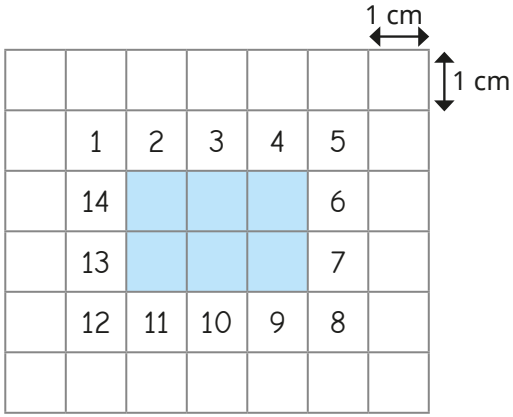


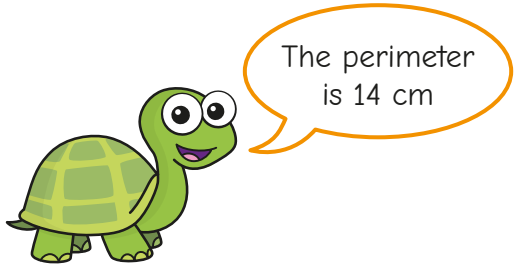
Do you agree with Whitney?

Explain your thinking.

No

Tiny is finding the perimeter of the shape by counting squares.





What mistake has Tiny made?

Find the correct perimeter.

Tiny has counted the squares rather than the edges of the shape.

10 cm

© White Rose Education 2022

Measure perimeter

Notes and guidance

In this small step, children measure the sides of different shapes in centimetres to find the perimeter. This builds on the previous step, where children found the perimeter by counting the number of squares of each length.

Encourage children to work in a systematic order, possibly marking the lengths after they have been measured, to ensure that children measure the lengths of all the sides.

Children should also be encouraged to think about whether it is necessary to measure every side to find the perimeter or whether they can use the properties of 2-D shapes to help them.

Children could explore measuring the perimeter of shapes with curved sides by using a piece of wool or string to place along the edges and then measuring the wool or string with a ruler.

Things to look out for

- When measuring, children may start from the beginning of the ruler, rather than from the zero mark.
- Children may not record the units of measurement in their answer.
- Children may measure using the non-metric side of the ruler.

Key questions

- What does "perimeter" mean?
- What equipment is useful for measuring the perimeter of a shape?
- Does starting in different places when measuring the perimeter give you a different answer?
- Do you need to measure all the sides? How do you know?
- How do you know that you have measured all the sides?
- Which method do you prefer, to find the perimeter of a square?
- Can you find the perimeter of a shape with a curved edge? How?

Possible sentence stems

- Perimeter is …
- _____ cm + _____ cm + _____ cm + _____ cm = _____ cm

National Curriculum links

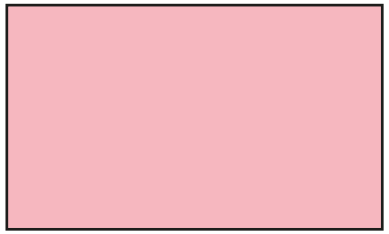
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- Measure the perimeter of simple 2-D shapes

© White Rose Education 2022

Measure perimeter

Key learning

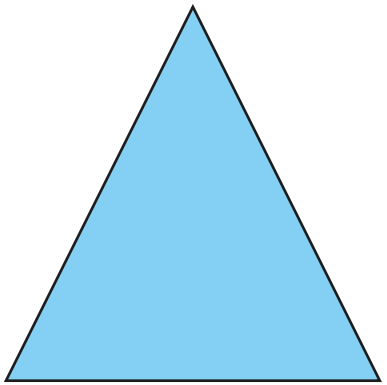
- Measure and label each side of the rectangle.

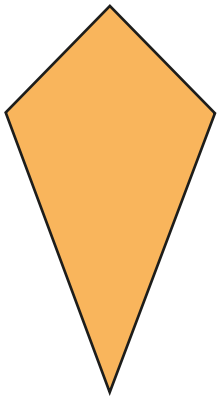


What is the perimeter of the rectangle?

_____ + _____ + _____ + _____ = _____ cm

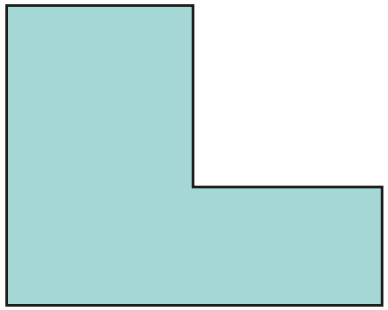
- Measure and label the sides on each shape.





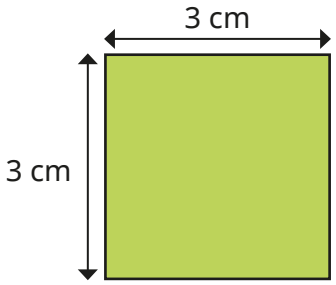
Work out the perimeter of each shape.

- Measure and label the sides of the hexagons.



Work out the perimeter of each hexagon.

- Here is a square.



Do you need to measure all the sides to find the perimeter?

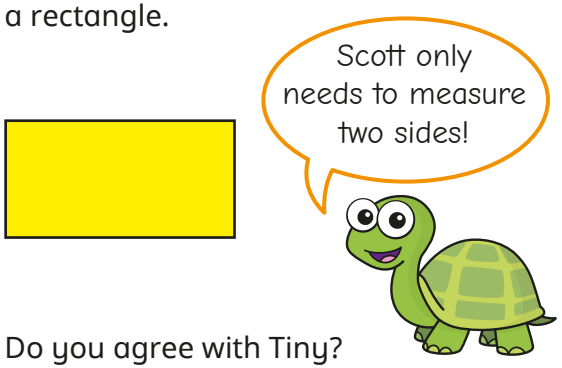
What is the perimeter of the square?

© White Rose Education 2022

Measure perimeter

Reasoning and problem solving

Scott is measuring the perimeter of a rectangle.

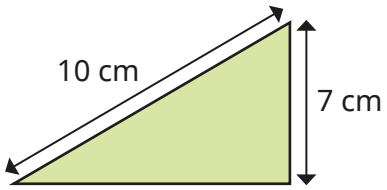


Do you agree with Tiny?

Explain your answer.

Yes

Dexter thinks that the perimeter of the triangle is 17 cm.

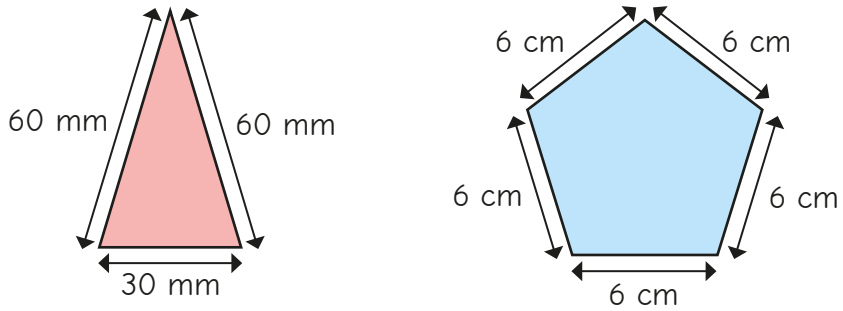


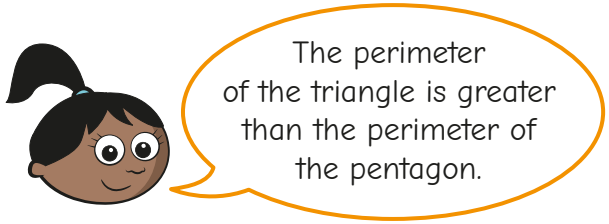
Explain why Dexter is incorrect.

Dexter has only measured two sides of the triangle.

The perimeter is the total distance around the shape.

Sam measures the sides to find the perimeters of the shapes.





What mistake has Sam made?

The units of measurement are different.

triangle = 15 cm; pentagon = 30 cm

© White Rose Education 2022

Calculate perimeter

Notes and guidance

In this small step, children use their understanding of the properties of different shapes to calculate the perimeter of simple 2-D shapes.

Encourage children to identify equal sides of a square and equal opposite sides of a rectangle to support them in calculating the perimeter. It is important to explore different strategies for calculating perimeter with children and encourage them to use more efficient strategies, for example for a rectangle they could add all four lengths, they could double the width and length and add them together or they could add the width and length and then double.

Although children can calculate the perimeter of rectilinear shapes in this step, these shapes are not formally introduced until Year 4

Things to look out for

- Children may not record the units of measurement in their answer.
- Children may not remember that a square has four equal sides and that opposite sides of a rectangle are equal.
- Children may find it difficult to add lengths measured in centimetres and millimetres.

Key questions

- Are any of the sides equal?
- How can you work out the perimeter of the shape?
- What other method could you use to find the perimeter of the shape?
- How can you work out the lengths of the sides that are not labelled?
- How many sides do you need to measure before you can find the perimeter?
- Do the lengths need to have the same unit of measurement? How do you find equivalent lengths?

Possible sentence stems

- Opposite sides of a rectangle are _____
- The missing side length is _____ cm because ...

National Curriculum links

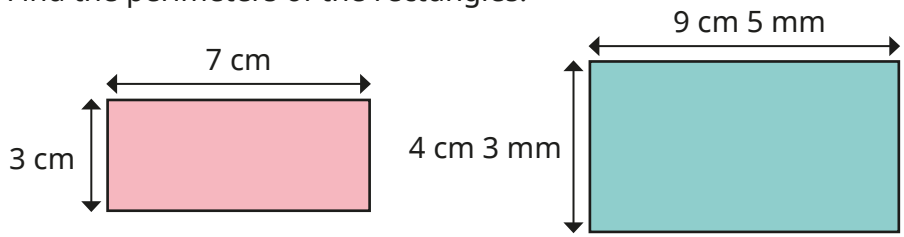
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- Measure the perimeter of simple 2-D shapes

© White Rose Education 2022

Calculate perimeter

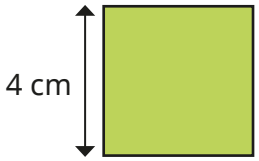
Key learning

- Find the perimeters of the rectangles.

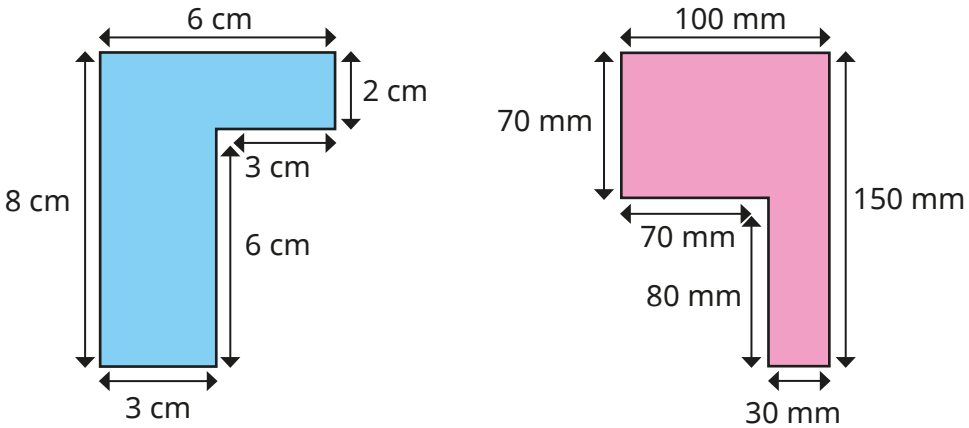


Compare methods with a partner.

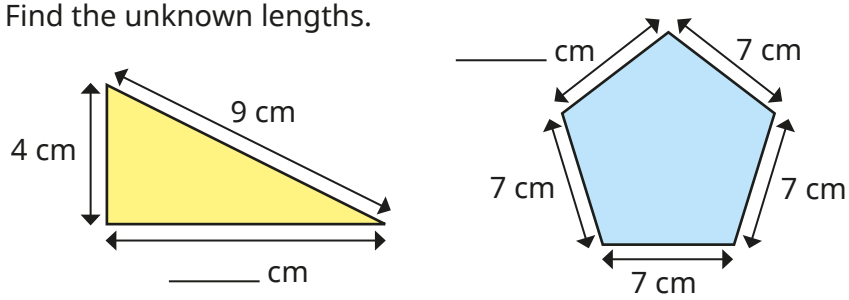
- Find the perimeter of the square.



- Work out the perimeter of each shape.



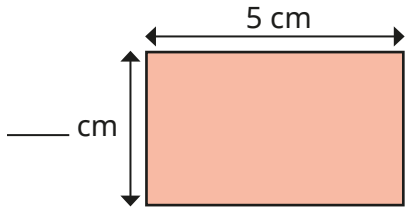
- Find the unknown lengths.



perimeter = 21 cm

perimeter = 35 cm

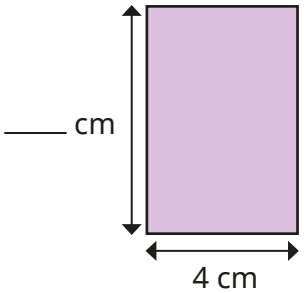
- Esther is finding the unknown length of the rectangle.



perimeter = 16 cm

5 cm + 5 cm = 10 cm
16 cm – 10 cm = 6 cm
6 cm ÷ 2 = 3 cm

Use Esther's method to find the unknown length.



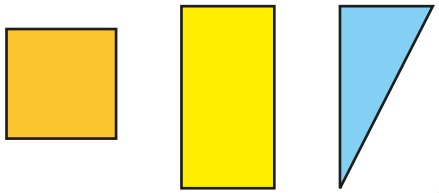
perimeter = 20 cm

© White Rose Education 2022

Calculate perimeter

Reasoning and problem solving

How many sides do you need to measure to find the perimeter of each shape?



Explain your answers.

square: one side

rectangle: two adjacent sides

triangle: all three sides

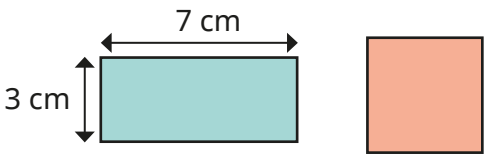
Each side of this shape is the same length.

The perimeter is 60 cm.

How long is each side?

6 cm

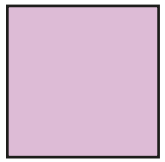
The rectangle and square have the same perimeter.



What is the length of each side of the square?

5 cm

The perimeter of the square is greater than 11 cm and less than 25 cm.



In whole centimetres, what could the length of one side be?

3 cm, 4 cm, 5 cm or 6 cm

© White Rose Education 2022

Spring Block 3

Fractions A

© White Rose Education 2022

White Rose MATHS

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

© White Rose Education 2022

Small steps

Step 9 Equivalent fractions on a number line

Step 10 Equivalent fractions as bar models

© White Rose Education 2022

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

© White Rose Education 2022

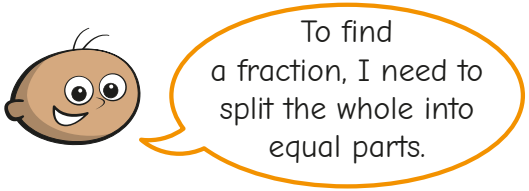
Understand the denominators of unit fractions

Key learning

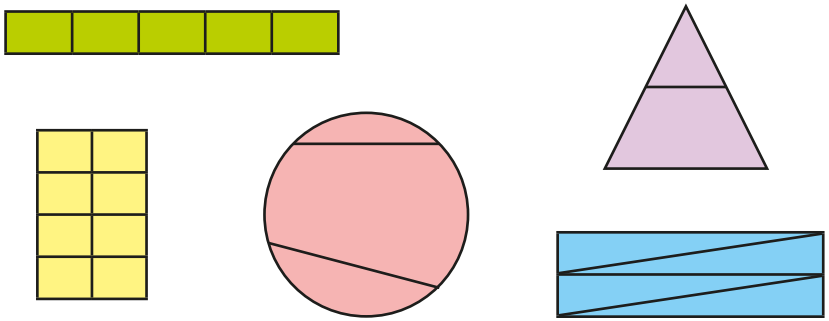
Give children a map of Europe. Tell them that Europe is the whole. Ask children to identify the parts and get them to answer using the stem sentence.

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

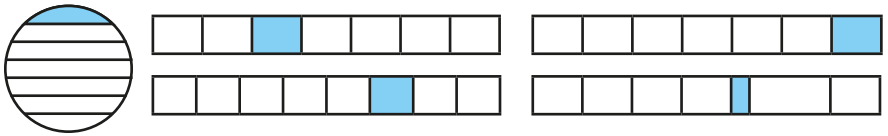
- Tommy is identifying fractions.



Which shapes have been split into equal parts?



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

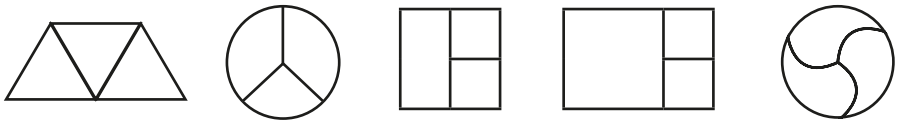


- Complete the sentences for each shape.

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

The fraction shaded is _____

- Which shapes have been split into thirds?

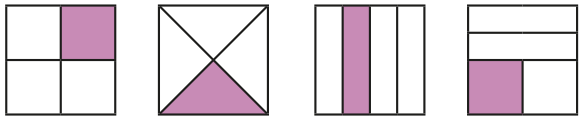


© White Rose Education 2022

Understand the denominators of unit fractions

Reasoning and problem solving

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

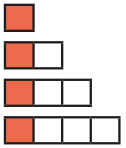


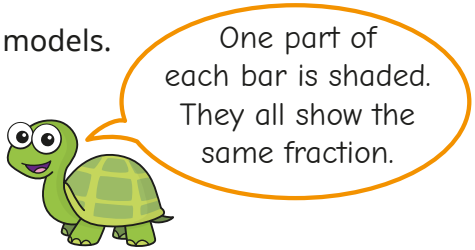
How do you know?

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.

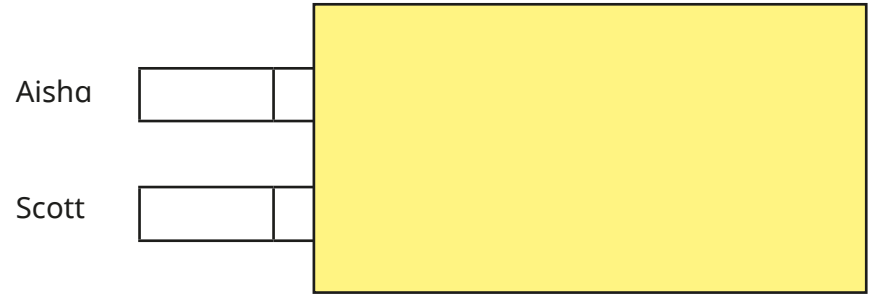
No

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.

© White Rose Education 2022

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

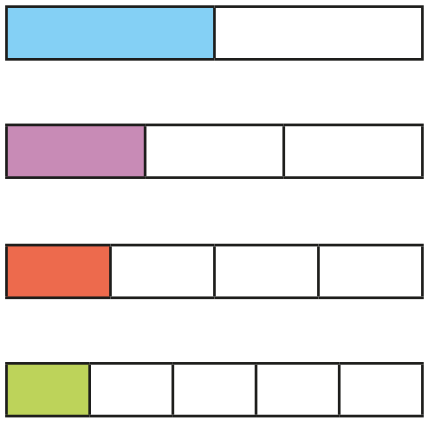
© White Rose Education 2022

Compare and order unit fractions

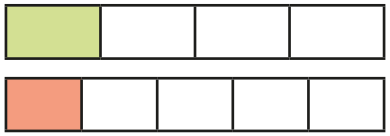
Key learning

- Match the fractions to the bar models.

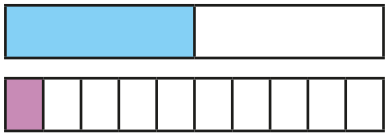
$\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{5}$ $\frac{1}{3}$



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



$\frac{1}{4}$ ◯ $\frac{1}{5}$

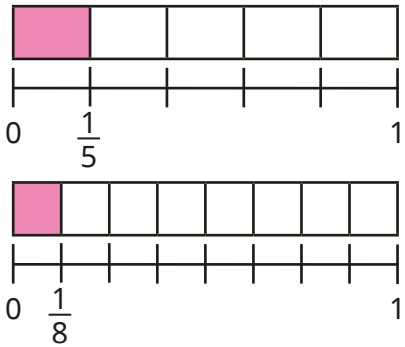


$\frac{1}{2}$ ◯ $\frac{1}{10}$

Complete the sentence.

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

- Write < or > to compare the fractions.

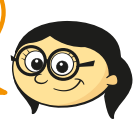


$\frac{1}{5}$ ◯ $\frac{1}{8}$

- Annie is comparing fractions.

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

If the numerators are the same, then the smaller the denominator, the greater the fraction.



Use Annie's method to compare the fractions.

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

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

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

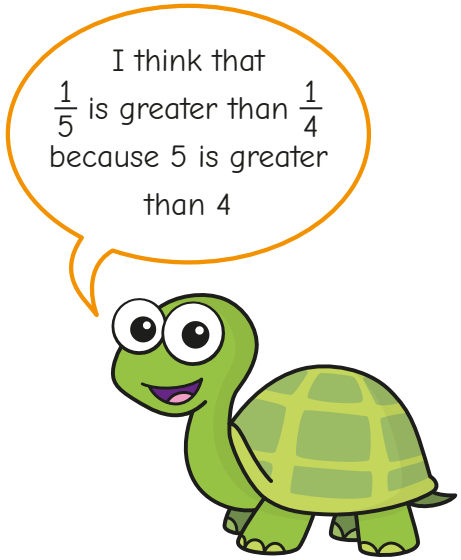
$\frac{1}{5}$ $\frac{1}{50}$ $\frac{1}{10}$ $\frac{1}{2}$ $\frac{1}{100}$

© White Rose Education 2022

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

© White Rose Education 2022

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

© White Rose Education 2022

Understand the numerators of non-unit fractions

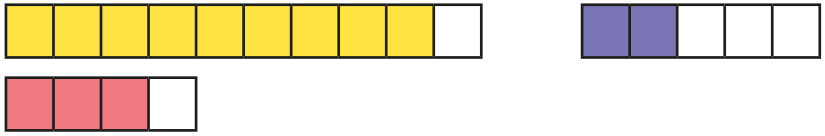
Key learning

-
  - 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?

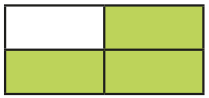
    How do you know?
  - What fraction of the bar model is shaded?

- What fraction of each bar model is shaded?



How do you know?

- The shape has been split into quarters.



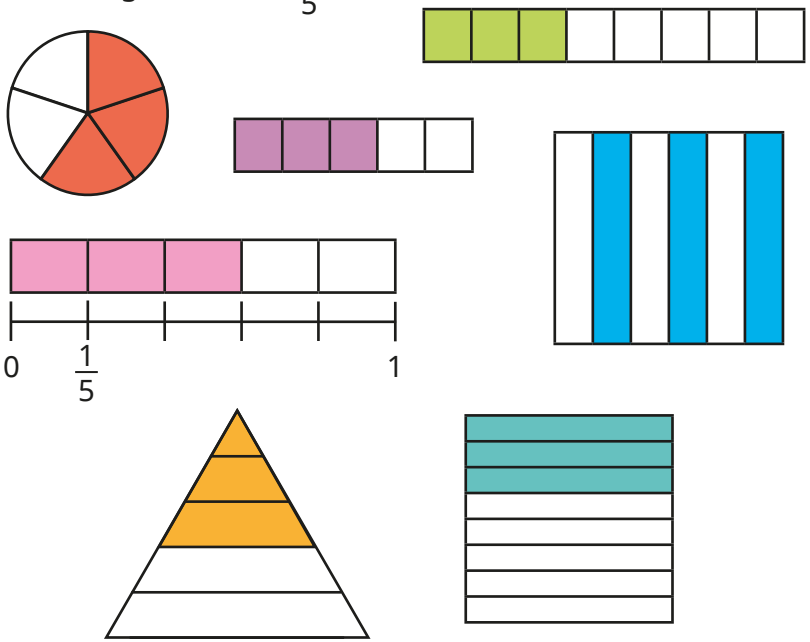
  - What fraction of the shape is shaded?
  - How many lots of one quarter are shaded?

What do you notice?

- Draw bar models to show each fraction.

$\frac{2}{3}$ $\frac{4}{5}$ $\frac{7}{10}$

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



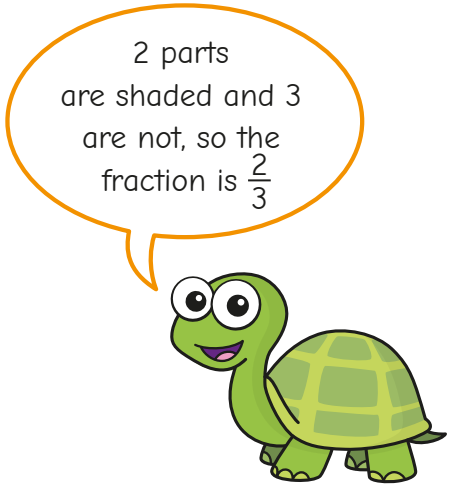
  - Draw another diagram that shows $\frac{3}{5}$
  - Draw another diagram that does not show $\frac{3}{5}$

© White Rose Education 2022

Understand the numerators of non-unit fractions

Reasoning and problem solving

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

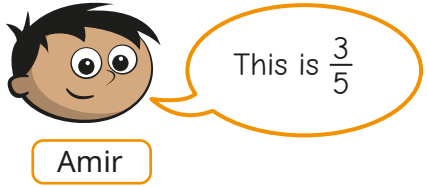


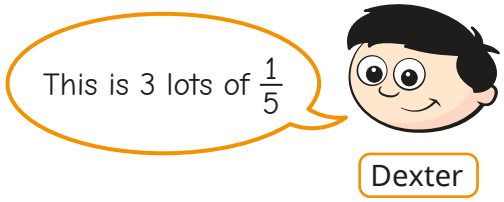
Do you agree with Tiny?

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

$\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$

© White Rose Education 2022

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

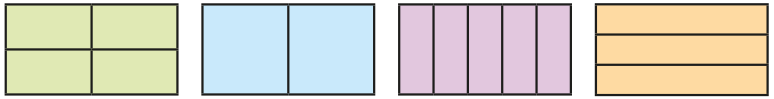
- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

© White Rose Education 2022

Understand the whole

Key learning

- Complete the sentences for each shape.

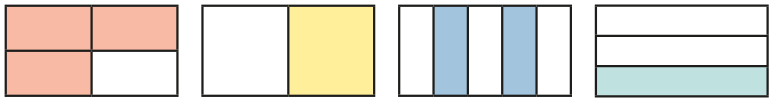


The whole is split into _____ equal parts.

_____ 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.

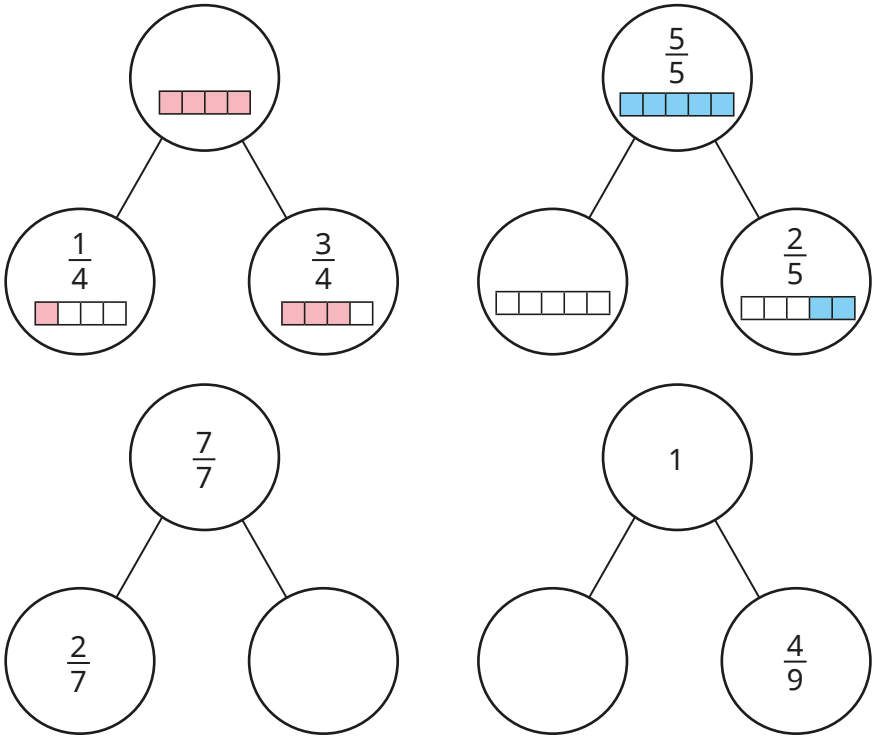
$\frac{\square}{\square}$ of the shape is shaded.

$\frac{\square}{\square}$ 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.

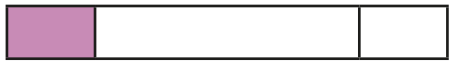


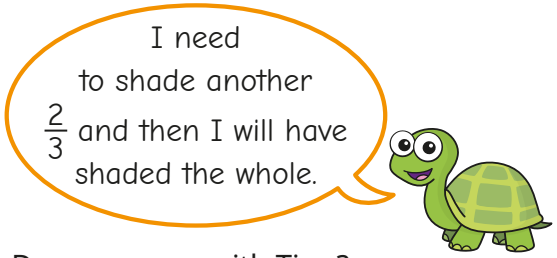
© White Rose Education 2022

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.

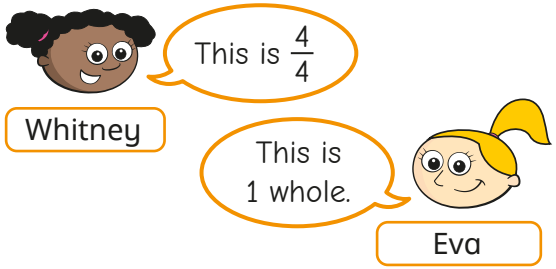
Max has run $\frac{5}{6}$ of the race.

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?

$\frac{5}{8}$

© White Rose Education 2022

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

© White Rose Education 2022

Compare and order non-unit fractions

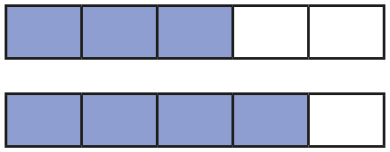
Key learning

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

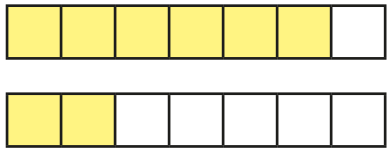
$\frac{1}{4}$ is _____ than $\frac{3}{4}$

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

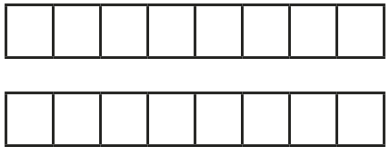
- Write <, > or = to compare the fractions.



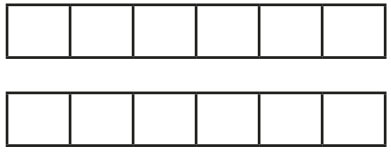
$\frac{3}{5}$ ◯ $\frac{4}{5}$



$\frac{6}{7}$ ◯ $\frac{2}{7}$



$\frac{7}{8}$ ◯ $\frac{3}{8}$



$\frac{1}{6}$ ◯ $\frac{6}{6}$

- Write < or > to compare the fractions.

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

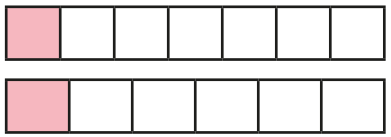
$\frac{8}{9}$ ◯ $\frac{1}{9}$ $\quad$ $\frac{5}{23}$ ◯ $\frac{1}{23}$ $\quad$ $\frac{5}{7}$ ◯ 1

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

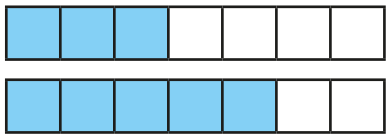
$\frac{7}{7}$ $\frac{6}{7}$ $\frac{1}{7}$ $\frac{5}{7}$ $\frac{4}{7}$

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

- Use the bar models to compare the fractions.



$\frac{1}{7}$ ◯ $\frac{1}{6}$



$\frac{3}{7}$ ◯ $\frac{5}{7}$

What is the same? What is different?

© White Rose Education 2022

Compare and order non-unit fractions

Reasoning and problem solving

Alex is ordering fractions.

She has spilt ink on her work.

$$\frac{2}{7} < \frac{\text{[illegible]}}{7} < 1$$

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

$\frac{1}{8}$

© White Rose Education 2022

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

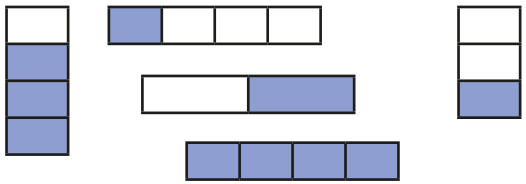
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

Fractions and scales

Key learning

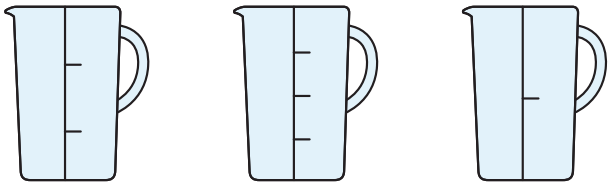
- What fraction of each shape is shaded?



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

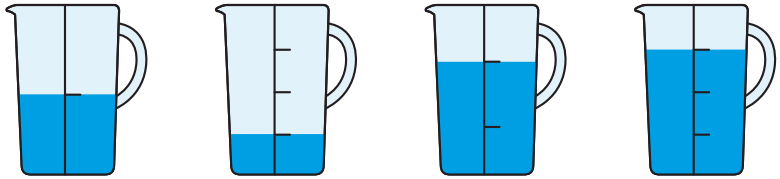
  What fraction of a metre is each line?

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



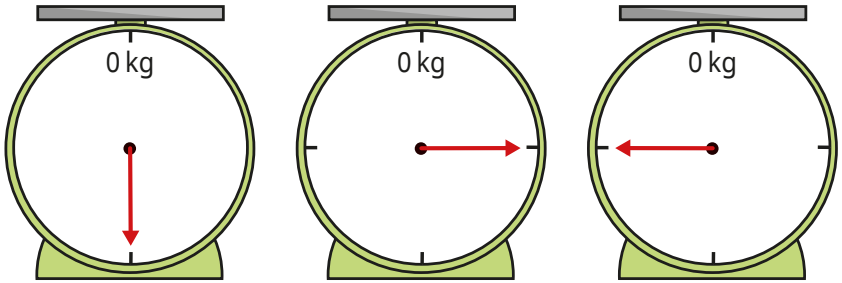
- Each jug has a capacity of 1 litre.

  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.

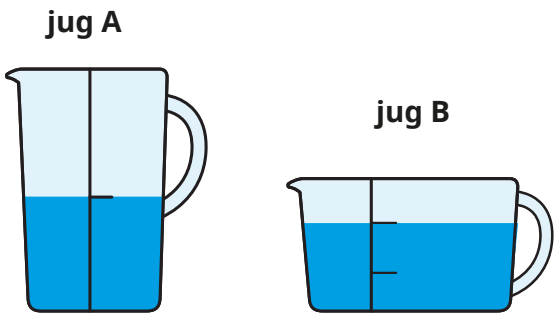
$\frac{1}{3}$ kg	$\frac{3}{3}$ kg	$\frac{1}{2}$ kg	$\frac{1}{4}$ kg

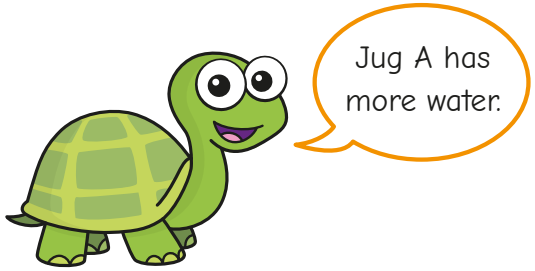
© White Rose Education 2022

Fractions and scales

Reasoning and problem solving

The capacity of each jug is 1 litre.



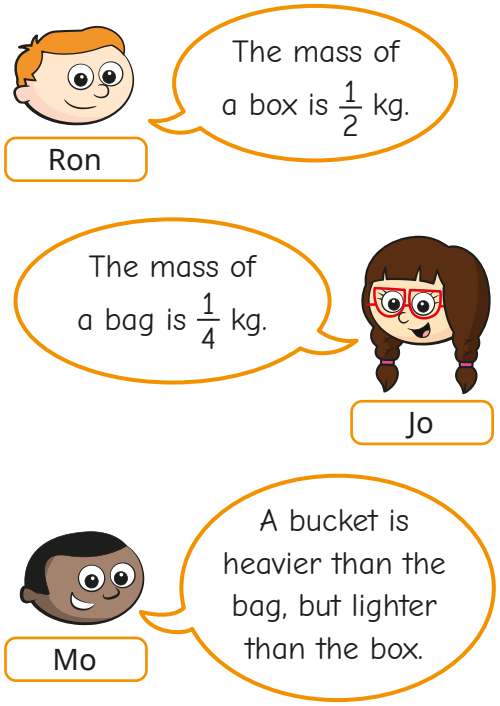


Do you agree with Tiny?

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

© White Rose Education 2022

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

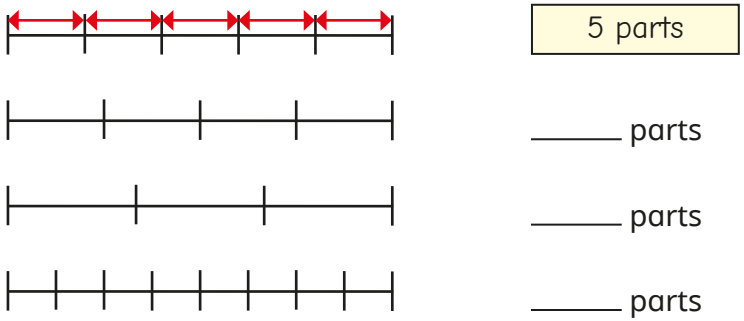
© White Rose Education 2022

Fractions on a number line

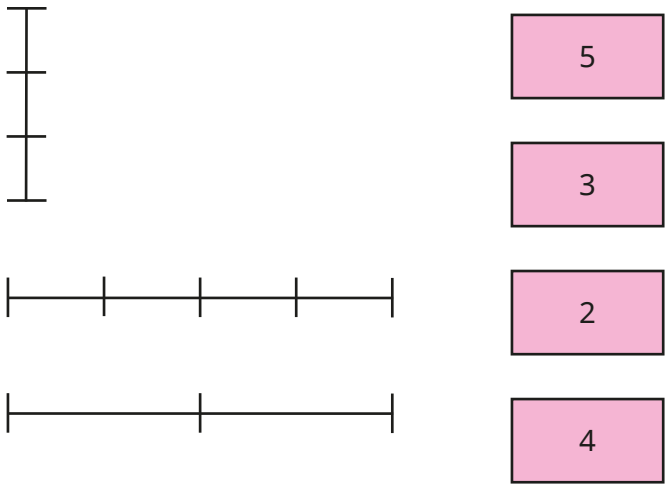
Key learning

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

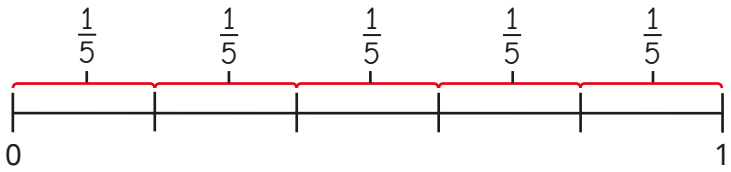
  Kim has completed the first example.



- Match the number lines to the number of intervals.



- Brett labels a number line to show fractions.

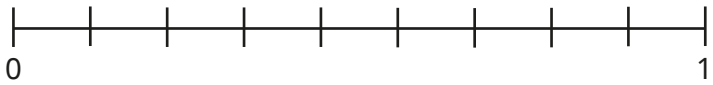


  Complete the sentences.

  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?

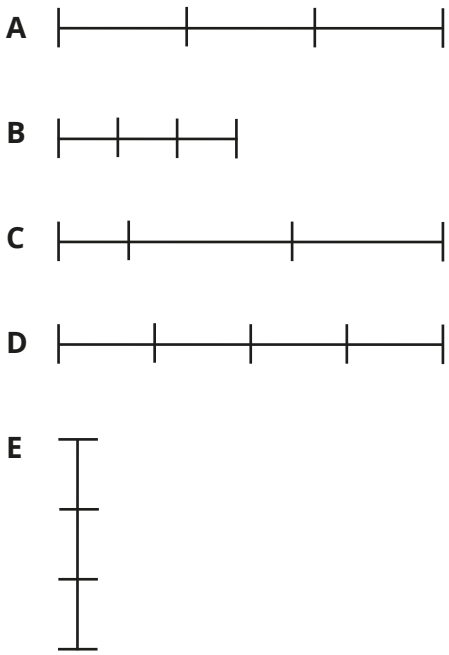
  What fraction is each interval worth? Label your number lines.

© White Rose Education 2022

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.

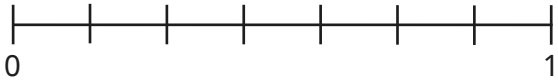
E is the only vertical number line.

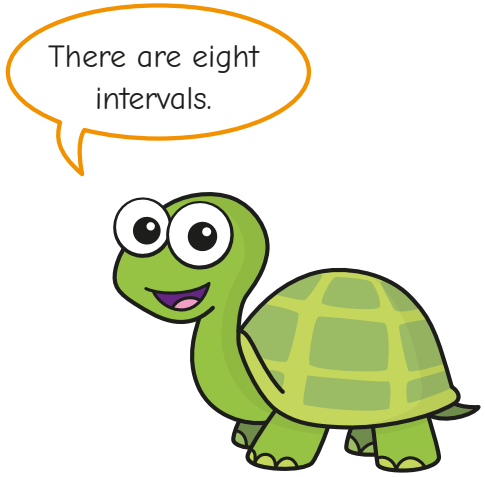
B is shorter than the other lines.

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

© White Rose Education 2022

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

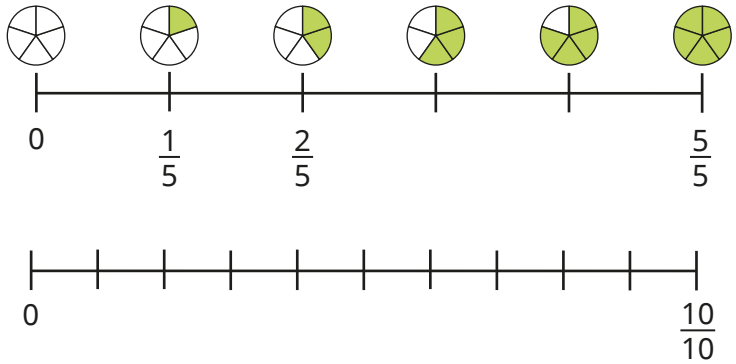
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators

© White Rose Education 2022

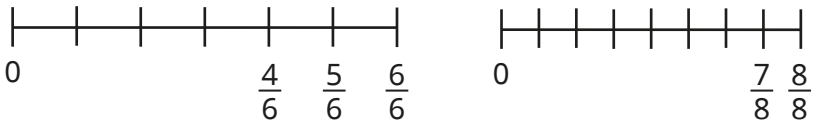
Count in fractions on a number line

Key learning

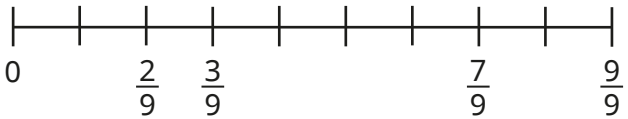
- Count forwards to complete the number lines.



- Count backwards to complete the number lines.

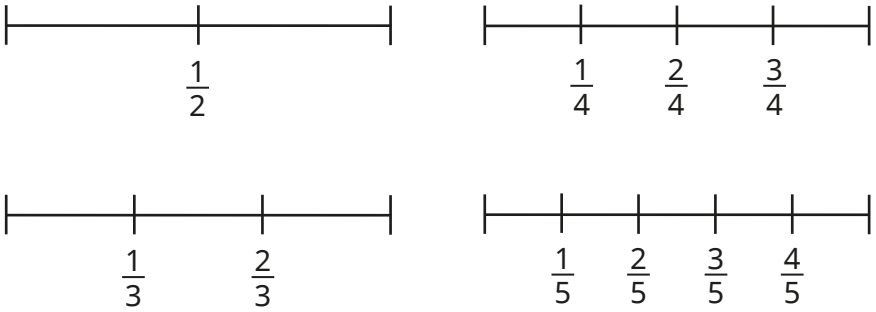


- Fill in the missing fractions.



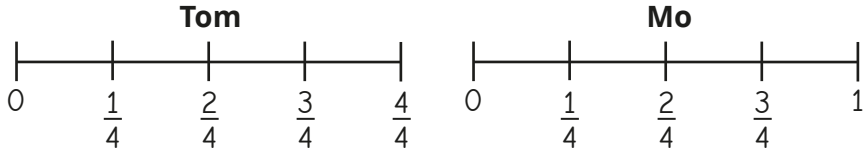
How did you work out each missing fraction?

- Complete the number lines.



What do you notice?

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



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

- Draw a number line counting in sixths.

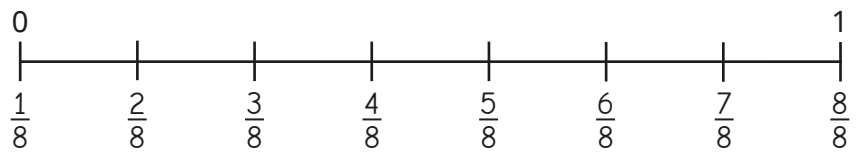
Label each interval.

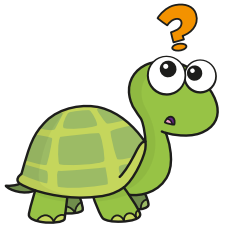
© White Rose Education 2022

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?

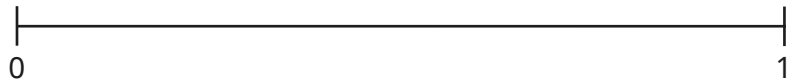
What should the labels be?

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)

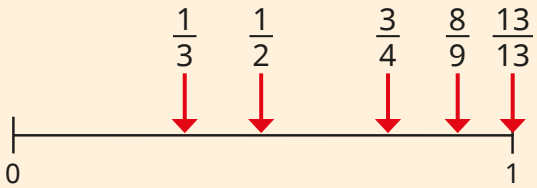
Estimate where the fractions belong on the number line.

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



How did you decide?

Talk about it with a partner.



© White Rose Education 2022

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

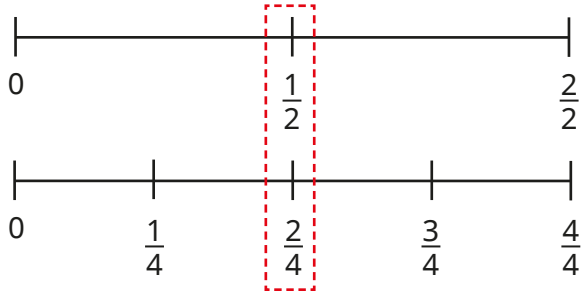
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Recognise and show, using diagrams, equivalent fractions with small denominators

© White Rose Education 2022

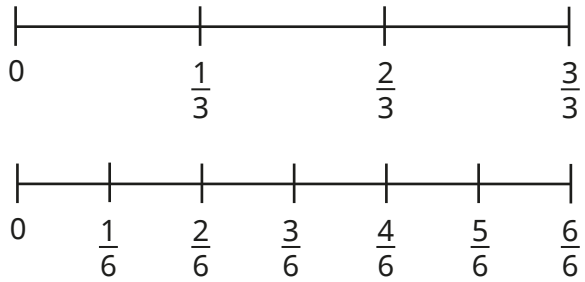
Equivalent fractions on a number line

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.

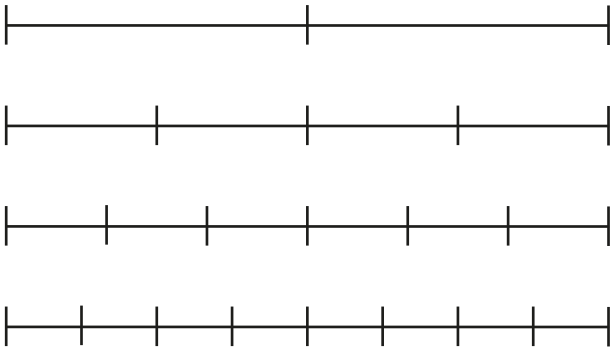


Have you got the same pair of fractions as your partner?

- Draw number lines to complete the equivalent fractions.

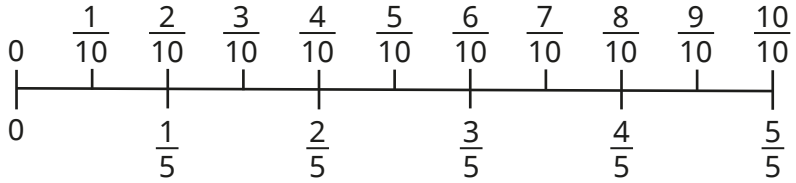
▸ $\frac{\square}{4} = \frac{2}{8}$ ▸ $\frac{2}{4} = \frac{\square}{8}$ ▸ $\frac{\square}{\square} = \frac{6}{8}$ ▸ $\frac{4}{4} = \frac{\square}{\square} = 1$

- Label the number lines with the correct fractions.



What equivalent fractions can you find?

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



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

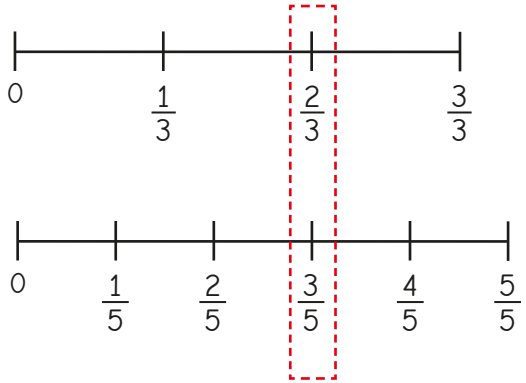
▸ $\frac{8}{\square} = \frac{4}{\square}$ ▸ $\frac{\square}{5} = \frac{\square}{10} = 1$

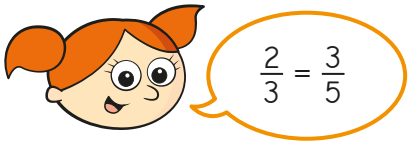
© White Rose Education 2022

Equivalent fractions on a number line

Reasoning and problem solving

Alex is drawing number lines to find equivalent fractions.



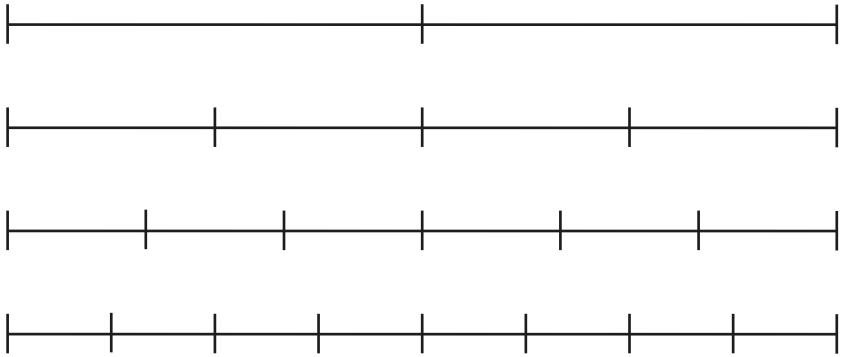


Do you agree with Alex?

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

© White Rose Education 2022

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

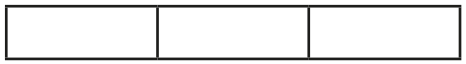
- Recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- Recognise and show, using diagrams, equivalent fractions with small denominators

© White Rose Education 2022

Equivalent fractions as bar models

Key learning

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



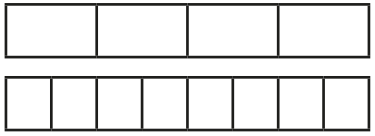
Shade $\frac{2}{6}$ of the bar model.

What do you notice?

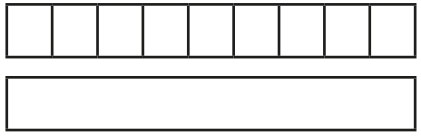
Complete the sentence. $\frac{\square}{\square}$ is equivalent to $\frac{\square}{\square}$

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

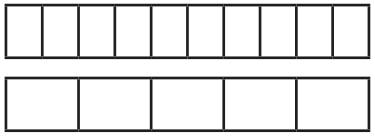
- Use the bar models to find the equivalent fractions.



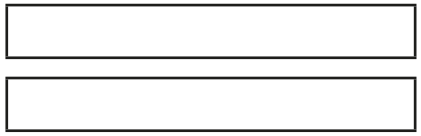
$\frac{1}{4} = \frac{\square}{8}$



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

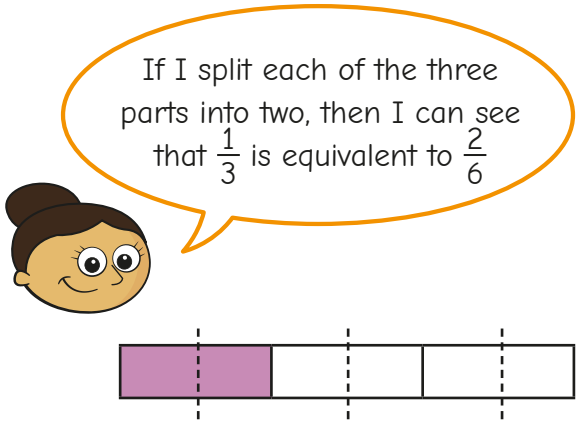


$\frac{8}{10} = \frac{\square}{\square}$

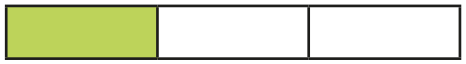


$\frac{3}{4} = \frac{\square}{12}$

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

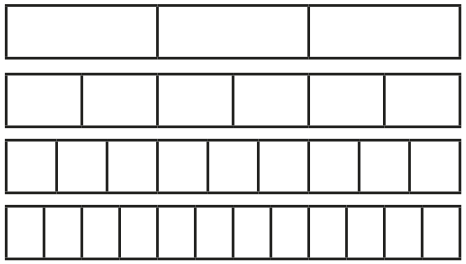


Split each part of this bar model into three equal parts and complete the equivalent fraction.



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

- Use the bar models to find the equivalent fractions.



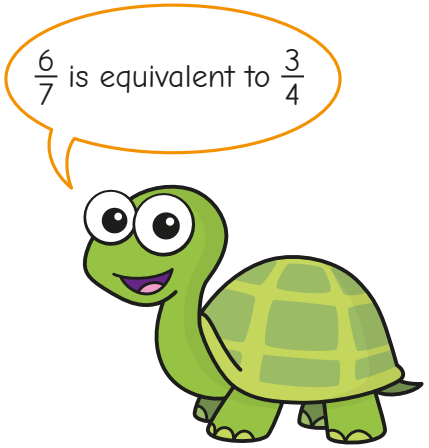
$\frac{2}{3} = \frac{\square}{6} = \frac{6}{\square} = \frac{\square}{\square}$

© White Rose Education 2022

Equivalent fractions as bar models

Reasoning and problem solving

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



Do you agree with Tiny?

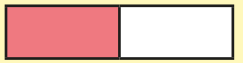
Explain your reasons.

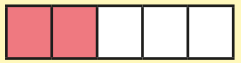
No

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?

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

© White Rose Education 2022

Spring Block 4

Mass and capacity

© White Rose Education 2022

White Rose MATHS

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

© White Rose Education 2022

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

© White Rose Education 2022

White Rose MATHS

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)

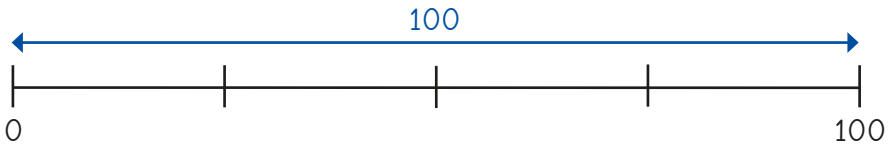
© White Rose Education 2022

Use scales

Key learning

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

- Tommy is labelling this number line.

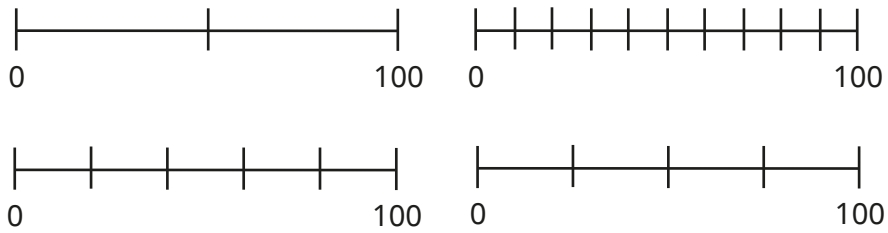


> 100 ÷ 4 = 25
> The number line is counting up in 25s.

Why did Tommy divide 100 by 4?

Label Tommy's number line.

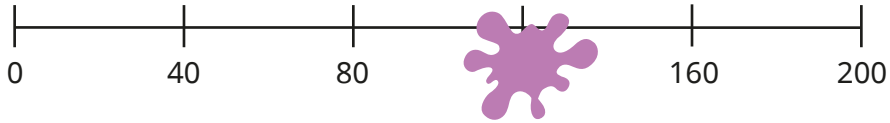
- Label the number lines.



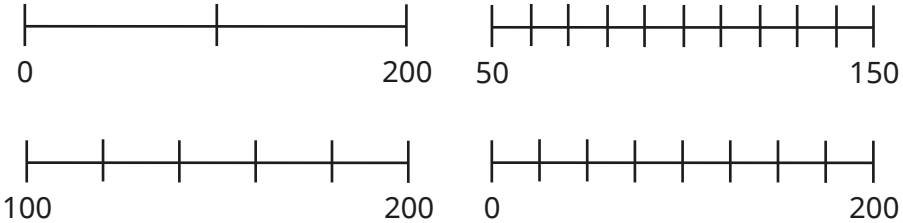
- Dani divides 200 into 5 equal parts on a number line.

She spills some paint.

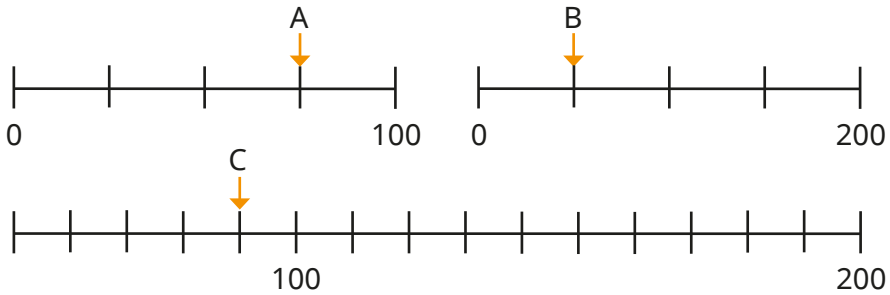
What number is the paint covering?



- Label the number lines.



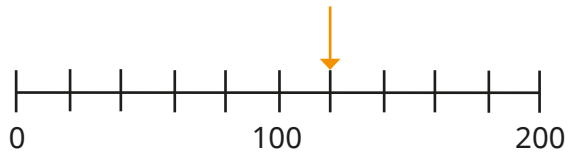
- What number is each arrow pointing to?

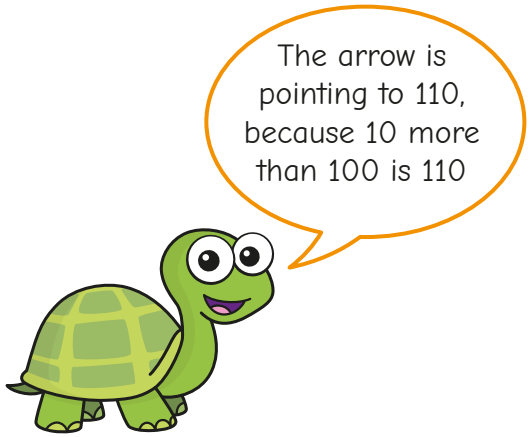


© White Rose Education 2022

Use scales

Reasoning and problem solving



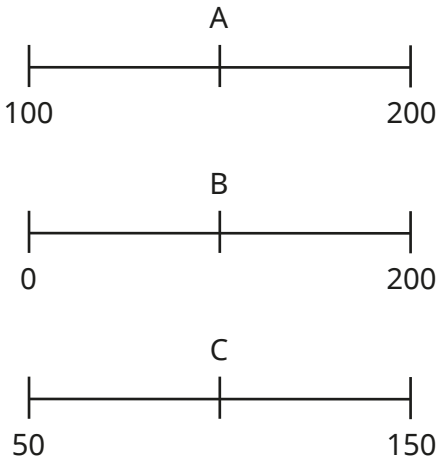


Do you agree with Tiny?

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

© White Rose Education 2022

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

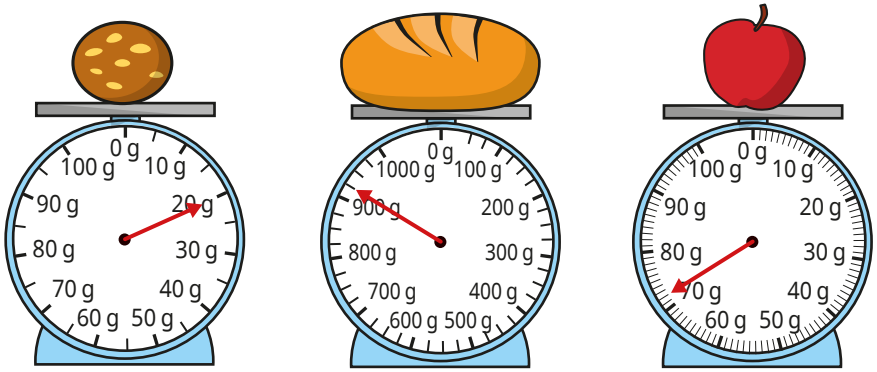
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

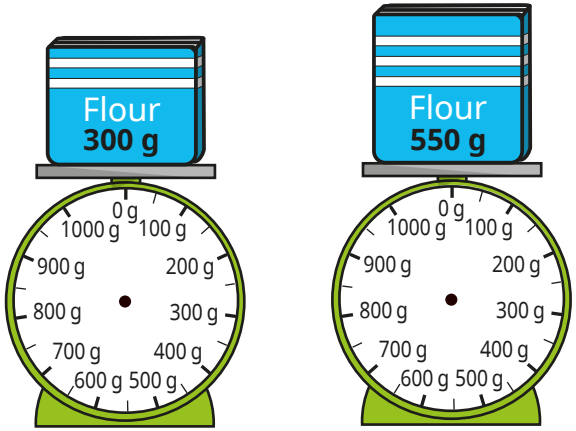
Measure mass in grams

Key learning

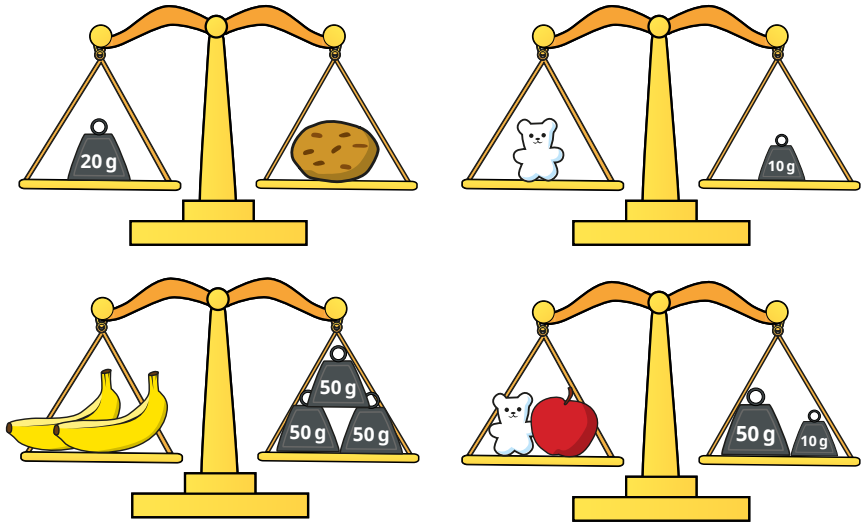
- What is the mass of each object?



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

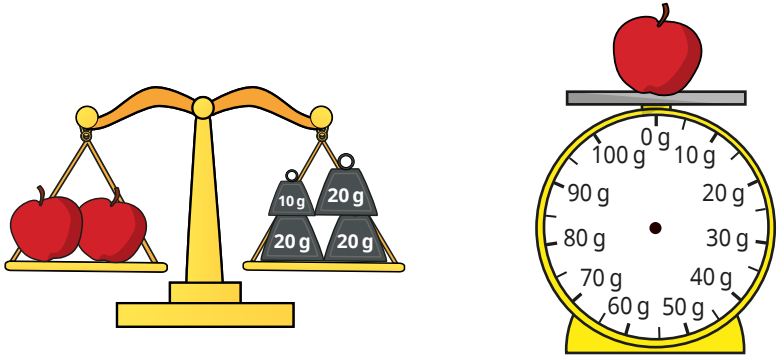


- What is the mass of each object?



- Work out the mass of one apple.

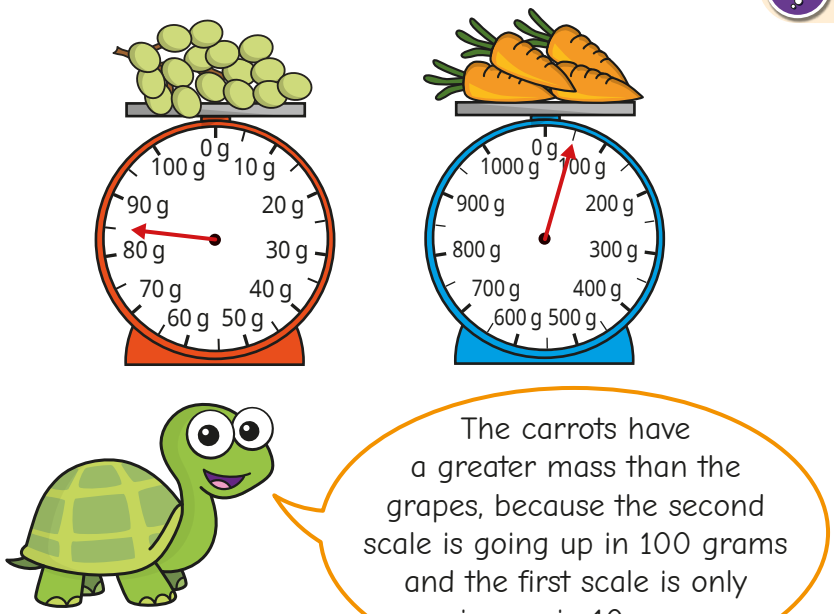
  Draw an arrow on the scale to show to show your answer.



© White Rose Education 2022

Measure mass in grams

Reasoning and problem solving



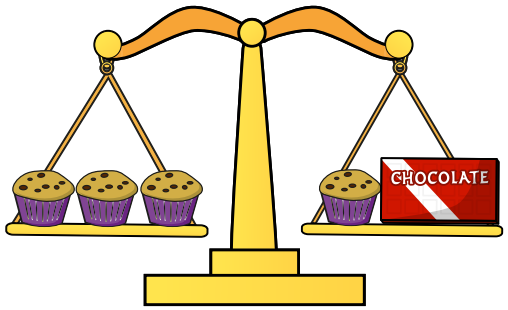
Do you agree with Tiny?

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

© White Rose Education 2022

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

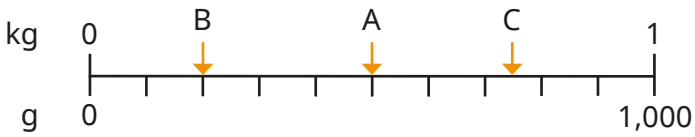
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

Measure mass in kilograms and grams

Key learning

- Complete the sentence for each arrow.

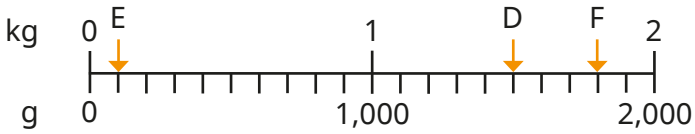


Arrow _____ is pointing to _____ g.

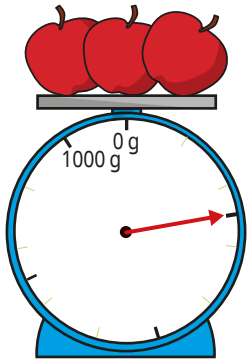
What fraction of a kilogram is each arrow pointing to?

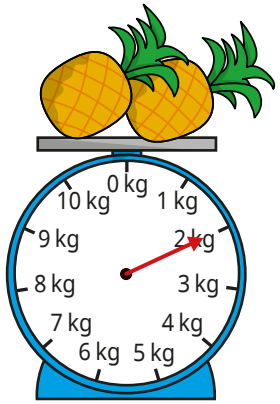
- What mass is each arrow pointing to?

Give your answers in kilograms and grams.

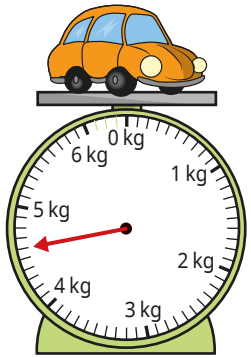


- What is the total mass of the apples and the pineapples?

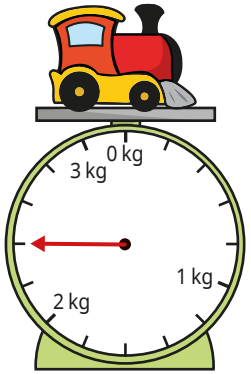




- Complete the sentences.



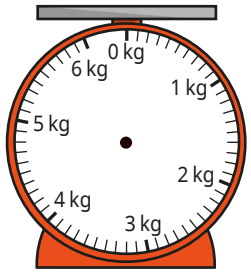
The toy car has a mass of 4 kg and _____ g.



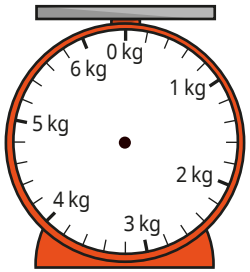
The toy train has a mass of _____ kg and _____ g.

- Draw arrows on the scales to show the mass.

1 kg and 700 g



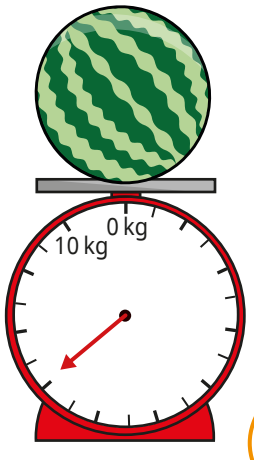
5 kg and 900 g



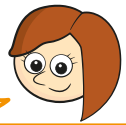
© White Rose Education 2022

Measure mass in kilograms and grams

Reasoning and problem solving



Amir: The watermelon has a mass of 13 kg.



Rosie: The watermelon has a mass of 14 kg.

Jack: The mass of the watermelon is greater than half of 10 kg.

Who do you agree with?

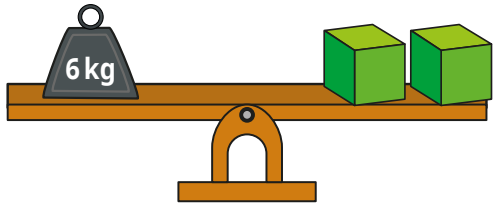
Explain your answer.

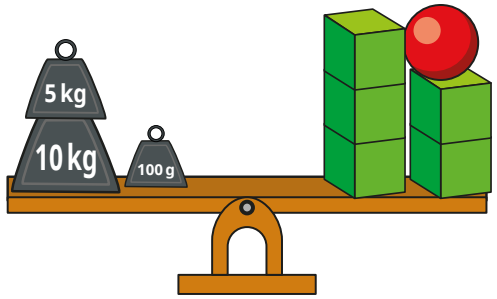
Work out the mass of the watermelon.

Show your workings.

Jack 7 kg

Here are some balance scales.





Work out the mass of the sphere.

100 g

© White Rose Education 2022

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

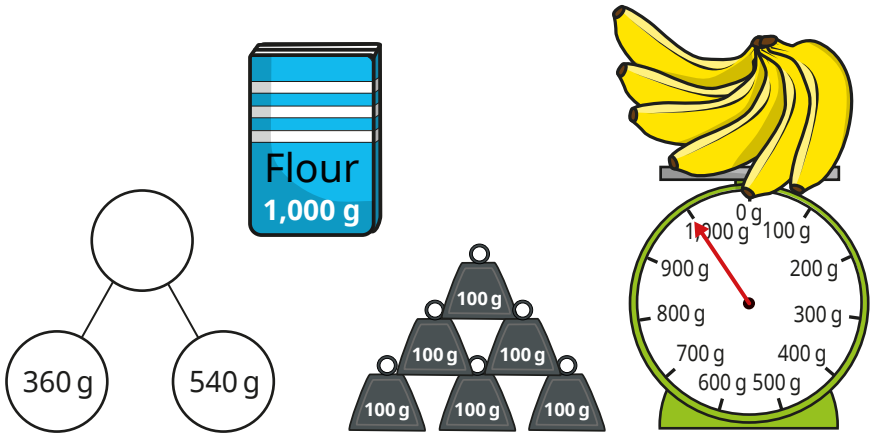
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

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

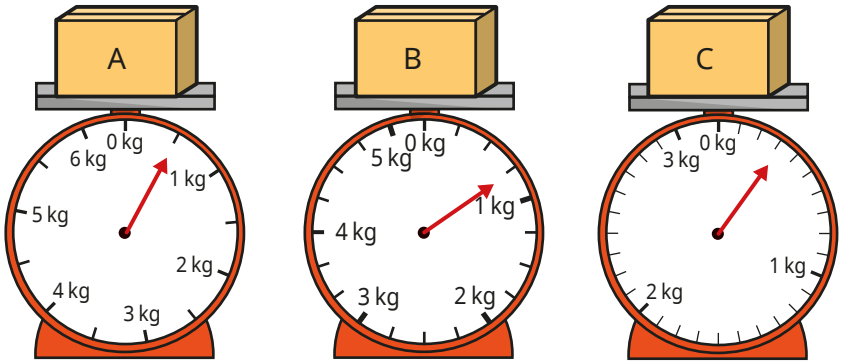
- Scott needs 200 g of flour to bake a cake.

  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

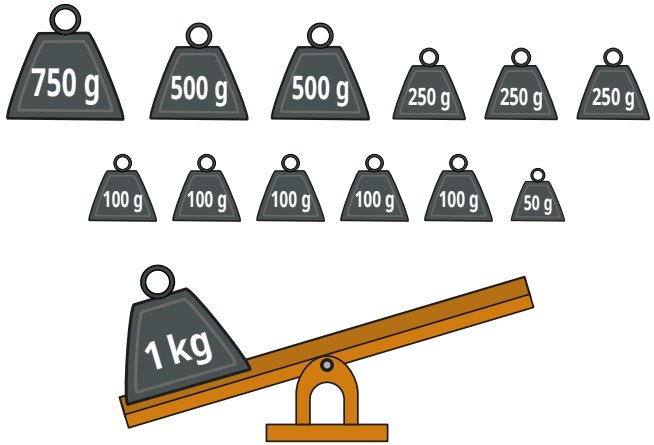
© White Rose Education 2022

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.

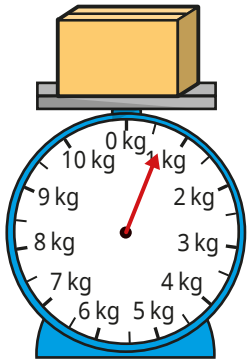
multiple possible answers, e.g.

750 g + 250 g

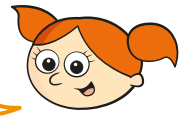
500 g + 250 g + 250 g

750 g + 100 g + 100 g + 50 g

What is the mass of the box?



I think the mass of the box is between 0 and 1,000 g.

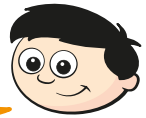


Alex

I think the mass of the box is between 500 g and 1,000 g.

Whitney

I think the mass of the box is over 1,000 g.



Dexter

Whose answer do you think is the best?

Explain why.

Whitney's

© White Rose Education 2022

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

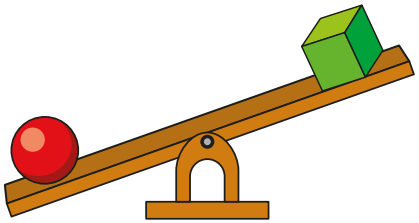
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

Compare mass

Key learning

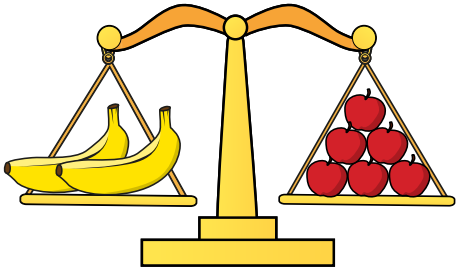
- Write **heavier** or **lighter** to complete the sentences.



The sphere is _____ than the cube.

The cube is _____ than the sphere.

- Complete the sentences.



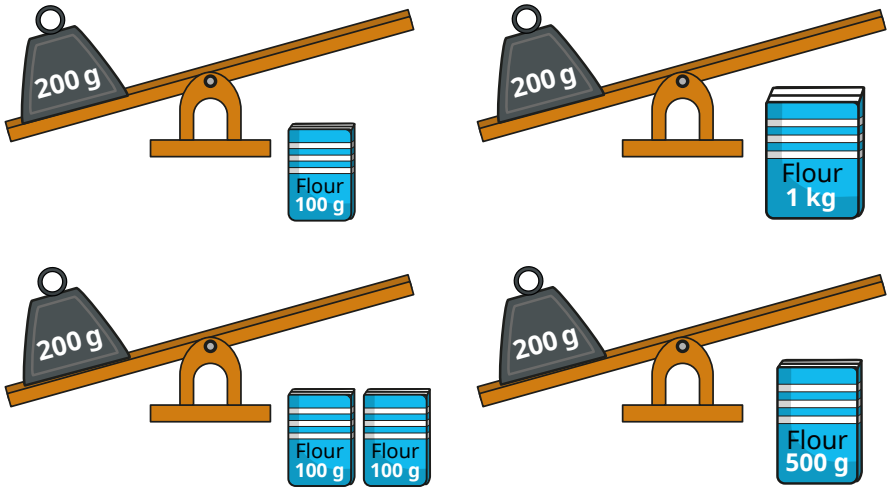
_____ bananas have the same mass as _____ apples.

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.

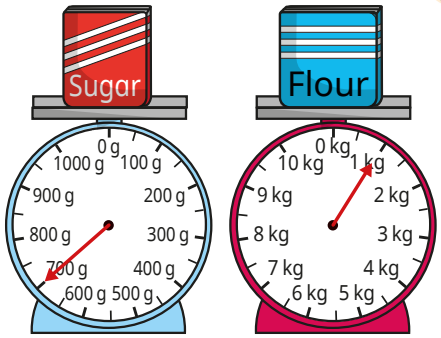
500 g	◯	500 kg	1 kg and 300 g	◯	3 kg and 300 g
900 g	◯	1 kg	1 kg and 300 g	◯	1 kg and 100 g
210 g	◯	$\frac{1}{5}$ kg	4 kg and 27 g	◯	27 kg and 4 g

© White Rose Education 2022

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.

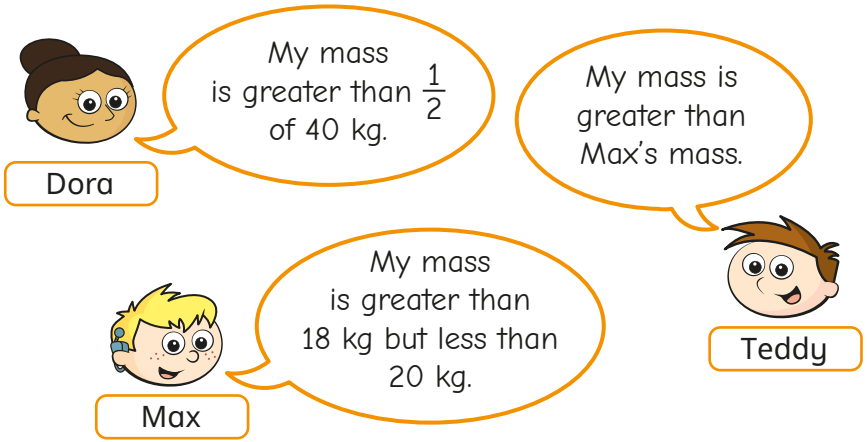
Explain your answer.

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

© White Rose Education 2022

Add and subtract mass

White Rose MATHS

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)

© White Rose Education 2022

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.

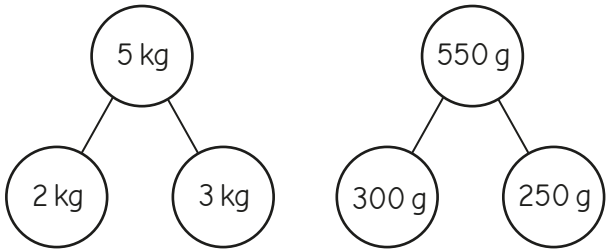
  What is the mass of the cookies?

- 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.



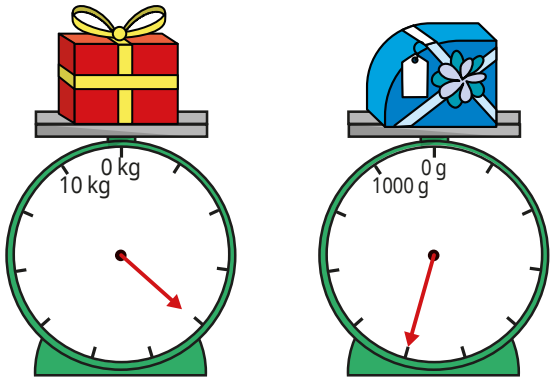
5 kg + 550 g = 5 kg 550 g

Use Huan's method to work out the totals.

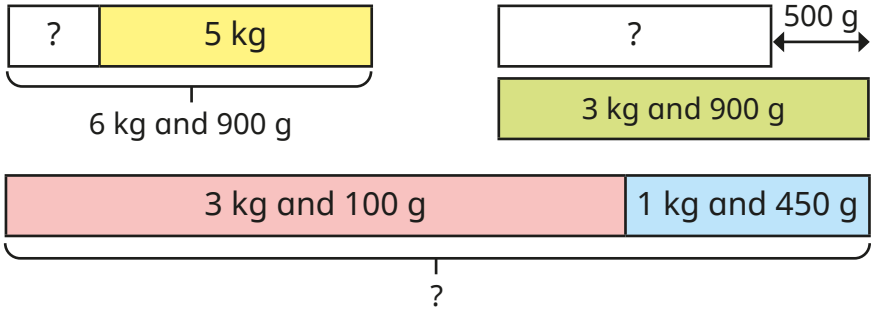
3 kg 450 g + 4 kg 200 g

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?

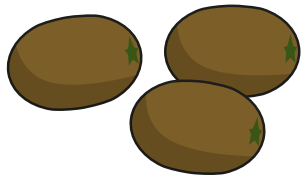
© White Rose Education 2022

Add and subtract mass

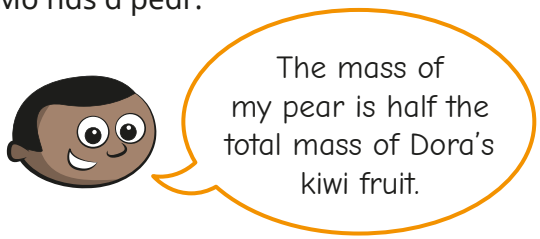
Reasoning and problem solving

Dora has 3 kiwi fruit.

The mass of each kiwi fruit is 70 g.



Mo has a pear.



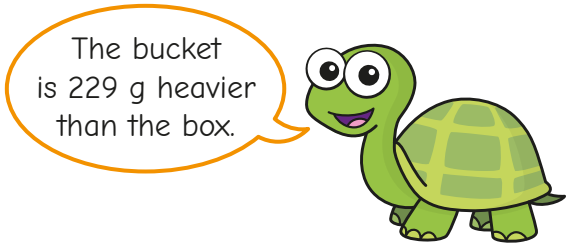
How much heavier is the pear than a kiwi fruit?

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?

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?

The box is heavier by 770 g.

1 kg 910 g

© White Rose Education 2022

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

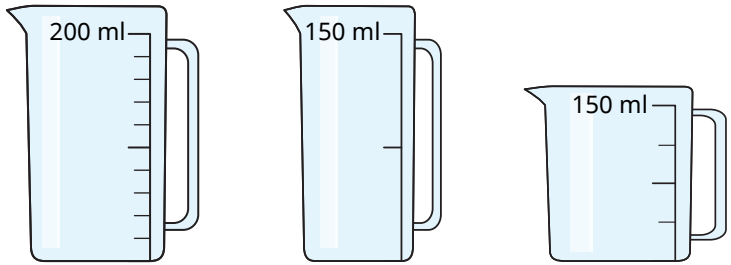
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

Measure capacity and volume in millilitres

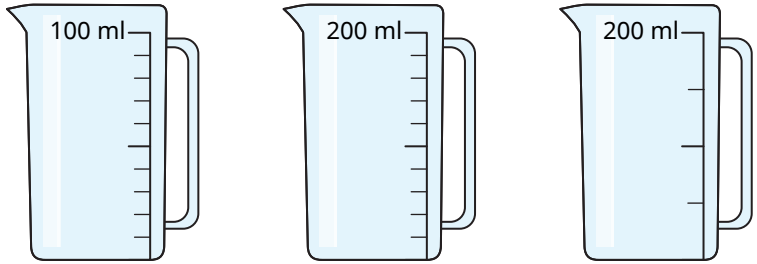
Key learning

- What is the capacity of each jug?



- Label the divisions on the scales of the jugs.

  Complete the sentences to help.

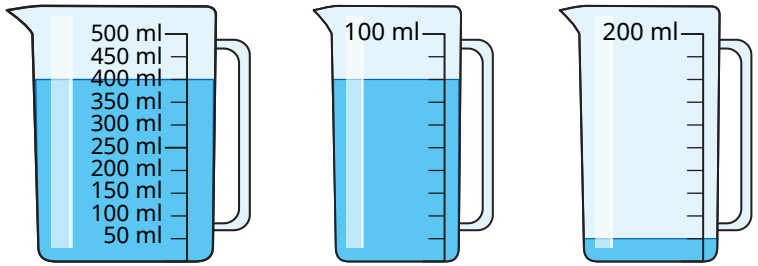


The difference between the start and end values on the scale is _____

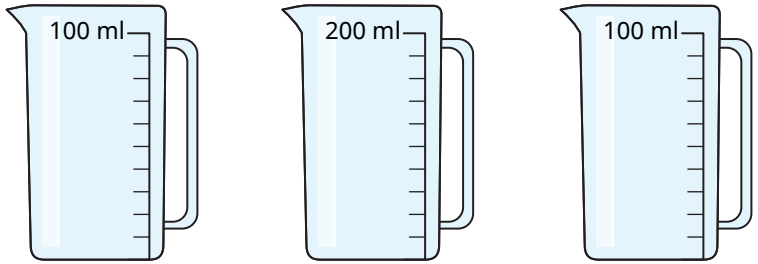
There are _____ equal intervals.

_____ ÷ _____ = _____

- What is the volume of water in each jug?

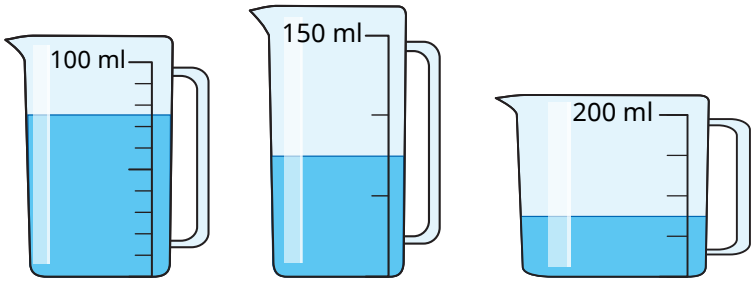


- Colour the jugs to show where the given amount of water will reach.



60 ml 60 ml 35 ml

- What is the volume of water in each jug?

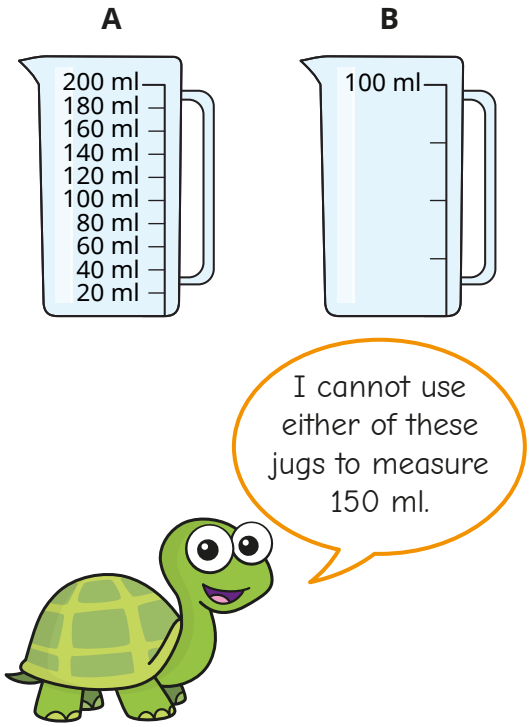


© White Rose Education 2022

Measure capacity and volume in millilitres

Reasoning and problem solving

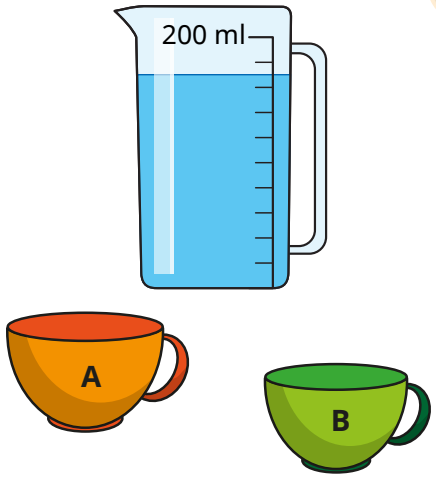
Tiny needs 150 ml of water.



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

© White Rose Education 2022

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)

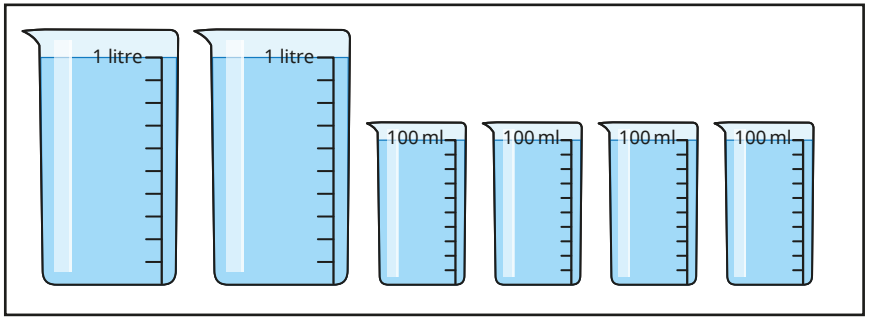
© White Rose Education 2022

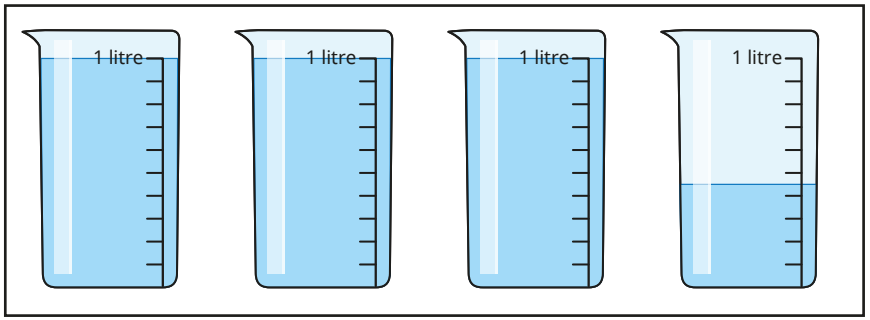
Measure capacity and volume in litres and millilitres

Key learning

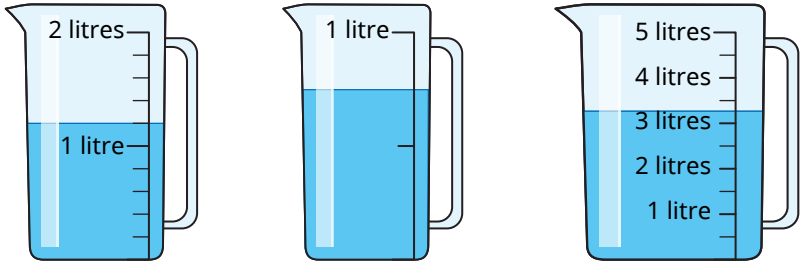
- Label the missing divisions on the jugs.

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



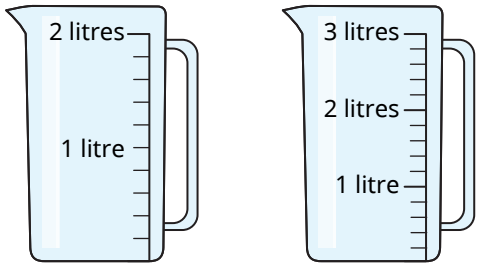


- What is the volume of water in each jug?



How accurate do you think your answers are?

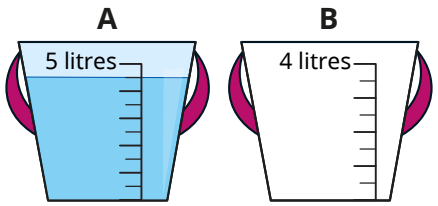
- Shade the jugs to show where the water will reach.



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.

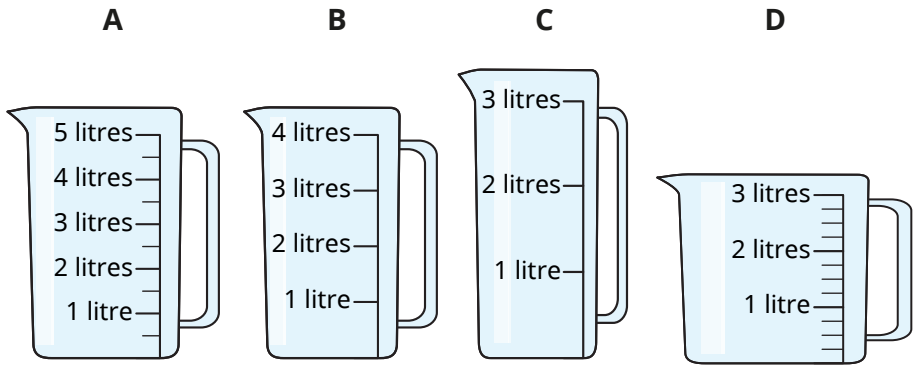


© White Rose Education 2022

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.

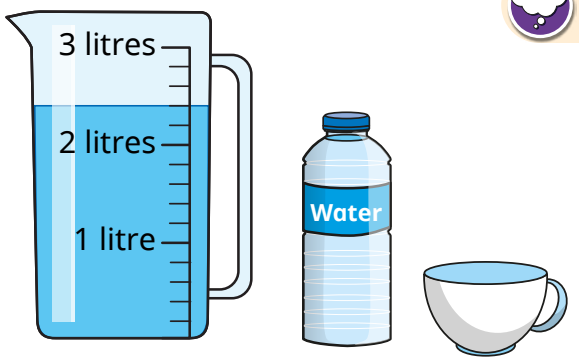


Which jug do you think will be easiest to use?

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

© White Rose Education 2022

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)

© White Rose Education 2022

Equivalent capacities and volumes (litres and millilitres)

Key learning

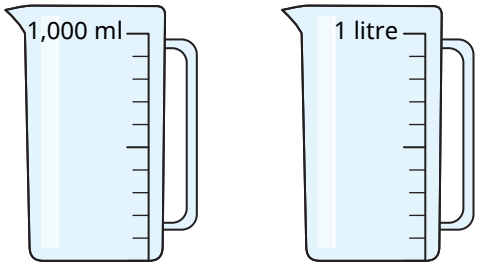
- Give children a 100 ml container, a 1 litre container and some water.

  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?

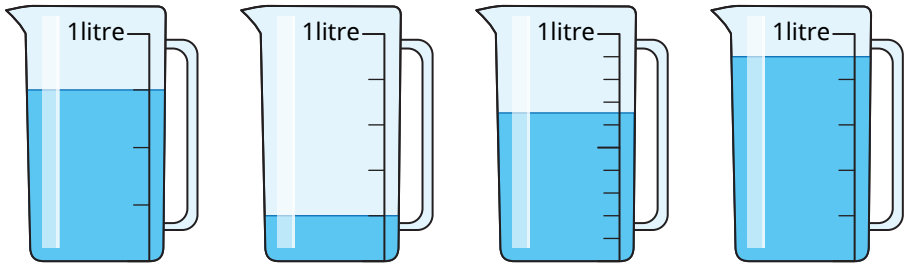
- What is the same and what is different about these jugs?



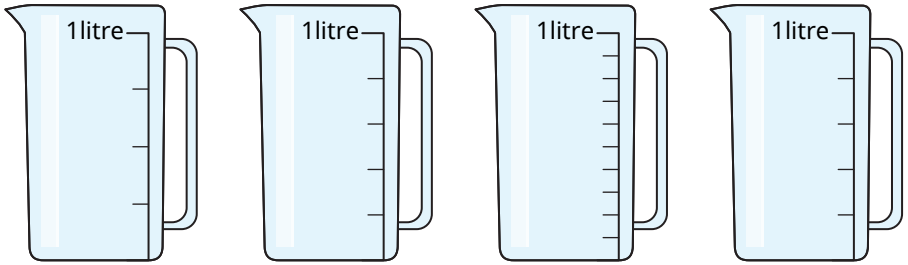
  Label the missing divisions on each jug.

- 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?

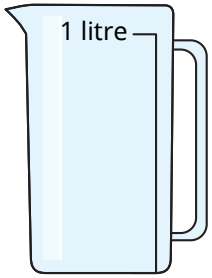
© White Rose Education 2022

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.



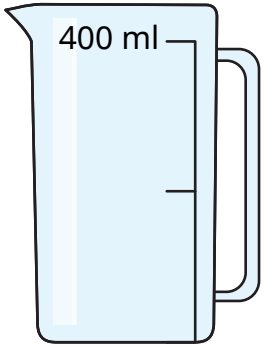
How many different ways can it be done?

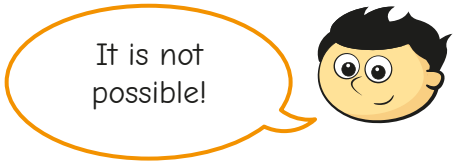
Jo can use each bottle more than once.

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

© White Rose Education 2022

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

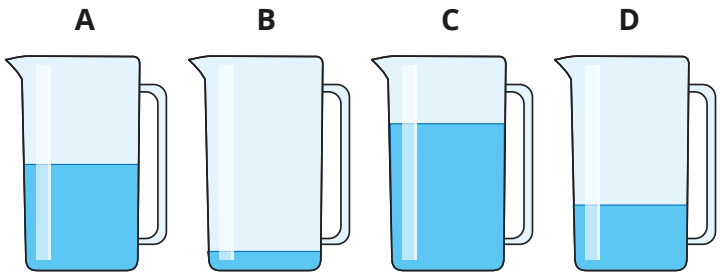
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

Compare capacity and volume

Key learning

- Each container has the same capacity.

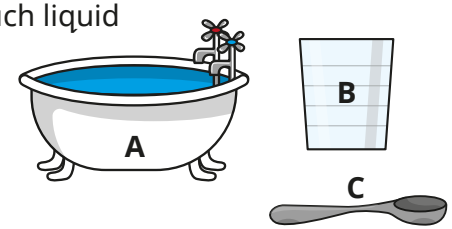


Put the containers in order of the volume of liquid they contain.

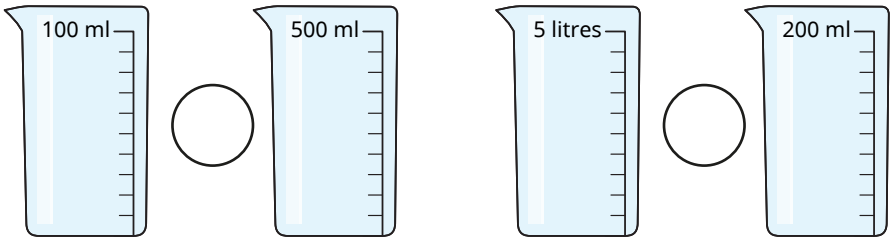
Start with the container with the greatest volume.

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

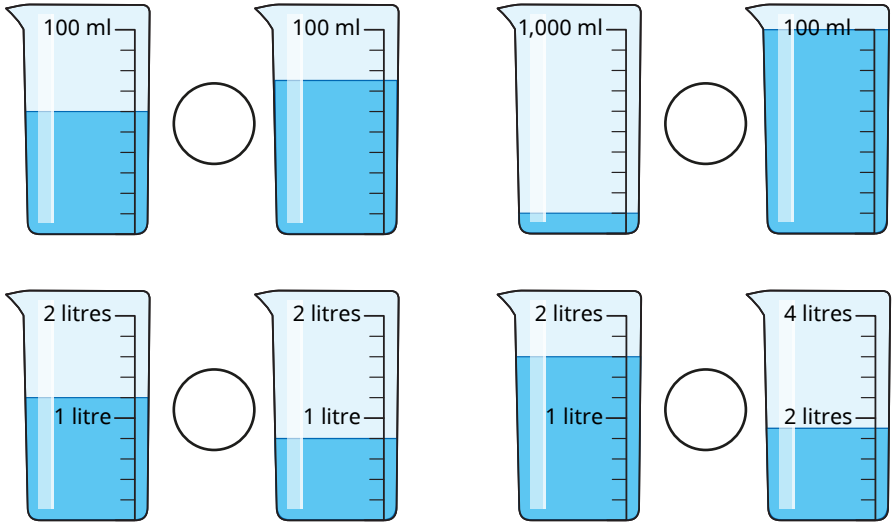
Start with the greatest capacity.



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

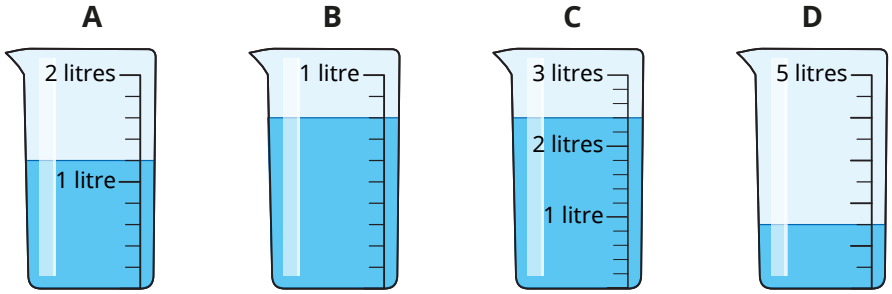


- Write <, > or = to compare the volumes.



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

Start with the smallest volume.

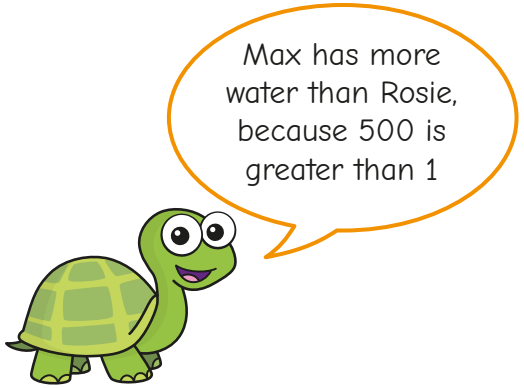


© White Rose Education 2022

Compare capacity and volume

Reasoning and problem solving

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



Do you agree with Tiny?

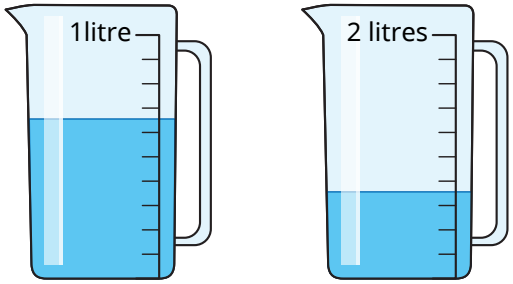
Explain your answer.

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

© White Rose Education 2022

Add and subtract capacity and volume

White Rose MATHS

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

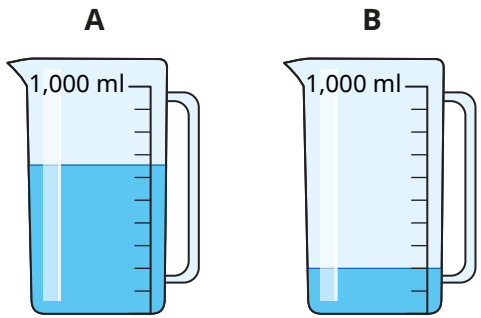
- Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)

© White Rose Education 2022

Add and subtract capacity and volume

Key learning

- Whitney has some jugs of water.



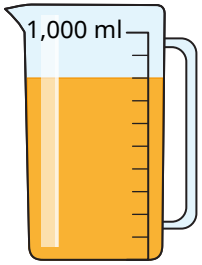
She pours all the water from jug A into jug B.

How much water is now in jug B?

- Alex has this orange juice in a jug.

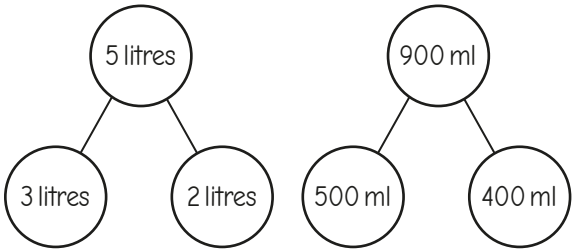
She drinks 300 ml.

How much orange juice is left in the jug?



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

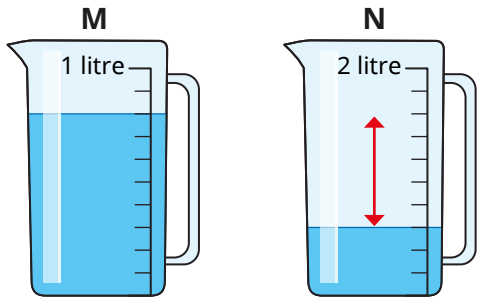
3 l 400 ml – 2 l	10 l 195 ml – 8 ml
10 l 195 ml – 3 l	3 l 400 ml – 400 ml

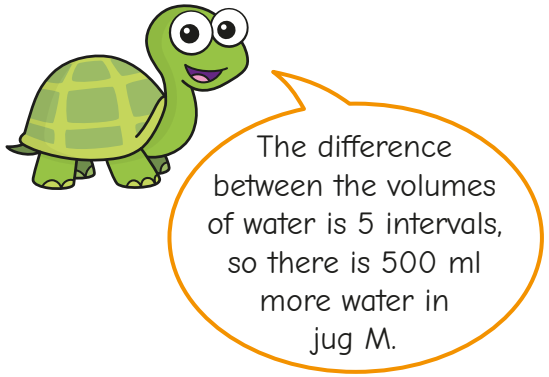
© White Rose Education 2022

Add and subtract capacity and volume

Reasoning and problem solving

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



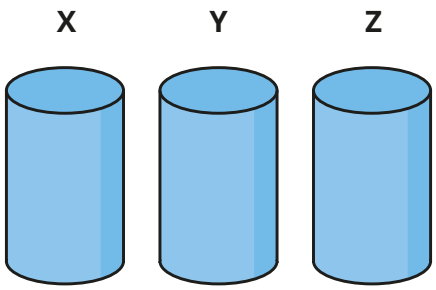


Do you agree with Tiny?

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

© White Rose Education 2022