Sum of the digits

The sum of the digits for a whole-number is 6.

All the digits are different.

What is the largest that the number could be? What is the smallest that the number could be?

Example: the sum of the digits for 214 is 7 (2 + 1 + 4 = 7)

SUPPORT

Examples:

24 is a 2-digit number. The sum of the digits is 6 *(2 + 4 = 6)*.

204 is a 3-digit number. The sum of the digits is 6 *(2 + 0 + 4 = 6)*.

Tip: *It is possible to make a 4-digit number where the sum of the digits is 6* ***if you use small digits.***

EXPLAIN

Agree or disagree:

'To make a large number when the sum of the digits is 6, you need to use a 5.'

'To make a large number where the sum of the digits is 6, use as many digits as possible.'

EXTEND

The sum of the digits for a whole-number is 11.

All the digits are different.

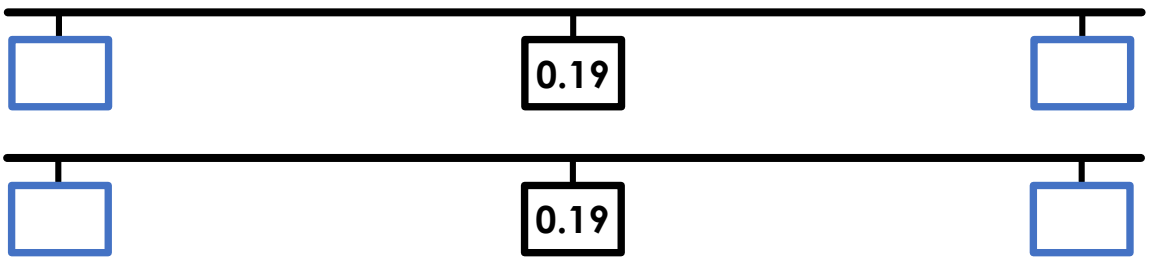
What is the largest that the number could be? What is the smallest that the number could be?

Decimals on a number line

0.19 is half-way between the numbers in the two blue boxes.

What numbers could be in the blue boxes?

Answer this question in two ways.



SUPPORT

Related examples:

1.9 is half-way between 1.8 and 2

1.9 is half-way between 1.6 and 2.2

EXPLAIN

Explain the mistakes:

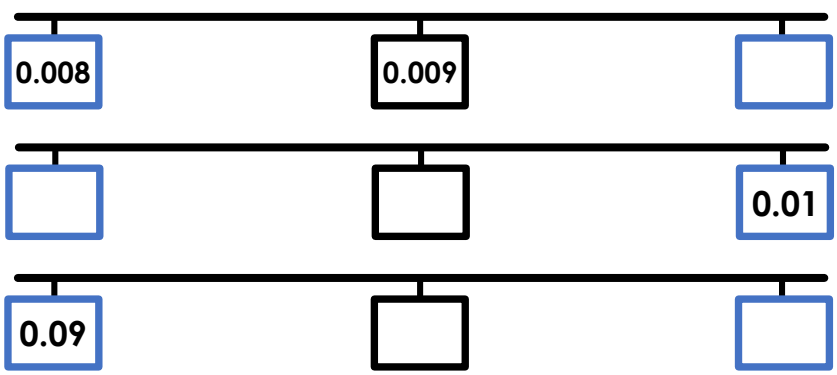
Example A:

Example B:

EXTEND

On each example, the black box is half-way between the two blue boxes.

Fill the gaps:



The café

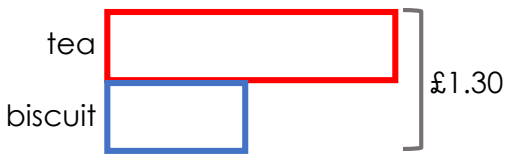
A cup of tea and a biscuit costs £1.30.

A cup of tea costs 60p more than a biscuit.

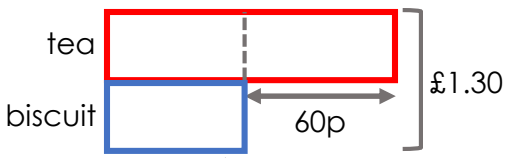
How much does a biscuit cost?

SUPPORT

STEP 1: tea + biscuit = £1.30



STEP 2: tea 60p more than biscuit

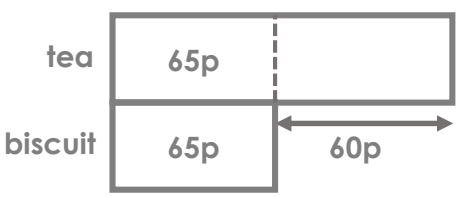


This bar model is split into 3 sections.

How big is each section?

EXPLAIN

Explain the mistake:



£1.30 ÷ 2 = 65p

Tea = £1.05

Biscuit = 65p

EXTEND

A cup of coffee and an apple costs £1.80.

The cup of coffee costs three times as much as the apple.

How much does a cup of coffee cost?

Sum and difference

The sum of two numbers is 9.

The difference between these two numbers is 4.

What are the numbers?

SUPPORT

Incorrect examples:

6 and 3 Sum = 9 (correct), difference = 3 (not correct)

6 and 2 Sum = 8 (not correct), difference = 4 (correct)

How can you make the difference between the numbers stay the same whilst increasing the sum?

EXPLAIN

30 and 10 have a sum of 40 and a difference of 20.

☐ and ☐ have a sum of 50 and a difference of 20.

☐ and ☐ have a sum of 50 and a difference of 30.

Describe how you can use the answer to one question to help you work out the answer to the next question.

EXTEND

Agree or disagree?

'The difference between two whole numbers is odd. This means one number must be odd and the other number must be even.'

'It's possible for the difference between two numbers to be the same as their sum.'

Four numbers challenge

The sum of four whole numbers is 23.

The difference between the smallest and the largest number is 6.

All four numbers are different.

What could the four numbers be?

*Find **all the possible answers** to this question.*

SUPPORT

Incorrect example:

'Maybe the smallest number is 5 and the largest number is 11.'

5 ___ ___ 11 ***5 + 11 = 16***

'These two numbers would have to add to 7'

*'This way **doesn't** work. If my other numbers are 4 and 3 my four numbers would have a sum of 23. However, the difference between the smallest and the largest number would be too big.'*

EXPLAIN

Explain how you know that this statement is correct:

'The largest number must be more than 7'

EXTEND

The sum of four numbers is 25.

The difference between the smallest and the largest number is 4.

All four numbers are multiples of 0.5

What could the four numbers be?

*Find **all the possible answers** to this question.*

One answer: 4, 4.5, 6.5, 8

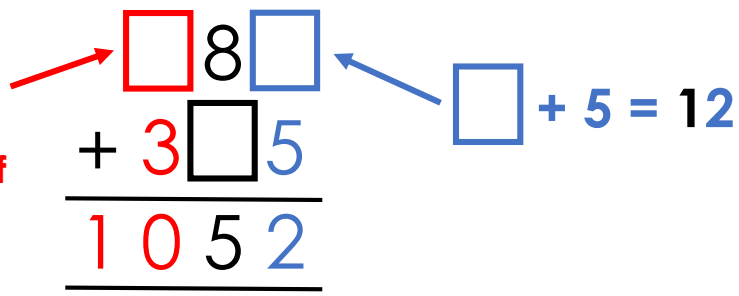
Missing digits addition

Fill in the missing digits in this calculation:

$$\square 8 \square + 3 \square 5 = 1052$$

SUPPORT

The hundreds value must be more than 5 to make a sum of 1052



EXPLAIN

Which of these calculations can be done **in more than one way?**

$$\begin{array}{r} \square 6 \square \\ +\square\square 3 \\ \hline 345 \end{array} \qquad \begin{array}{r} \square\square 7 \\ +\square 3 \square \\ \hline 586 \end{array} \qquad \begin{array}{r} \square 5 \square \\ +4 \square 8 \\ \hline 1148 \end{array}$$

EXTEND

Write a missing digits addition question. Requirements:

- The calculation is a 3-digit number plus a 3-digit number.
- At least 3 of the digits are hidden. The sum is shown.
- Your question can be answered in either 2, 3 or 4 ways.

Example: $\square 8 \square + \square\square 3 = 524$

Possible answers: 181+363=524, 281+263=524, 381+163=524

Missing digits subtraction

Fill in the missing digits in this calculation:

$$6\square 2 - \square 3\square = 243$$

SUPPORT

An example of a similar question, with the solution shown step-by-step:

Question:

$$\begin{array}{r} 4\square 9 \\ -\ \square 7\square \\ \hline 184 \end{array}$$

Step 1:

$$\begin{array}{r} 4\square 9 \\ -\ \square 75 \\ \hline 184 \end{array}$$

9 – 5 = 4

Step 2:

$$\begin{array}{r} 3\,{}^{1}\!\not{4}\,{}^{1}\!5\,9 \\ -\ \square 75 \\ \hline 184 \end{array}$$

15 – 7 = 8

Step 3:

$$\begin{array}{r} 3\,{}^{1}\!\not{4}\,{}^{1}\!5\,9 \\ -\ 275 \\ \hline 184 \end{array}$$

3 – 2 = 1

EXPLAIN

Complete these missing digit questions. Then, rank the questions by difficulty from easiest to hardest. Explain your choice.

Question A:

$$3\square 7 - \square 5\square = 83$$

Question B:

$$4\square 6 - \square 7\square = 158$$

Question C:

$$8\square 9 - \square 2\square = 237$$

EXTEND

Complete the subtraction calculation using every digit 0-9. Position the digits 0 and 8 as shown:

$$\square\,0\,\square\,8 - \square\square\square = \square\square\square$$

Rounding money

Rounded to the nearest £10, Alex has £250.

Rounded to the nearest £100, Jim has £400.

Alex and Jim have an exact amount in £ pounds.

What is the greatest possible difference between the amount of money that Alex and Jim have?

SUPPORT

This picture shows the greatest possible difference:

EXPLAIN

What is the largest amount that Jim could have?

(a) £399

(b) £404

(c) £449

EXTEND

Jim has £98 more than Alex.

How much money could Alex have?

List all possible amounts.

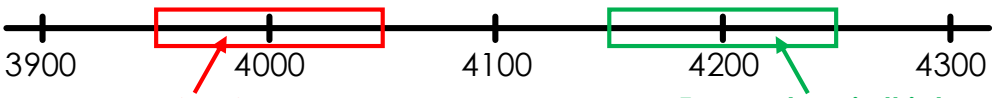
Rounding puzzles

Part 1: What is the largest whole number that, when rounded to the nearest 100, is 4000?

Part 2: What is the largest whole number that, when rounded to the nearest 500, is 4000?

SUPPORT

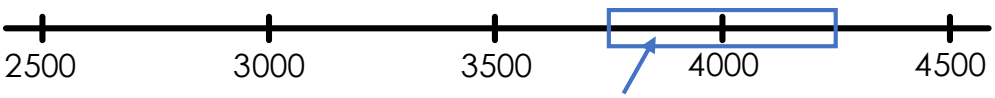
This number line counts in steps of **100:**



For numbers in this box, the nearest multiple of 100 is 4000. *Example: 4032 is nearer to 4000 than 4100*

For numbers in this box, the nearest multiple of 100 is 4200. *Example: 4176 is nearer to 4200 than 4100*

This number line counts in steps of **500:**



For numbers in this box, the nearest multiple of 500 is 4000.
Example: 3823 is nearer to 4000 than 3500

EXPLAIN

Round 2670 to the nearest:

(a) 100

(b) 200

(c) 50

(d) 1000

Challenge: *round 2670 to another number. The answer must be* ***different*** *than the answers to questions a→d.*

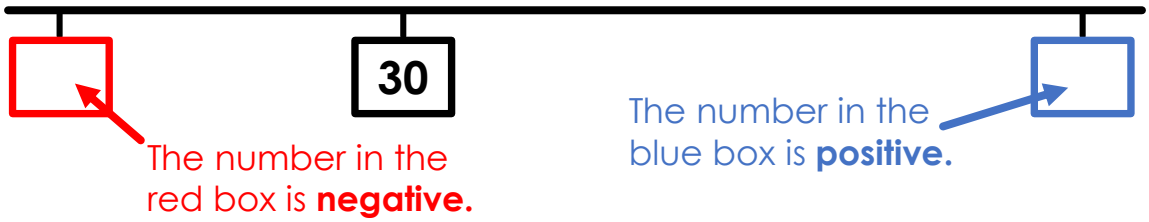
EXTEND

Rounded to the nearest ☐, E is 600.

What is the greatest possible whole-number value of E?

Number line challenge

Look at this number line:



What numbers could be in the red and blue boxes?

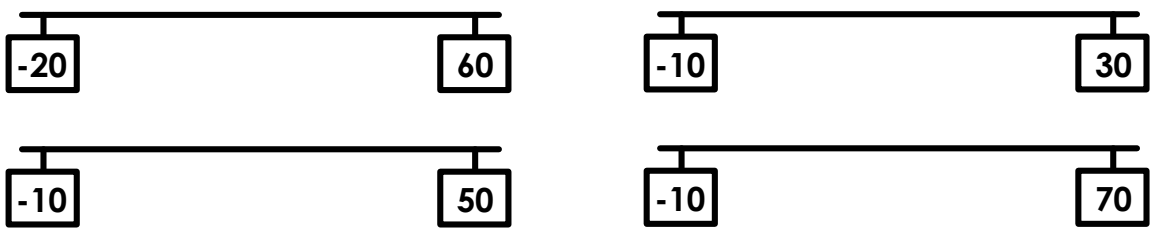
Challenge: think of two possible pairs of answers.

SUPPORT

Part-finished example:

EXPLAIN

Mark the position of 20 on each number line. *What do you notice?*



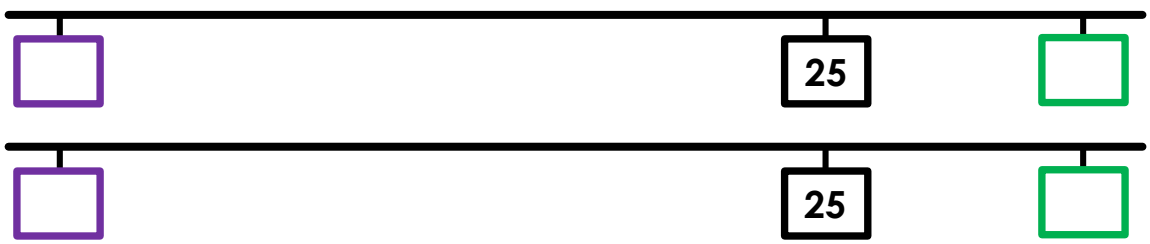
EXTEND

The number in the purple box is negative.

25 is positioned $\frac{3}{4}$ of the distance from the purple box to the green box.

What numbers could be in the purple and green boxes?

Think of two possible pairs of answers.



Remainder of one-half

Complete the calculation using digits 0 → 9. You can only use each digit once. Position the digits 1, 2 and 8 as shown.

$$\square\square \div 8 = \square\frac{1}{2}$$

Level 1: I can find an answer

Level 2: I can find different answers

Level 3: I know how many possible answers there are

SUPPORT

When dividing by 2, a remainder of 1 is equivalent to $\frac{1}{2}$

Example: 13 ÷ 2 = 6 remainder 1 = $6\frac{1}{2}$

When dividing by 4, a remainder of 2 is equivalent to $\frac{1}{2}$

Example: 26 ÷ 4 = 12 remainder 2 = $6\frac{1}{2}$

When dividing by 8, a remainder of 4 is equivalent to $\frac{1}{2}$

Example: 52 ÷ 8 = 6 remainder 4 = $6\frac{1}{2}$

EXPLAIN

Agree or disagree:

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

'The number in the blue box is the same is the number in the red box.'

EXTEND

Complete the calculation using digits 0 → 9. You can only use each digit once. Position the digits 4 and 8 as shown.

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

Level 1: I can find an answer

Level 2: I can find different answers

Level 3: I know how many possible answers there are

Part-finished number sentences 1

$10 - 8 < \square - \square$

$20 > \square \times 3$

$\square + 4 = 15 - \square$

Fill the boxes, using each of these numbers once:

4, 5, 6, 7, 8

SUPPORT

Tip 1: There is only one box where the 8 can go. Find it.

Tip 2: Work out which of the numbers **can't** go in this space.

$20 > \square \times 3$

Think about where to place these numbers.

EXPLAIN

Look at these answers to the original question. **Spot the mistakes.**

Mistake 1:

$10 - 8 < 8 - 7$

$20 > 4 \times 3$

$5 + 4 = 15 - 6$

Mistake 2:

$10 - 8 < 8 - 4$

$20 > 6 \times 3$

$6 + 4 = 15 - 5$

EXTEND

Order the number sentences by the ***number of possible answers*** (from the fewest to the most possible answers).

For this task, only positive whole numbers are used.

$8 \times \square = 30 - \square$

$53 - \square = 48 + \square$

$60 \div \square = 10 + \square$

$28 \div \square = \square \times 2$

Part-finished number sentences 2

$\square \times 3 = 18 + \square$

$2 < 9 - \square$

$\square \div 2 < 4$

$2 \times 2 \times 2 \times 2 < \square + 8$

Fill the boxes, using each of these numbers once:

3, 6, 7, 8, 9

SUPPORT

Tip 1: Only one of the numbers can go here.

$2 \times 2 \times 2 \times 2 < \square + 8$

Tip 2: Work out if the number in this box more or less than 8.

$\square \div 2 < 4$

EXPLAIN

Do you **agree or disagree** with these statements?

$2 < 9 - \square$

Mo: 'The number red box must be less than 8.'

Dan: 'The number red box must be less than 6.'

EXTEND

$\square \times 3 = 18 + \square$

$2 < 9 - \square$

$\square \div 2 < 4$

$2 \times 2 \times 2 \times 2 < \square + 8$

Which of these sets of numbers can be used to fill the gaps?

Set A: 5, 6, 7, 8, 9

Set B: 9, 8, 7, 5, 3

Set C: 6, 6, 9, 9, 9

Subtraction number sentences

H – 25 < 35

80 – H < 39

H is a multiple of 6

Find all the possible values for H

SUPPORT

□ – 25 = 35

H – 25 < 35 H must be □ or **more/less.**

80 – □ = 39

80 – H < 39 H must be □ or **more/less.**

circle correct word

EXPLAIN

True or false? ✓ ✗

60 – 25 < 35	80 – 39 < 39
25 – 60 < 35	80 – 41 < 39
62 – 25 < 35	80 – 42 < 39

EXTEND

Change one number used in the question.

Making this change means there are now **three more** possible values for H.

Do in different ways.

Find the factors

Which of the digits from 1 to 9 are factors of 532?

List the digits that you knew were/were not factors of 532 ***without*** *having to do any calculations.*

SUPPORT

Tip 1: 532 has 2 ones. That helps us to know whether 2 and 5 are factors of 532.

Tip 2: use a related multiplication fact. For example, $6 \times 90 = 540$. Therefore, is 6 a factor of 532?

Tip 3: for some digits it might be easiest to perform a division calculation.

EXPLAIN

$532 \div 4 = 133$. This shows that 4 is a factor of 532.

Agree or disagree:

'We know that 4 is a factor of 532. This means that 8 must also be a factor of 532.'

EXTEND

List all the 2-digit factors of 288.

Reasoning sentence stems:

I know that ☐ *is a 2-digit factor of 288 so* ☐ *must also be a factor of factor of 288.*

The first 2-digit number I tried was… because…

I know I have found all the possible answers because…

Multiplication missing digits

$$\begin{array}{r} 6\square \\ \times\ \square 3 \\ \hline 204 \\ 2720 \\ \hline 2924 \end{array}$$

What are the missing digits?

SUPPORT

$$\begin{array}{r} 6\square \\ \times\ \square 3 \\ \hline 204 \\ 2720 \\ \hline 2924 \end{array}$$

Work out this digit first.

$6\square \times 3 = 204$

Clue: $60 \times 3 = 180$

EXTEND

$$\begin{array}{r} \square\square \\ \times\ \square 7 \\ \hline 322 \\ 3680 \\ \hline 4002 \end{array}$$

What are the missing digits?

EXPLAIN

Method 1: 37×24

	30	7
20	600	140
4	120	28

600
140
120
28
888

Method 2: 37×24

$$\begin{array}{r} 37 \\ \times\ 24 \\ \hline 148 \\ 740 \\ \hline 888 \end{array}$$

What are the similarities and differences between these methods?

Number detective

The sum of the digits in a 2-digit number is 13.

The number is a multiple of 4.

What is the number?

SUPPORT

Example:

92 is a 2-digit number (the digits are 9 and 2)

92 is a multiple of 4 ($23 \times 4 = 92$)

The sum of the digits of 92 is 11 ($9 + 2 = 11$)

Tip: start by listing the digits that add up to 13.

EXPLAIN

The sum of the digits of 64 is 10.

It is possible to keep the sum of the digits the same but change the size of the number by…

Find different ways.

EXTEND

The sum of the digits of a number is 6.

Each digit is different.

What is largest that the number can be?

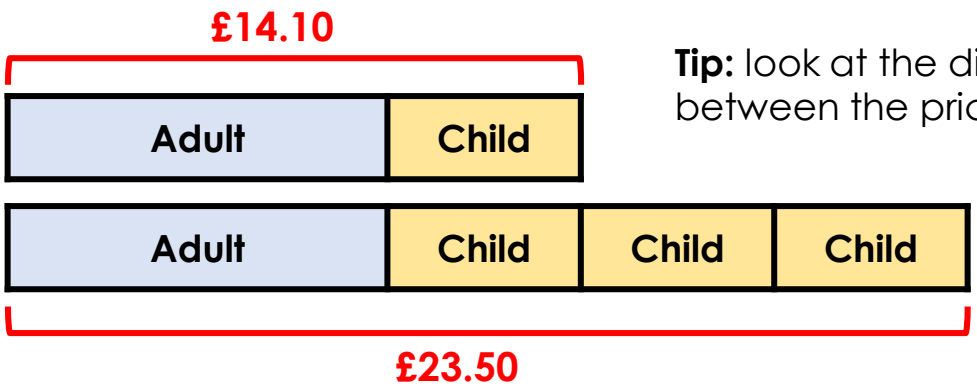
Ticket prices

It costs **£14.10** for **an adult and a child** ticket to the zoo.

It costs **£23.50** for **an adult and three child** tickets to the zoo.

What is the cost for one child ticket at the zoo?

SUPPORT



Tip: look at the difference between the prices.

EXPLAIN

Aquarium Prices:

Adult ticket: £12.80 Child ticket £5.30

Family ticket: £40 (2 adults + all children)

Complete the statement:

'A family with two adults should buy a family ticket if they take ☐ or more children to the Aquarium.'

EXTEND

It costs **£23.60** for **three adult and two child** tickets at the cinema.

It costs **£14.60** for **two adult and one child** tickets at the cinema.

What is the cost for one adult cinema ticket?

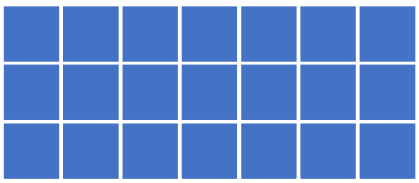
Tip: consider the difference between these total costs

Change the perimeter

For this task you will need some small squares.

Make a rectangle with an area of 24 squares which has the largest possible perimeter.

Example:

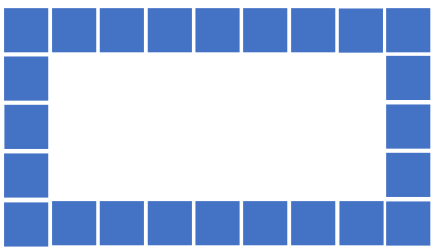


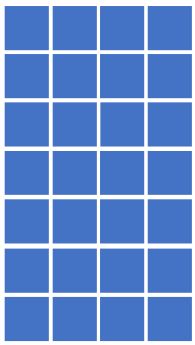
Area of this shape = 21 squares

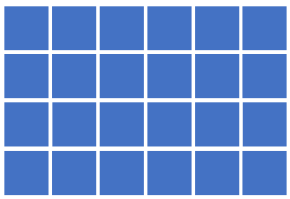
Perimeter of this shape = 20

SUPPORT

Which of these shapes have an area of 24 squares?





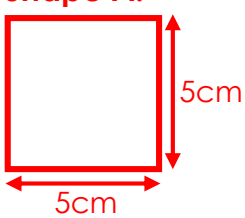


Explain the mistakes.

EXPLAIN

Order these shapes by area (smallest to largest). Then order the shapes by perimeter (smallest to largest).

Shape A:

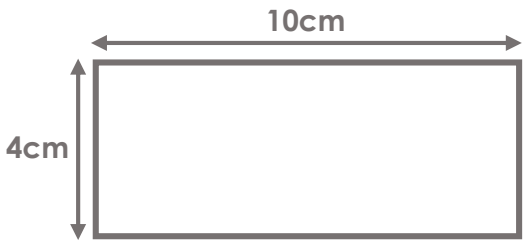


Shape B:

Shape C:

What do you notice?

EXTEND



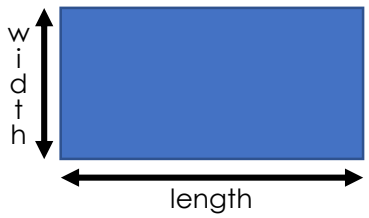
*Draw a rectangle with a **larger area and a smaller perimeter** than this rectangle. Label the length and width of your rectangle.*

Rectangle length

The length of the rectangle is double its width.

The area of the rectangle, rounded to the nearest 100cm², is 200cm².

The length and width of the rectangle are whole numbers (in cm).



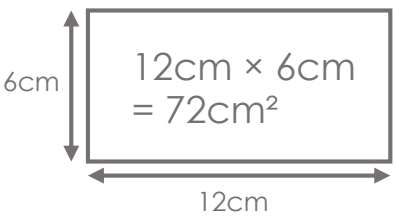
NOT TO SCALE

What is the smallest that the length of rectangle can be?

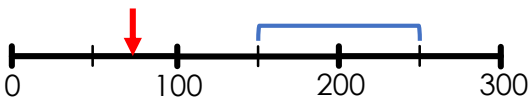
SUPPORT

Example:

12cm is double 6cm.



72cm² does not round to 200cm² so this example **does not** work.



EXPLAIN

True or false? ✓ ✗

Statement 1: 'Doubling the length of a rectangle's sides doubles the perimeter of the rectangle.'

Statement 2: 'Doubling the length of a rectangle's sides doubles the area of the rectangle.'

EXTEND

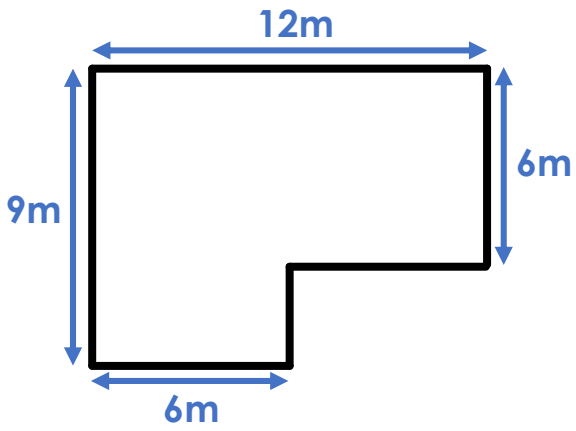
Draw a rectangle. Label the length and width.

Draw a new rectangle with half the length and double the width.

Agree or disagree:
'The area of these two rectangles is the same.'

Describe what you notice.

Compound shape

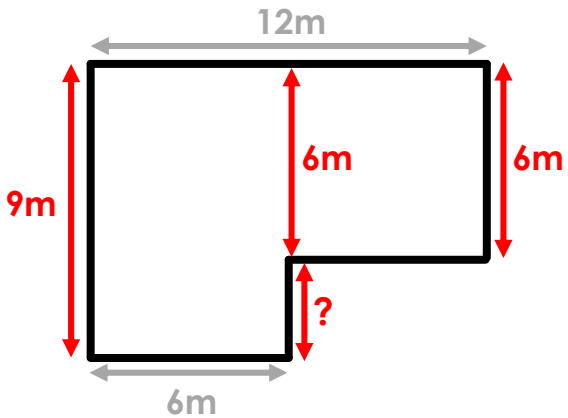


What is the area of the shape?

Can you work it out in different ways?

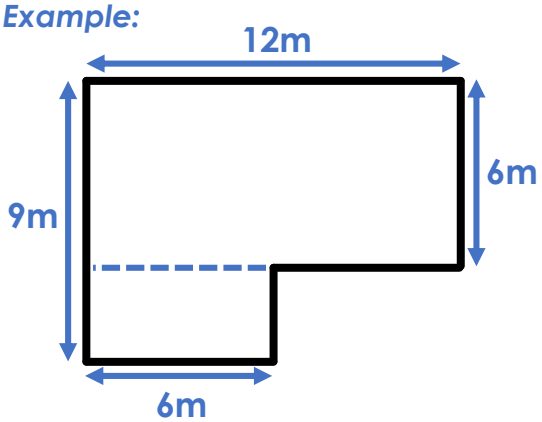
SUPPORT

Calculate missing lengths:



Split shape into rectangles

Example:



EXPLAIN

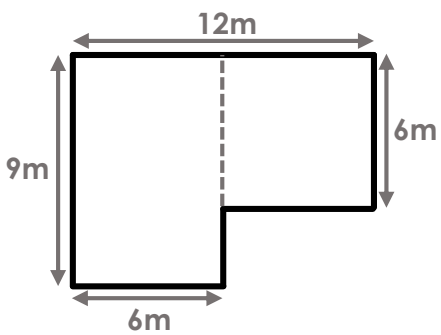
Explain the mistake:

$9m \times 6m = 54m^2$

$12m \times 6m = 72m^2$

$54m^2 + 72m^2 = 126m^2$

Area = $\underline{126m^2}$

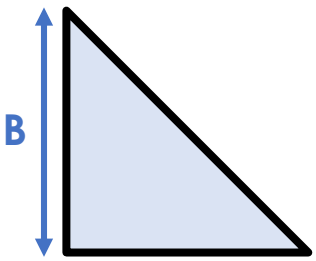


EXTEND

Design a compound shape with an area of $79cm^2$.

Label the length of the sides.

Right-angled triangle area



The area of an isosceles right-angled triangle is **less than** 150cm².

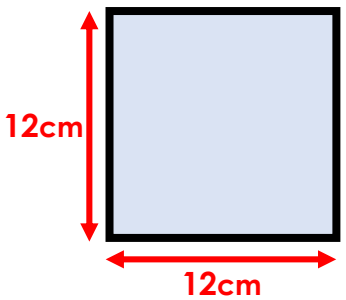
What is the largest possible value for length B?

Length B is a whole number.

SUPPORT

Area of this square:

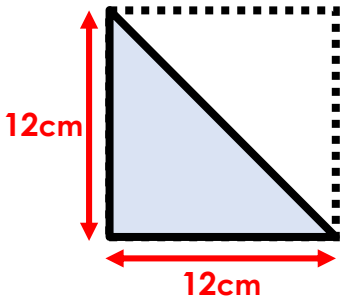
12cm × 12cm = **144cm²**



not to scale

Area of this triangle:

12cm × 12cm ÷ 2 = **72cm²**



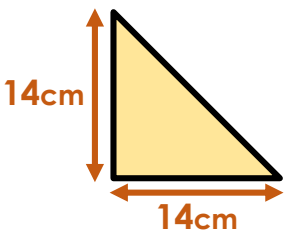
not to scale

EXPLAIN

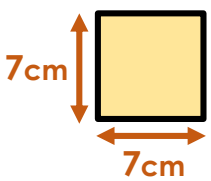
Which shape is the odd one out?

Note: drawings not to scale

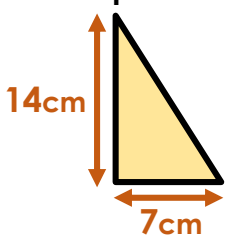
Shape A:



Shape B:

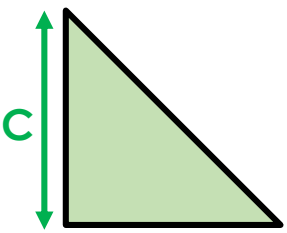


Shape C:



Challenge: *Think of a reason why* ***each shape*** *could be the odd one out.*

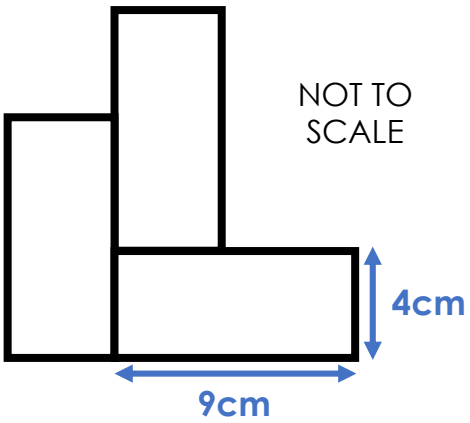
EXTEND



Rounded to the nearest 100cm², the area of an isosceles right-angled triangle is 200cm².

Find all the possible values of length C.

Combined shapes



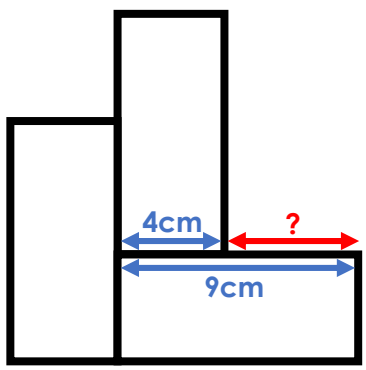
This shape is made using three identical rectangles.

Each rectangle has a length of 9cm and a width of 4cm.

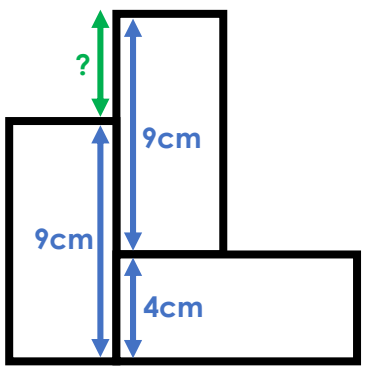
What is the perimeter of the shape?

SUPPORT

How long is the red line?

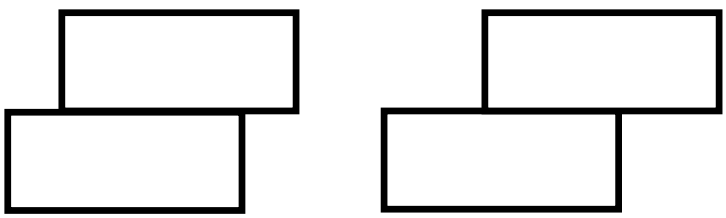


How long is the green line?



EXPLAIN

Agree or disagree? ✓ ✗



'These shapes have different perimeters.'

EXTEND

Challenge 1: add one more identical rectangle to the start shape to make the perimeter as large as possible.

Challenge 2: add one more identical rectangle to the start shape so that the perimeter of the shape stays the same.

Combined weights

Ben and Sam weigh 90kg in total.

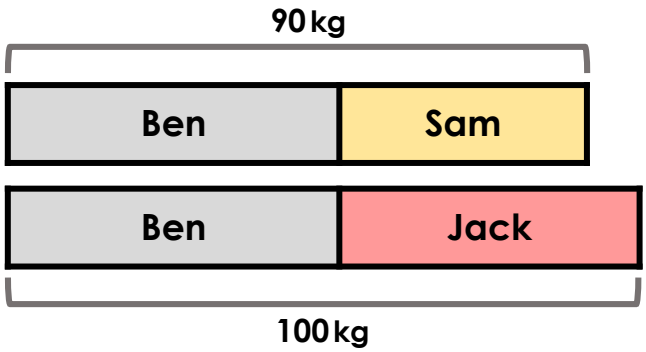
Jack and Ben weigh 100kg in total.

Sam and Jack weigh 80kg in total.

How heavy is Sam?

SUPPORT

Compare the weight of Sam and Jack:



Ben and Sam weigh 90 kg

Ben and Jack weigh 100 kg

Sam and Jack weigh 80kg in total.

[ ] weighs [ ] kg more than [ ]

EXPLAIN

Stan is taller than Zack.

Stan is shorter than Tim.

Zack is [ ] than Tim.

Fill in the missing word.

Explain your choice.

EXTEND

Julie and Steph weigh 80kg in total.

Alice and Julie weigh 80kg in total.

Agree or disagree:

'Alice, Julie and Steph must all weigh 40kg.'

Steph and Alice must weigh the same.'

Julie and Steph must weigh the same.'

Sports ball weights

A golf ball and a tennis ball weigh 104g in total.

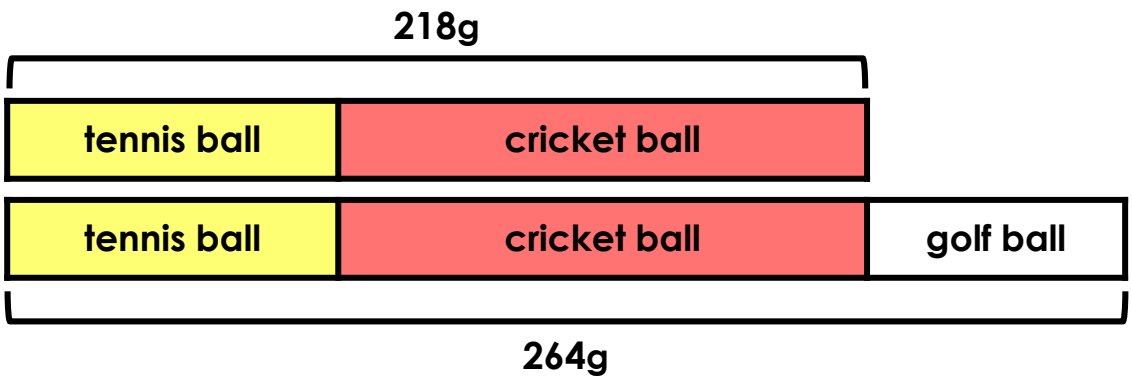
A tennis ball and a cricket ball weigh 218g in total.

A tennis ball, a golf ball and a cricket ball weigh 264g in total.

How heavy is a cricket ball?

SUPPORT

Tip: start by working out the weight of a golf ball



EXPLAIN

A lacrosse ball and a baseball weigh 295g in total.

A baseball and hockey ball weigh 305g in total.

Agree or disagree:

'This shows that a lacrosse ball is lighter than a baseball.'

'This shows that a hockey ball is heavier than a lacrosse ball.'

EXTEND

A football and a volleyball weigh 700g in total.

A netball and a football weigh 850g in total.

A volleyball and a netball weigh 690g in total.

How heavy is a volleyball?

Going surfing

It costs £7 to hire a surfboard plus £3 per half-hour used.

Kate goes surfing for 3 hours. It costs her ☐ to hire the surfboard.

Jack goes surfing for ☐ hours. It costs him £34 to hire the surfboard.

SUPPORT

Example:

Nia goes surfing for $1\frac{1}{2}$ hours.

It costs her **£16** to hire the surfboard.

EXPLAIN

Imagine that the prices were changed to the following:

It costs £10 to hire a surfboard plus £2.50 per half-hour used.

Is it now cheaper or more expensive to hire a surfboard?

EXTEND

Raja goes surfing for 3 hours 45 minutes. He expected to pay £29.50.

The shopkeeper charges him £31. They argue about the cost.

Why did Raja think it would cost £29.50?
Why did the shopkeeper charge £31?

Dot pattern sequence

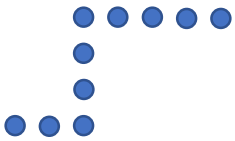
Picture 1:

4 dots

Picture 2:

7 dots

Picture 3:



10 dots

How many dots are there in:

(a) Picture 8

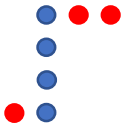
(b) Picture 16

SUPPORT

Picture 1:

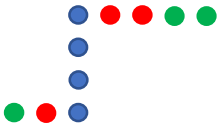
4 dots

Picture 2:



7 dots

Picture 3:



10 dots

Notice: There are 4 dots in the first pattern. Each time, 3 dots are added to make the next picture.

EXPLAIN

Which sequence is the odd one out?

4, 7, 10… **4, 8, 12…** **3, 6, 9…**

*Think of a reason why **each sequence** could be the odd one out.*

EXTEND

Agree or disagree?

Kara: *'Doubling the number of dots in the 8th picture **does not** give you the number of dots in the 16th picture.'*

Jen: *'There are 10 dots in the 3rd picture, so there will be 50 dots in the 15th picture.'*

Lena: *'There is a picture with 361 dots.'*

Number sequences

The first 3 terms of a sequence are positive whole numbers.

The second negative number in the sequence will be -7.

Write the first 3 terms of the sequence.

Example: 9, 7, 5…
The second negative number in this sequence will be -3.

SUPPORT

Tip 1: make numbers in the sequence get smaller

10, 7, 4… ✓

4, 7, 10… ✗

Every number in this sequence will be positive

Tip 2: keep the difference between the numbers the same

10, 7, 4… ✓

10, 7, 3… ✗

Tip 3: the difference between the numbers is more than 3

10, 7, 4… ✗

The first two negative numbers in this sequence are -2 and -5

EXPLAIN

Circle the sequences that will include the number 0:

98, 91, 84… **725, 700, 675…** **580, 540, 500…**

Explain how you know.

EXTEND

Find another possible answer to this question.

The first number in your new sequence must be more than 50.

Change the difference between the numbers in your new sequence.

Example: if the numbers in your first sequence went down by 5, you could make the numbers in your second sequence go down by 6.

My secret number

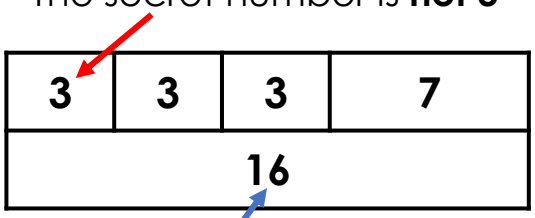
I have a secret number. I multiply my secret number by 3 and add 7. This makes a whole number in the 20s (20→29).

What could my secret number be?

Find all the possible values for the secret number.

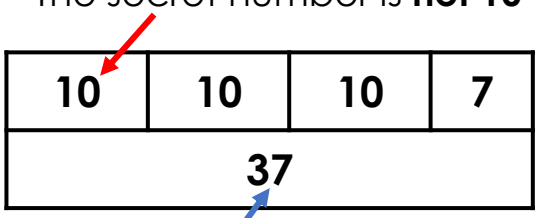
SUPPORT

The secret number is **not 3**



This number is below 20

The secret number is **not 10**



This number is above 29

EXPLAIN

I have a secret number. I multiply my secret number by 3 and **subtract** 7. This makes a whole number in the 20s (20→29).

What could my secret number be?

How many possible values are there for the secret number now?

EXTEND

I have a secret number.

I multiply my secret number by ☐ and subtract ☐.

This makes a whole number in the 40s (40→49).

What could my secret number be?

*Fill in the red boxes so there are **two possible values** for the secret number.*

Driving to work

Lorna has a $\frac{3}{4}$ hour drive to work. She works every day from Monday to Friday, although she only works until lunchtime on Wednesday.

How long, in hours and minutes, does she spend driving to work each week?

SUPPORT

Tip 1: Lorna **does not** spend $\frac{3}{4}$ hour driving each day. Why?

Tip 2: Think about how the amount of driving Lorna does on Wednesday is the same/different to Lorna's other working days.

Tip 3: $\frac{3}{4}$ hour = ☐ minutes

EXPLAIN

Explain the mistakes:

Mistake 1:

$$\frac{3}{4} \times 5 = \frac{15}{4}$$

$$\frac{15}{4} = 3\frac{3}{4} \text{ hours}$$

Mistake 2:

$$\frac{3}{4} \times 10 = \frac{30}{4}$$

$$= 8 \text{ hours } 30 \text{ mins}$$

Mistake 3:

$$45 \text{ minutes} \times 10$$

$$= 450 \text{ minutes}$$

$$= 4 \text{ hours } 50 \text{ mins}$$

EXTEND

As well as not working over the weekend, Lorna has 35 days of holiday per year (this includes Bank Holidays).

How long does Lorna spend driving to work per year?

Give your answer in days, hours and minutes.

Clothes shop sales

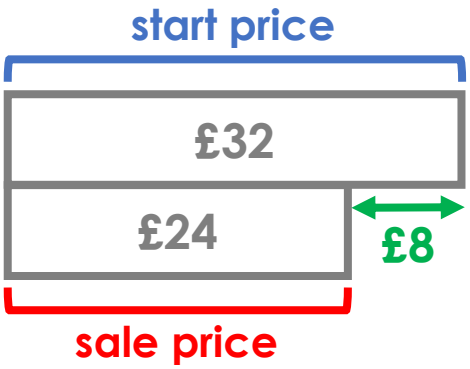
A pair of trainers cost £32.

The shop had a sale.

Now the pair of trainers cost £24.

What is the percentage discount?

SUPPORT



Tip: think about how many lots of £8 in £32. This will allow you to work out the discount ***as a fraction.*** Then work out the percentage discount.

EXPLAIN

Explain the mistake:

'The trainers are £8 cheaper in the sale.'

'£8 is one-third of £24.'

'One-third as a percentage is 33% so the answer is 33%.'

EXTEND

All pairs of shoes are 25% cheaper in the sale.

The sale price for these shoes is £48.

How much did the shoes cost before the sale?

Pages read

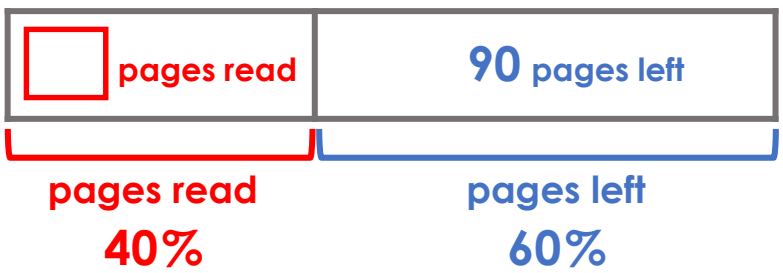
I have read 40% of my book.

I have 90 pages left to read.

How many pages have I read so far?

SUPPORT

This bar model represents the question:



90 pages = 60%

pages = 20%

pages = 40%

EXPLAIN

Explain the mistakes:

Mistake 1:

40% of 90 = 36

Answer: 36 pages

Mistake 2:

60% of the book is 90 pages

10% of the book is 15 pages

The whole book = 150 pages

Answer: 150 pages

EXTEND

45 is 60% of 75

24 is 40% of ☐

45 is ☐ % of 75

☐ is 60% of 75

Athletics club

In week 1 there were twice as many girls as boys at athletics club.

Six more girls join athletics club in week 2. Now for every boy at athletics club there are three girls.

How many children go to athletics club in week 2?

SUPPORT

Week 1:

Girls ☐ ☐

Boys ☐

Twice as many girls as boys.

We **don't know** how many children in total yet.

Week 2:

Girls ☐ ☐ 6

Boys ☐ girls that join

For every boy there are three girls.

We **can** now work out how many children in total.

EXPLAIN

Which answer? *Explain the mistake*

There are three times more boys than girls in tennis club. There are 36 children in total. **How many girls go to tennis club?**

Answer 1:

Boys ☐ ☐ ☐

Girls ☐ $36 \div 4 = 9$

9 girls

Answer 2:

Boys ☐ ☐ ☐

Girls ☐ $36 \div 3 = 12$

12 girls

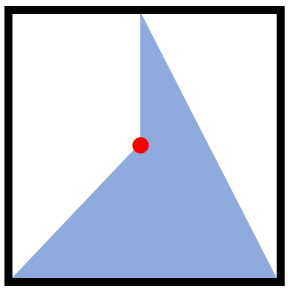
EXTEND

Question 1: In Carus Park School there are 3 girls for every 2 boys. There are 90 children in Carus Park School. ***How many boys?***

Question 2: In Springvale School there are 3 boys for every 2 girls. There are 90 boys in Springvale School. ***How many children?***

Question 3: In Mayfield School there are 3 girls for every 2 boys. There are 90 boys at Mayfield School. ***How many girls?***

Fraction of square



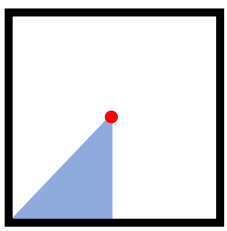
What fraction of the square is blue?

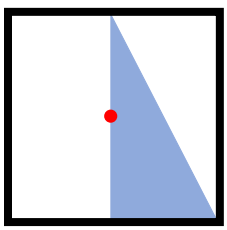
The red spot is in the middle of the square.

SUPPORT

Tip:

- *Split the shape into two triangles.*
- *Each triangle is what fraction of the square?*
- *Add these fractions.*

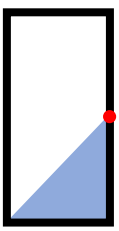




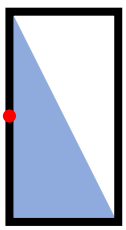
EXPLAIN

Explain the mistake:

'I split the shape into two triangles. I worked out the fraction of each triangle and added these fractions. The answer is $\frac{3}{4}$.



$\frac{1}{4}$

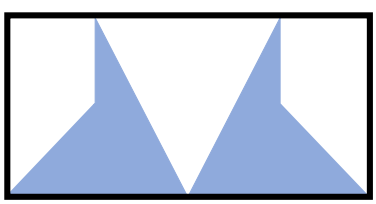


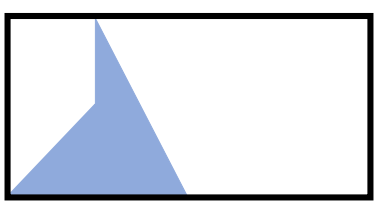
$\frac{1}{2}$

$$\frac{1}{4} + \frac{1}{2} = \frac{3}{4}$$

EXTEND

What fraction of each shape is shaded?





Adding fractions

$$\frac{\square}{6} + \frac{1}{\square} = \frac{\square}{3}$$

The answer must be a proper fraction

Level 1: I can find a way

Level 2: I can find different ways

Level 3: I know how many ways there are

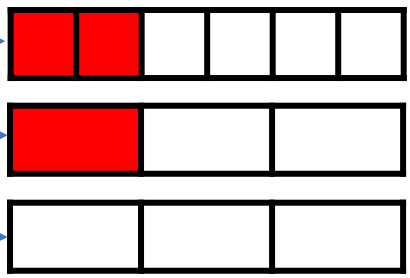
SUPPORT

Example:

This is $\frac{2}{6}$ →

This is $\frac{1}{3}$ →

Draw $\frac{2}{6} + \frac{1}{3}$ →



$$\frac{\boxed{2}}{6} + \frac{1}{\boxed{3}} = \frac{\square}{3}$$

EXPLAIN

Which of the fractions below **can not** be used in this calculation?

$$\frac{1}{2} \quad \frac{1}{3} \quad \frac{1}{4} \quad \frac{1}{6} \quad \frac{1}{12}$$

$$\frac{\square}{6} + \frac{1}{\square} = \frac{\square}{3}$$

Explain why the fractions you have chosen cannot be used.

EXTEND

Look at this question: $\frac{\square}{4} + \frac{\square}{8} = \frac{\square}{12}$

Nick: *'This is not possible because 8 is not a factor of 12.'*

Sam: *'This can only be done by making* $\frac{6}{12}$ *as this is one-half.'*

Jim: *'There are different ways that this can be done.'*

Fractions of an amount

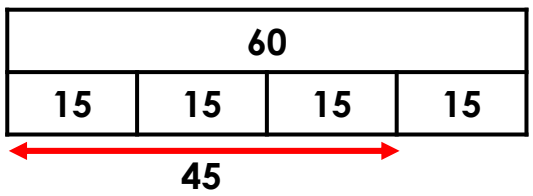
$\frac{2}{\square}$ of $\square$ = 32

Level 1: I can find an answer

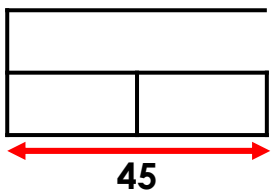
Level 2: I can find three different answers

SUPPORT

Bar model for $\frac{3}{4}$ **of 60 = 45**



Part of bar model for $\frac{2}{\square}$ **of** $\square$ **= 45**



EXPLAIN

$\frac{\square}{5}$ of $\square$ = 60

'When the number in the red box increases, the number in the blue box ***increases/decreases****.'*

Which is the correct word to finish this statement? Explain.

EXTEND

In how many ways can each of the questions below be answered?

Note: the fractions are always proper fractions.

Question 1:

$\frac{3}{\square}$ of $\square$ = 60

Question 2:

$\frac{\square}{3}$ of $\square$ = 60

Question 3:

$\frac{5}{\square}$ of $\square$ = 60

Question 4:

$\frac{\square}{3}$ of $\square$ = 60

Improper fractions

$$\frac{17}{\square} = 2\frac{\square}{\square}$$

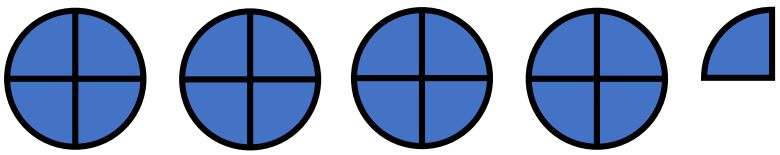
Level 1: I can find an answer

Level 2: I can find different answers

Level 3: I know how many possible answers there are

SUPPORT

This is seventeen **quarters**:



$$\frac{17}{4} = 4\frac{1}{4}$$

When the denominator used is 4, there are 4 whole circles and one quarter.

*To answer the question, try a different denominator that gives **fewer** circles.*

EXPLAIN

Circle the fractions that are **more than 3 and less than 4.**

$\frac{14}{3}$ $\frac{14}{4}$ $\frac{21}{7}$ $\frac{11}{3}$ $\frac{19}{5}$

How did you work it out?

EXTEND

Fill in the missing numerators so the fractions are written **in order of size**, from smallest to largest:

$$\frac{\mathbf{21}}{\mathbf{5}} \quad \frac{\square}{\mathbf{6}} \quad \frac{\square}{\mathbf{7}} \quad \frac{\mathbf{39}}{\mathbf{8}}$$

smallest **largest**

Make 2 and a quarter

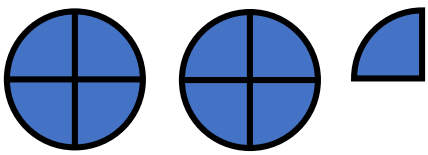
$\frac{\square}{\square} \times \square = 2\frac{1}{4}$

Level 1: I can find an answer

Level 2: I can find three different answers

SUPPORT

This is two and a quarter:

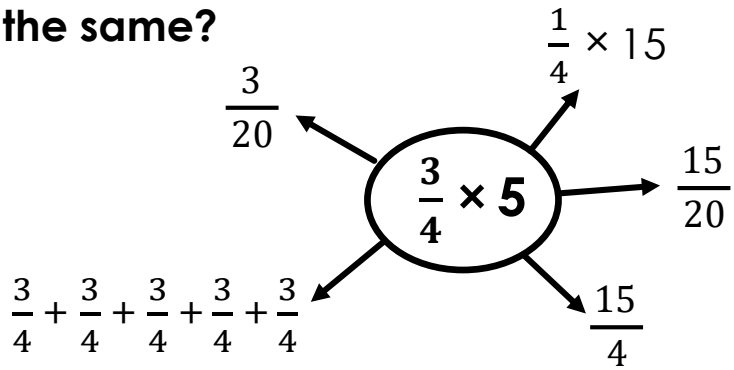


Two and a quarter is ☐ quarters.

Two and a quarter is ☐ eighths.

EXPLAIN

Is it the same?



EXTEND

$\frac{\square}{8} \times \square = 3\frac{3}{4}$

single-digit number

Level 1: I can find an answer

Level 2: I can find different answers

Level 3: I know how many possible answers there are

Fill in the missing numerators so the fractions are written **in order of size**, from smallest to largest:

Make one and a quarter

$$\frac{3}{\square} + \frac{\square}{\square} = 1\frac{1}{4}$$

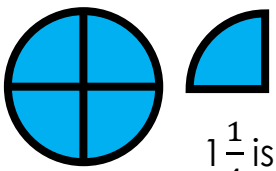
Make the two fractions that are being added proper fractions

Level 1: I can find a way

Level 2: I can find three ways

SUPPORT

Tip 1:



This is $1\frac{1}{4}$

$1\frac{1}{4}$ is five quarters

Tip 2:

$$\frac{3}{6} + \frac{\square}{\square} = 1\frac{1}{4}$$

EXPLAIN

Circle the fractions that are **more than 1 and less than 2**

$\frac{8}{4}$ $\frac{15}{16}$ $\frac{19}{10}$ $\frac{7}{6}$ $\frac{6}{7}$

Explain your choices.

EXTEND

$$\frac{3}{\square} + \frac{\square}{8} = 1\frac{\square}{4}$$

Make the two fractions that are being added proper fractions

Find all the possible answers.

Part-finished book

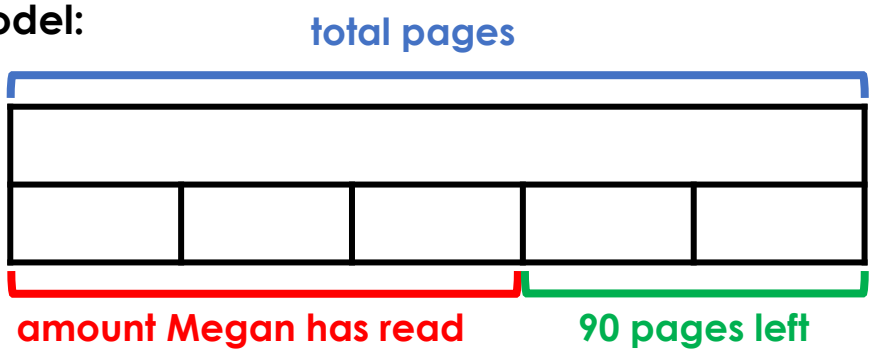
Megan has read $\frac{3}{5}$ of her book.

She has 90 pages left to read.

How many pages long is her book?

SUPPORT

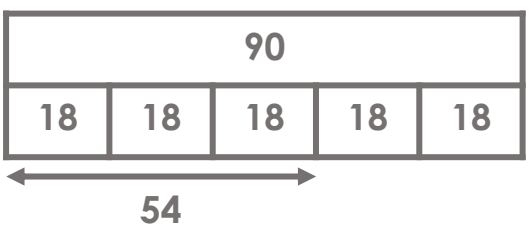
Bar model:



EXPLAIN

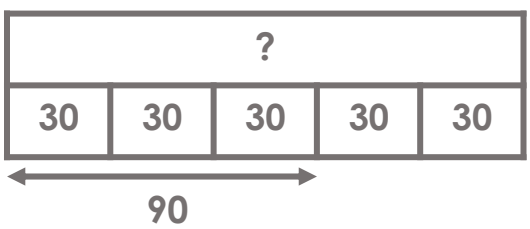
Explain the mistakes:

Mistake 1



$\frac{3}{5}$ of 90 = 54 pages

Mistake 2



$\frac{3}{5} = 90$ so $\frac{1}{5} = 30$

$30 \times 5 = 150$ pages

EXTEND

Sam is reading two books: 'Olympic Stories' and 'Jack's Big Surprise'.

He has read $\frac{3}{4}$ of Olympic Stories.

He has read $\frac{3}{5}$ of Jack's Big Surprise.

He has 60 pages left to read of each book.

How many pages long is each book?

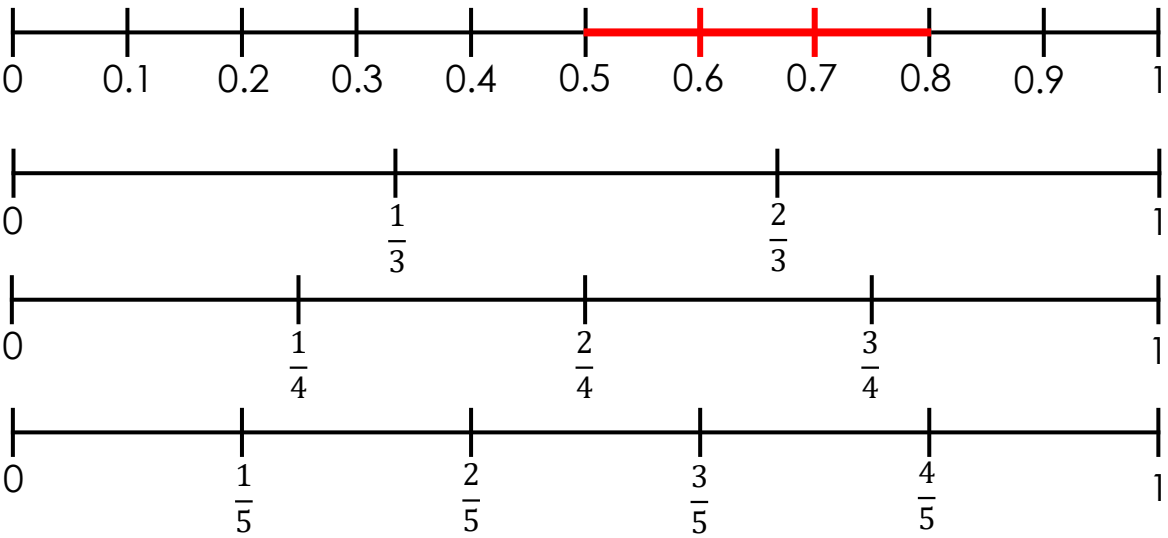
Fractions digit challenge

How many fractions can be made that are more than 0.5 and less than 0.8 using the following numbers:

2, 3, 4, 5

SUPPORT

The number lines help to show fractions between 0.5 and 0.8:



EXPLAIN

Circle the correct fraction to decimal conversions.

Explain the mistakes.

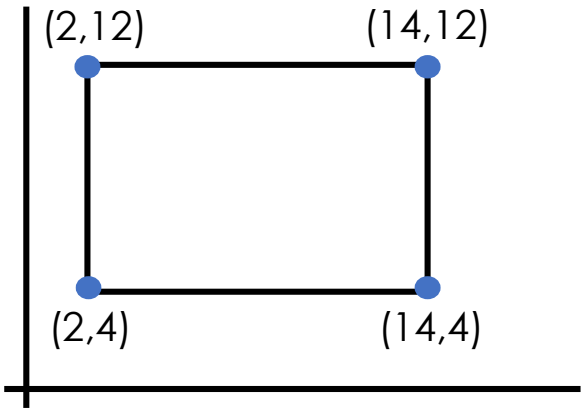
$\frac{3}{4} = 0.34$ $\frac{4}{5} = 0.6$ $\frac{1}{5} = 0.2$ $\frac{3}{4} = 0.75$ $\frac{1}{3} = 0.3$

EXTEND

How many fractions can be made that are more than 0.5 and less than 0.8 using the following numbers:

4, 5, 6, 8, 10, 12

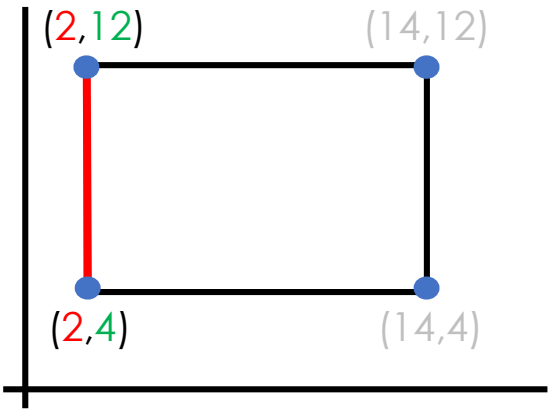
Inside, edge or outside?



Are these coordinates on the inside, the edge or on the outside of the rectangle?

	Inside	Edge	Outside
(6,10)	✓		
(9,14)			
(14,9)			
(13,5)			

SUPPORT



Example:
Every coordinate on the red line has an x coordinate of 2.

Every coordinate on the red line has a y coordinate between 4 and 12.

(2,7) and (2,10) are on the red line.

(3,7) and (2,13) are not on the red line.

EXPLAIN

Agree or disagree:

'To work out the length of the left edge of the rectangle do 12 – 4. It is 8.'

'To work out the length of the bottom side of the rectangle do 14 – 4. It is 10.'

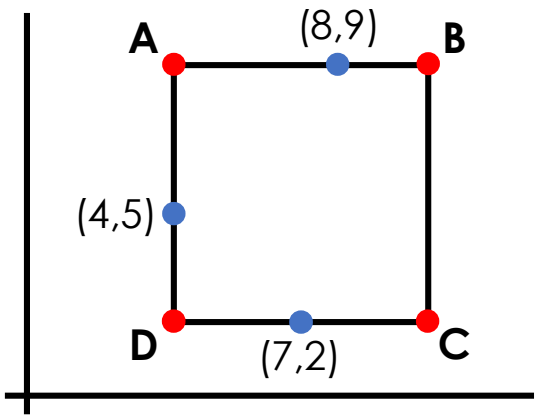
EXTEND

Agree or disagree:

'You only need to know two of the coordinate points to answer this question.'

Explain.

Which vertices?

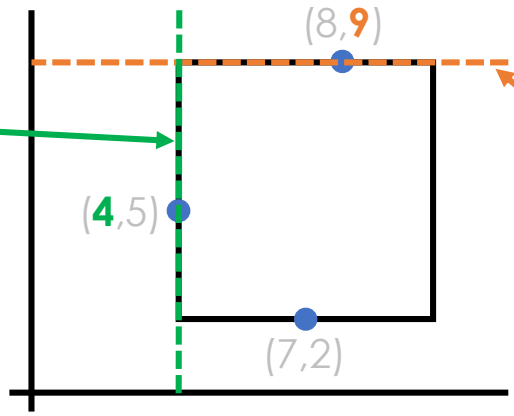


Which of the vertices can be calculated? (see the red dots)

Give the coordinate points of these vertices.

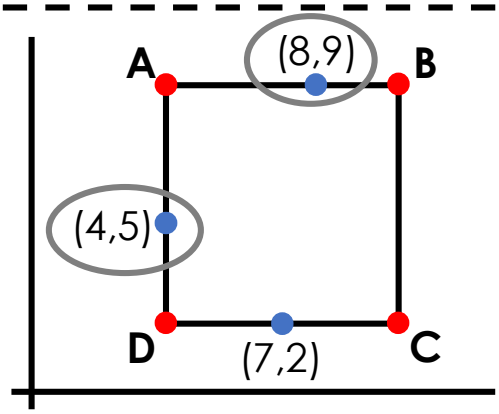
SUPPORT

Every point on the green line has an x coordinate of 4.



Every point on the orange line has a y coordinate of 9.

EXPLAIN



Explain the mistake:

'I have circled the two coordinates needed to work out point A.'

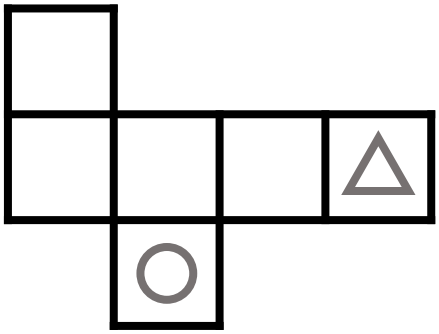
'The coordinates of point a are (5,9).'

EXTEND

If you were given one more coordinate point, you could work out the coordinates of all four vertices.

Where would this coordinate point have to be?

Cube nets



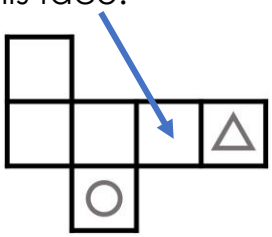
Complete the cube net so…

There are 2 squares, 2 circles and 2 triangles drawn on the net (draw one shape in each face).

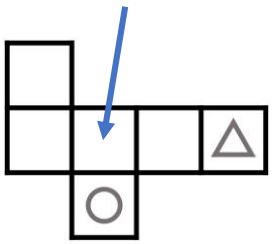
When the net is made into a cube, the shapes on the opposite faces will match.

SUPPORT

Tip 1: Remember that opposite faces don't touch. For example, the second triangle is **not** on this face.

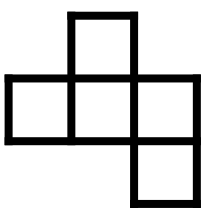


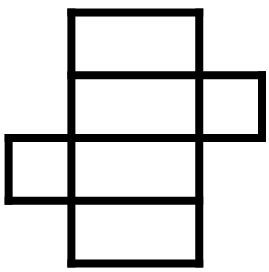
Tip 2: Imagine this face staying still and the other faces being folded around it.

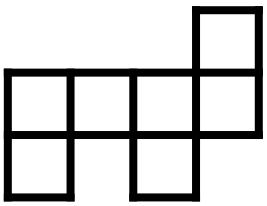


EXPLAIN

Explain why each of these shape is **not** the net of a cube:



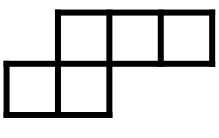


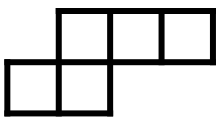


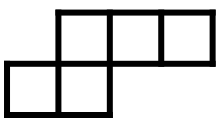
EXTEND

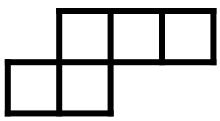
Draw a sixth square on each shape to complete the net of a cube.

Do in four different ways.



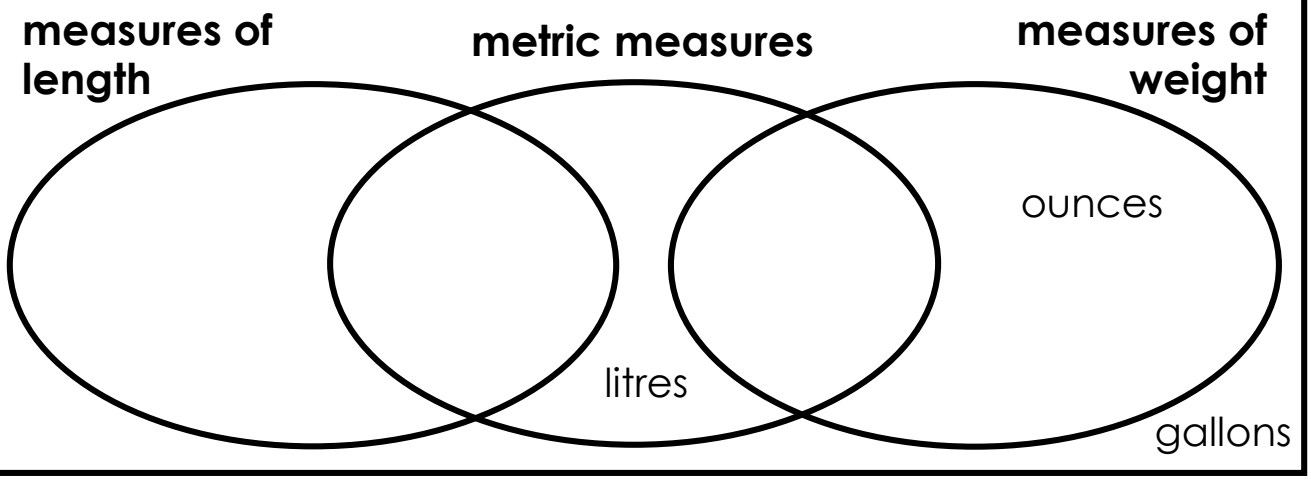






Sorting measures

Write different measures in each section of the Venn Diagram:



SUPPORT

Example measures to include in Venn Diagram:

stones	millilitres	inches
miles	metres	grams
pints	hours	kilometres

EXPLAIN

Which of these measure is the **odd one out?**

yards **millimetres** **kilograms**

Challenge: how many of the measures could be the odd one out?
The odd one out could be… because…
The odd one out could also be… because…

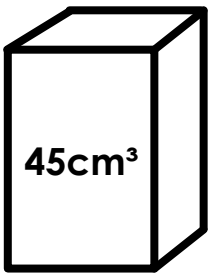
EXTEND

Draw lines to match each unit to the correct form of measure:

decade	**temperature**
lux	**time**
light year	**length**
centigrade	**light**
acre	**area**

Explain: do light years measure length, brightness of light or time?
Give an example of something that is measured in light years.

Cuboid dimensions

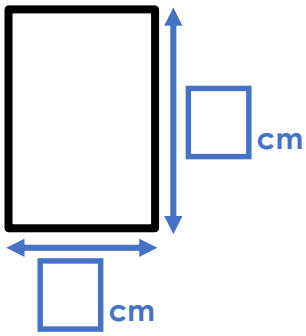


This cuboid is made with two squares and four rectangles.

The volume of the cuboid is 45cm³.

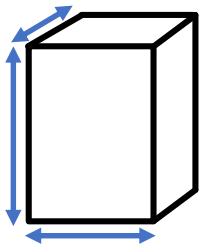
The length of each edge, measured in cm, is a whole number.

Label the length and width of the rectangular faces of the cuboid.

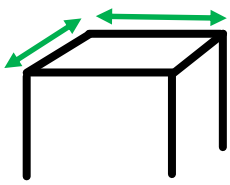


SUPPORT

Tip 1: volume of cuboid = length × width × height



Tip 2: the lengths of the edges on the square face are the same



Tip 3: the square's sides can **not** be 4cm.

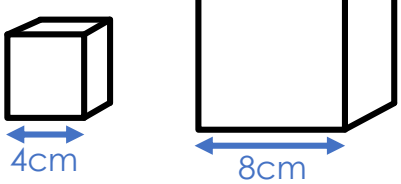
4cm × 4cm × ☐ cm = 45cm²

4 is not a factors of 45, so this number is a decimal.

What could be the length of the sides of the square?

EXPLAIN

Here are two cubes.



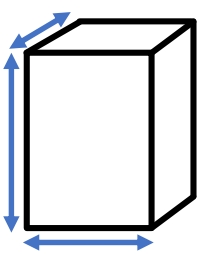
How many of the smaller cubes fit into the larger cube?

(a) 2

(b) 4

(c) 8

EXTEND



To double the volume of a cuboid…

(a) Double the length of one side

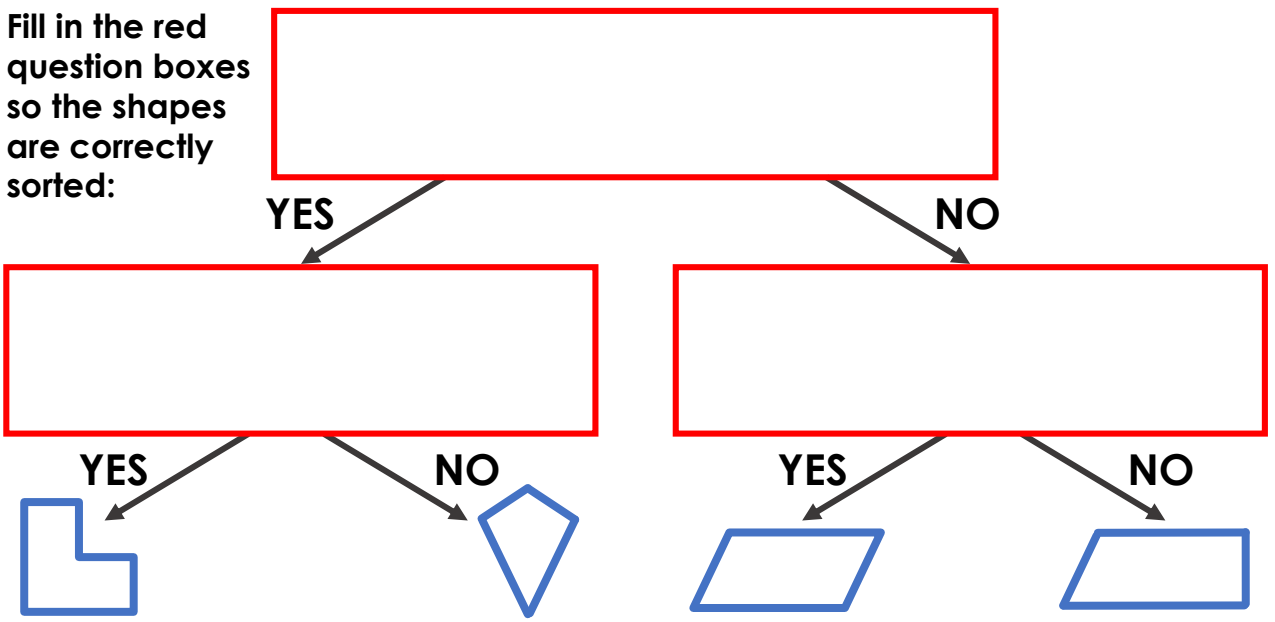
(b) Double the length of two of the sides

(c) Double the length of all of the sides

Explain.

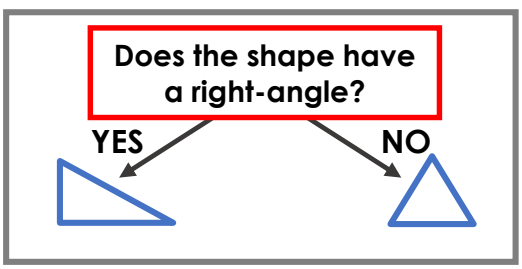
Branching database

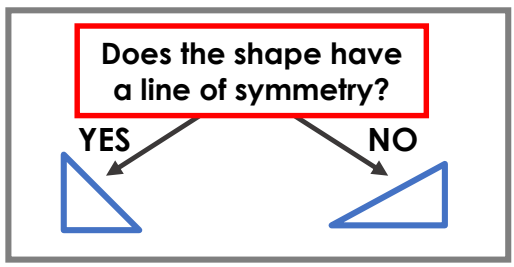
Fill in the red question boxes so the shapes are correctly sorted:



SUPPORT

Examples The questions in the red boxes sort these shapes correctly:



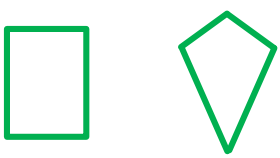


EXPLAIN

For each pair of shapes, what is the same and what it different?

Pair of shapes A:

Pair of shapes B:

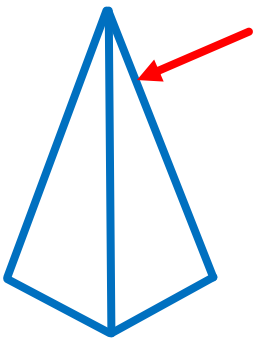


Pair of shapes C:

EXTEND

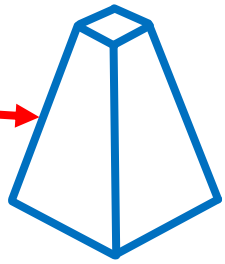
Think of a reason why **each shape** could be the **odd one out**:

Faces, edges, vertices



This is a square-based pyramid.

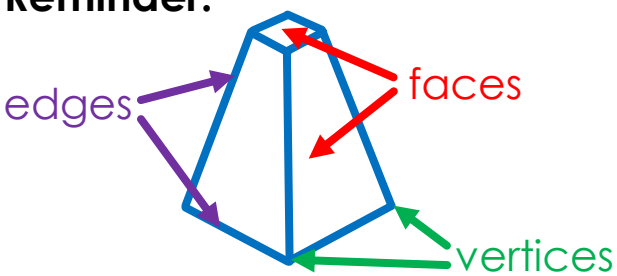
The top of the square-based pyramid is cut off. This new shape is made.



How many more faces, edges and vertices does the new shape have than the square-based pyramid?

SUPPORT

Reminder:



Consider:

What is the same about the shapes?

What about the shapes is different?

EXPLAIN

Agree or disagree:

'If you cut off one end of a prism, the number of faces, edges and vertices stays the same.'

'If you cut off one end of a pyramid, the number of faces, edges and vertices increases.'

EXTEND

2D faces:

1 square and

___ triangles

2D faces:

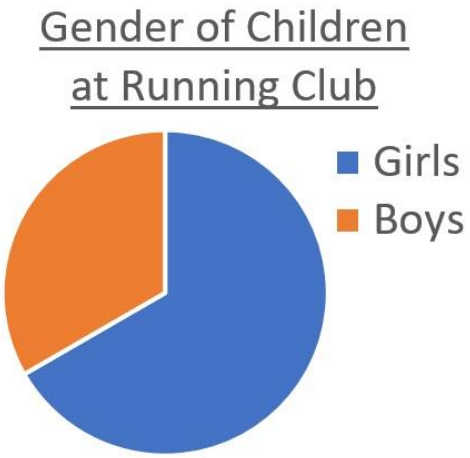
Your example

Shape:

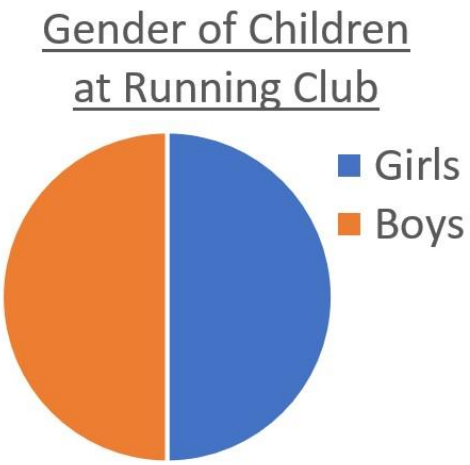
2D faces:

Running club graphs (part 1)

At the start of term, there were 12 children in running club. These graphs tell you about the children at running club:



This term, 4 children joined running club. Nobody left. These graphs tell you about the children at running club now:



What do you know about the 4 children who joined running club?

Running club graphs (part 2)

SUPPORT

Running club, start of term:

____ boys

____ girls

Running club, end of term:

8 boys

8 girls

Running club, start of term:

2 children in Y3

6 children in Y4

3 children in Y5

1 child in Y6

Running club, end of term:

____ children in Y3

____ children in Y4

____ children in Y5

____ children in Y6

EXPLAIN

Agree or disagree:

'Most of the children who joined running club were boys.'

'All of the children who joined running club were boys.'

'None of the children who joined running club were in Y4.'

EXTEND

A few weeks later, a group of year 5 children joined running club. This meant that half the children at running club were from year 5.

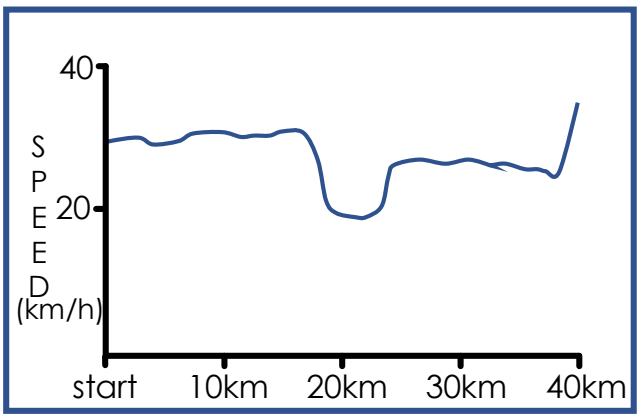
How many year 5 children joined running club?

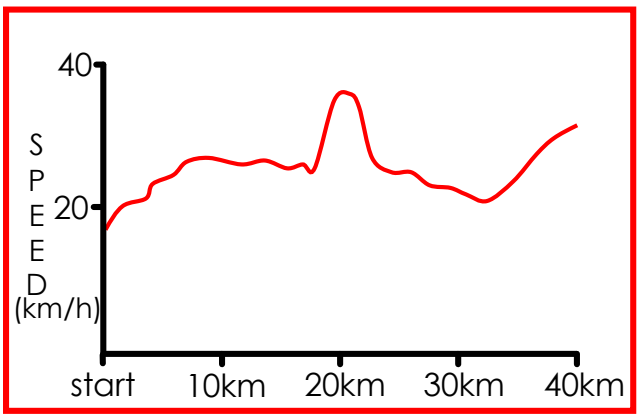
Bike race (part 1)

Jen took part in a 40km bike ride. Here, she describes her race:

'I started the race quickly. There was a big uphill climb half-way through the race. I slowed down for the last 5km but I did a sprint finish.'

Which graph shows Jen's performance in the race?

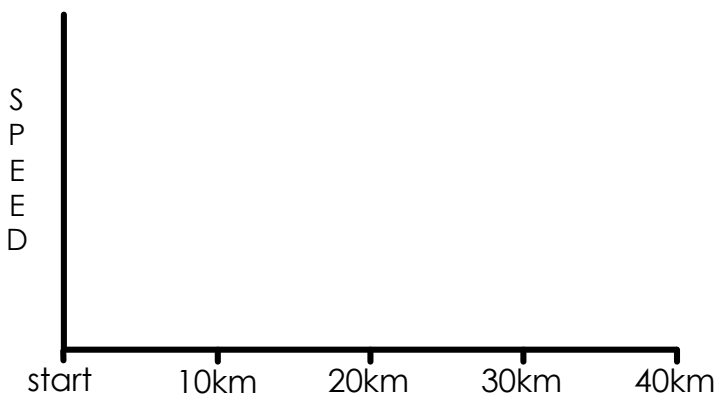




Jamie took part in a 20km bike race. He describes his ride:

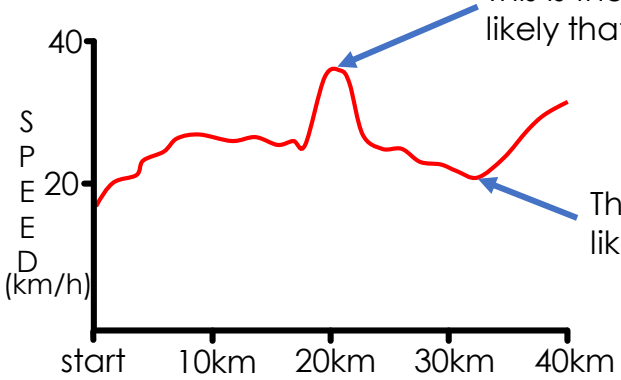
'I started quickly - first 3km of the race was downhill. I slowed down after that, cycling at a similar speed in the middle part of the race. There was a long hill that started 15km into the race. The fastest part of my race was the last 2km.

Complete the graph of Jamie's performance in the race:



Bike race (part 2)

SUPPORT

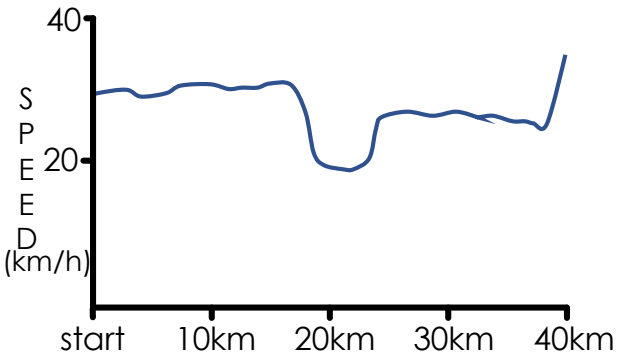


This is the cyclist's fastest speed. It is likely that they are riding down a hill.

This is the cyclist's slowest speed. It is likely that they are riding up a hill.

EXPLAIN

Look at the circled section of the line graph.



Agree or disagree:

'Here, the rider is going downhill'

'The rider slows down here. They might be riding uphill.'

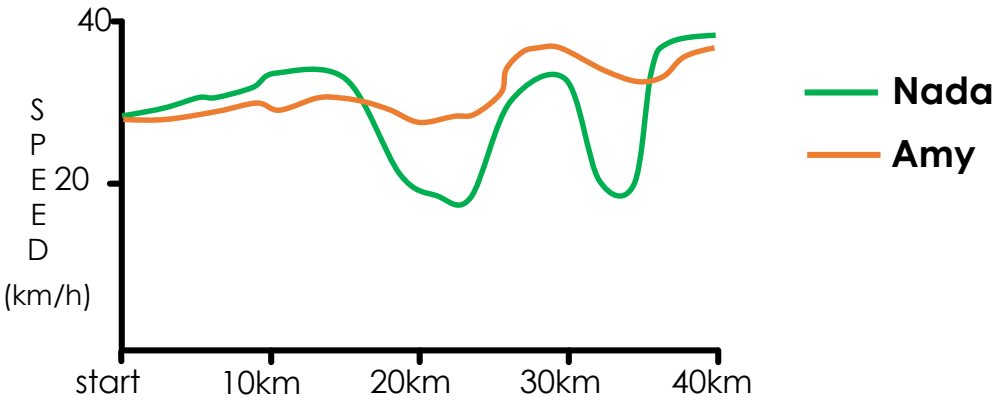
'The rider stops for a rest here.'

EXTEND

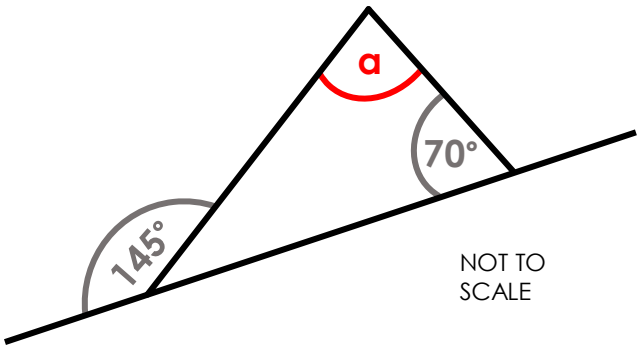
This graph shows the speeds of Nada and Amy in the race.

Describe the difference between their races.

Which cyclist do you think finished first - Nada or Amy?



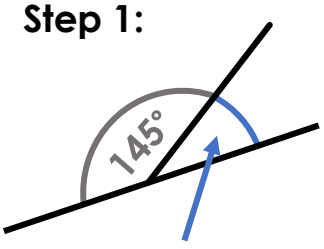
Missing angles



What is the size of angle a?

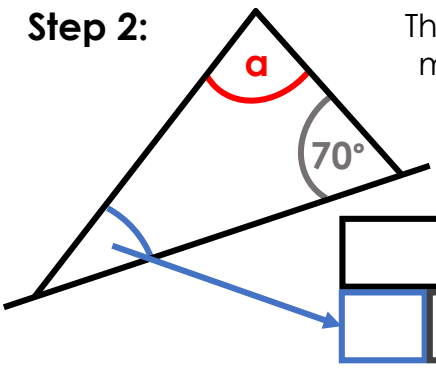
SUPPORT

Step 1:

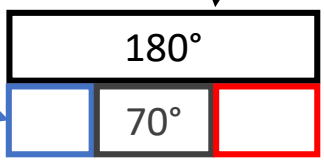


Work out the size of this angle

Step 2:



The bar model may help you to calculate angle a.



EXPLAIN

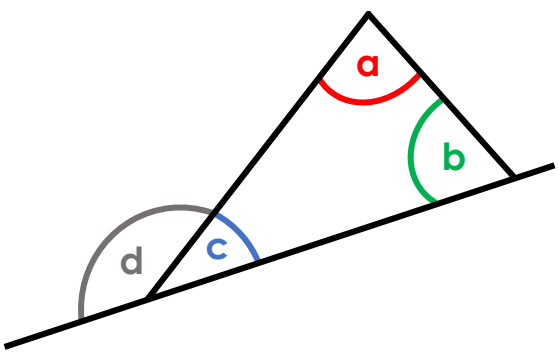
True or false? ✓ ✗

a + b + c = 180°

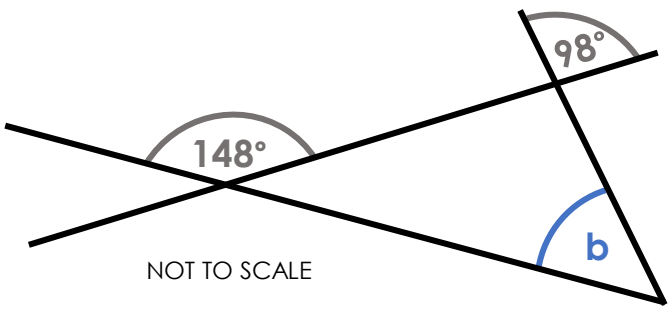
a + b + c + d = 180°

a + b + c + d = 360°

c + d = 180°



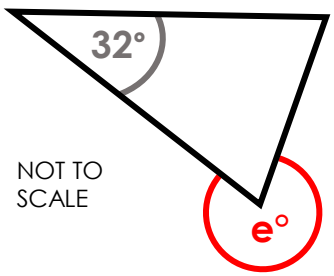
EXTEND



What is the size of angle b?

How many calculations are needed to work it out?

Isosceles triangle angles

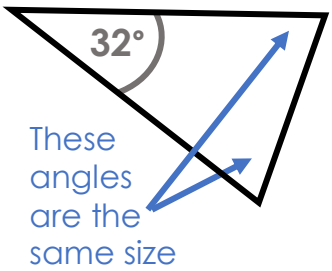


This is an isosceles triangle.

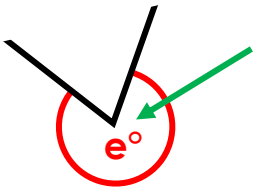
What is the size of angle e?

SUPPORT

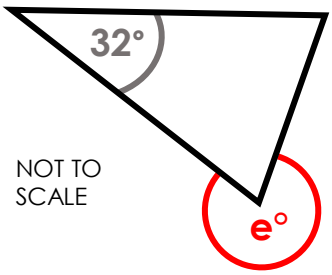
Tip 1:

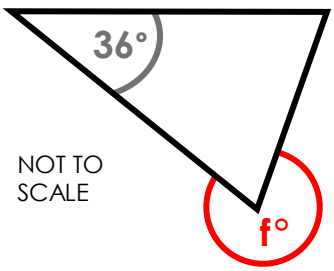


Tip 2:



EXPLAIN



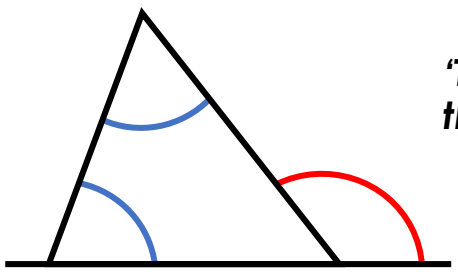


Complete: Angle e is ____° **bigger/smaller** than angle f.

Explain why.

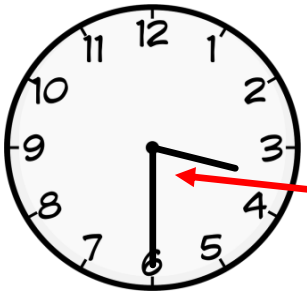
EXTEND

Agree or disagree:



'The sum of the blue angles is the same as the red angle.'

Clock hands angles

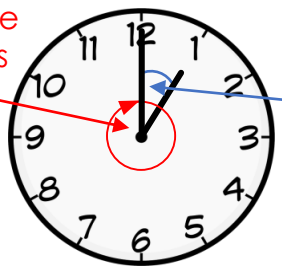


What is the angle between the hands of a clock at 3:30pm?

SUPPORT

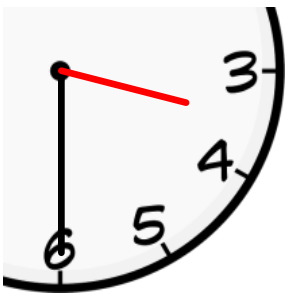
Tip 1:
Calculate the angle between each hour on a clock face

Whole turn is 360°



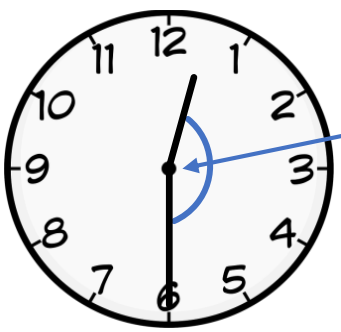
Clock face split into 12 equally sized parts

Tip 2:
How far has the hour hand moved between 3 and 4?



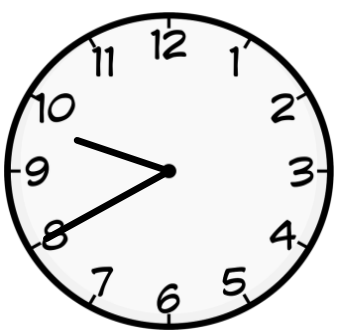
EXPLAIN

Explain the mistake:



'The angle between the hands of a clock at 12:30pm is 180°'

EXTEND



Calculate the angle between the hands on a clock face at 9:40am.

Explain how you worked it out.

Average puzzle

Three positive whole-numbers have an average of 6.

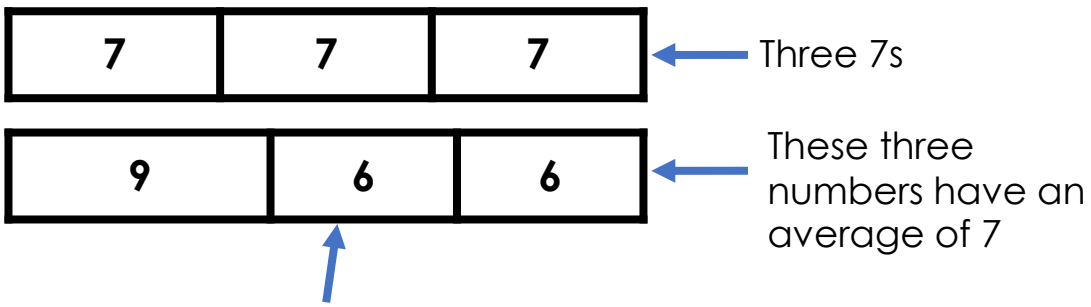
The difference between the largest and the smallest of these numbers is 5.

What are the three numbers?

There are two possible answers.

SUPPORT

Example:



The difference between the largest and smallest of these numbers is 3 (the difference between 9 and 6 is 3).

EXPLAIN

Explain the mistakes:

Example 1:
9, 7, 4, 4

Example 2:
4, 6, 9

Example 3:
8, 6, 4

EXTEND

The average of four positive whole-numbers is 8.

The difference between the largest and the smallest of these numbers is 5.

What could the four numbers be?

Find all possible answers.

Average ages

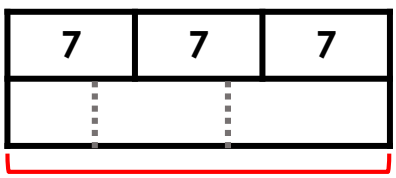
There were three children in the room, with an average age of 7.

Then, Harry walked into the room. Now the average age of the people in the room is 9.

How old is Harry?

SUPPORT

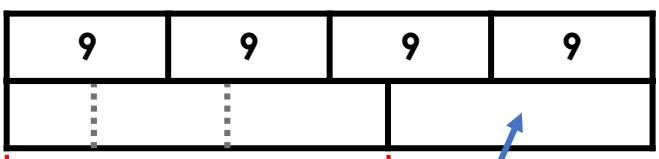
Three children with an average age of 7:



21

We don't know the ages of the three children.

Four children with an average age of 9:



21

Harry's age

EXPLAIN

Possible or impossible?

'The average age of three children is 8. None of the children are 8 years-old.'

'The average age of three brothers is 9. One of the brothers is 21 years old.'

EXTEND

Sophie and Anna are twins. Their younger sister is called Jenna.

The twins are 6 years older than Jenna. The average age of the three children is 9.

How old is Jenna?

Train times

Here is a train timetable for the morning trains from Sheffield to Newcastle:

Sheffield	6:20	7:04	7:58	8:45
Doncaster	6:47	7:33	8:25	9:14
York	7:14	8:00	8:52	9:41
Darlington	7:43	8:29	9:21	10:11
Durham	8:01	8:48	9:39	10:30
Newcastle	8:14	9:01	9:52	10:43

Stan is travelling from Doncaster to Durham.

He gets to Doncaster train station at 7:35am.

When will he arrive in Durham?

SUPPORT

Using train timetables:

Sheffield	6:20	7:04	7:58	8:45
Doncaster	6:47	7:33	8:25	9:14
York	7:14	8:00	8:52	9:41
Darlington	7:43	8:29	9:21	10:11
Durham	8:01	8:48	9:39	10:30
Newcastle	8:14	9:01	9:52	10:43

Rows show the times that trains leave each train station.

This row shows the times that trains are leaving Doncaster train station.

Start by working out the time at which Stan's train left Doncaster.

Columns show the journey of each train. This is the first train. We can see the time it leaves each train station.

EXPLAIN

Explain the mistake:

'The first train sets off at 6:20 from Sheffield and arrives at 8:45.'

'If I arrive at York train station at quarter past seven I can catch the first train.'

EXTEND

Jen lives in York. She has a job interview a 10-minute walk from Newcastle train station. Her interview starts at 9:15am.

At what time should Jen arrive at York train station?

Explain your choice.