YEAR 8 MATHEMATICS CHALLENGE

Heat 4, via *Livestorm*

Tuesday 9th May 2023

William Thallon, Secondary Mathematics Adviser

David Cook, Lead Primary Mathematics Adviser

FORMAT OF CHALLENGE

Round 1	General Maths questions
Round 2	Memory Round
Round 3	Estimation Round
Round 4	General Maths questions

60 marks for each round

FOUR HEATS AND A FINAL

This is the last of four heats.

The top 12 (or so) teams from across all the heats will be invited to take part in the Final. This will be a face-to-face event, to be held in Stevenage on Thursday 22nd June.

PRELIMINARIES

- You should have pens or pencils, rubbers, and rough working out paper only.
- No calculators, no measuring equipment, and no use of computers, phones, Internet etc!
- Decide on a team name which includes the name of your school.
- Don’t leave any answers blank. ‘Near misses’ or partially correct answers may score points.

PRELIMINARIES

- Your teacher has been sent a link to a *Google* sheet to record your answers. If possible, this should be updated at the end of each round.
- Teachers: please check that the link works, and enter the names of your teams during Round 1.

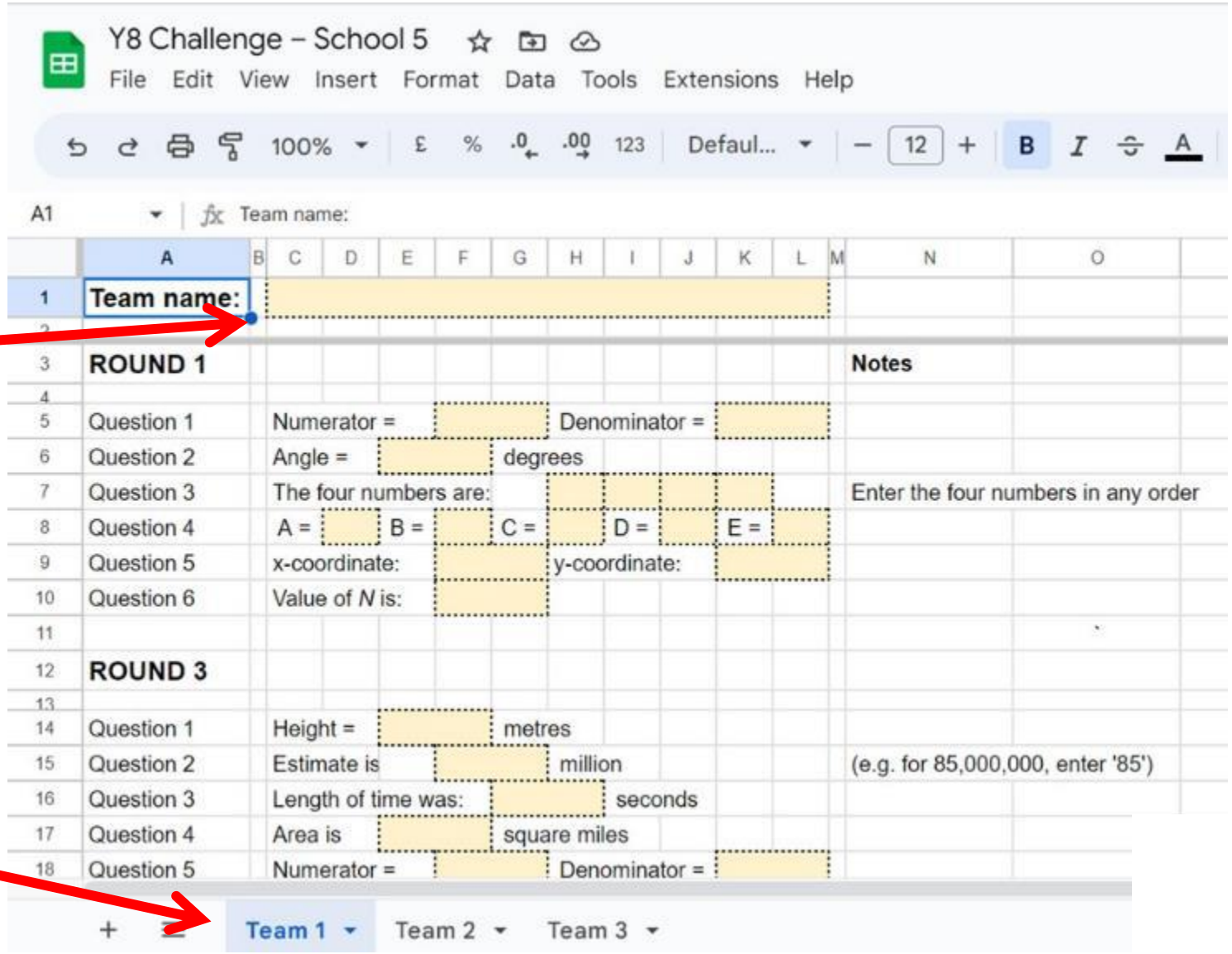
GOOGLE SHEET

Enter in the yellow cells only.

Team name at the top.

Scroll down for Rounds 3 and 4.

Separate tab for each team.
(Please do **not** delete unneeded tabs.)



Round 1

General Mathematics Questions

90 seconds for each question

ROUND 1, QUESTION 1

What fraction is half-way between

$\frac{1}{2}$ and $1\frac{1}{4}$?

There are separate spaces on the *Google* sheet for the numerator and denominator of your fraction.

ROUND 1, QUESTION 2

This diagram is not drawn to scale.

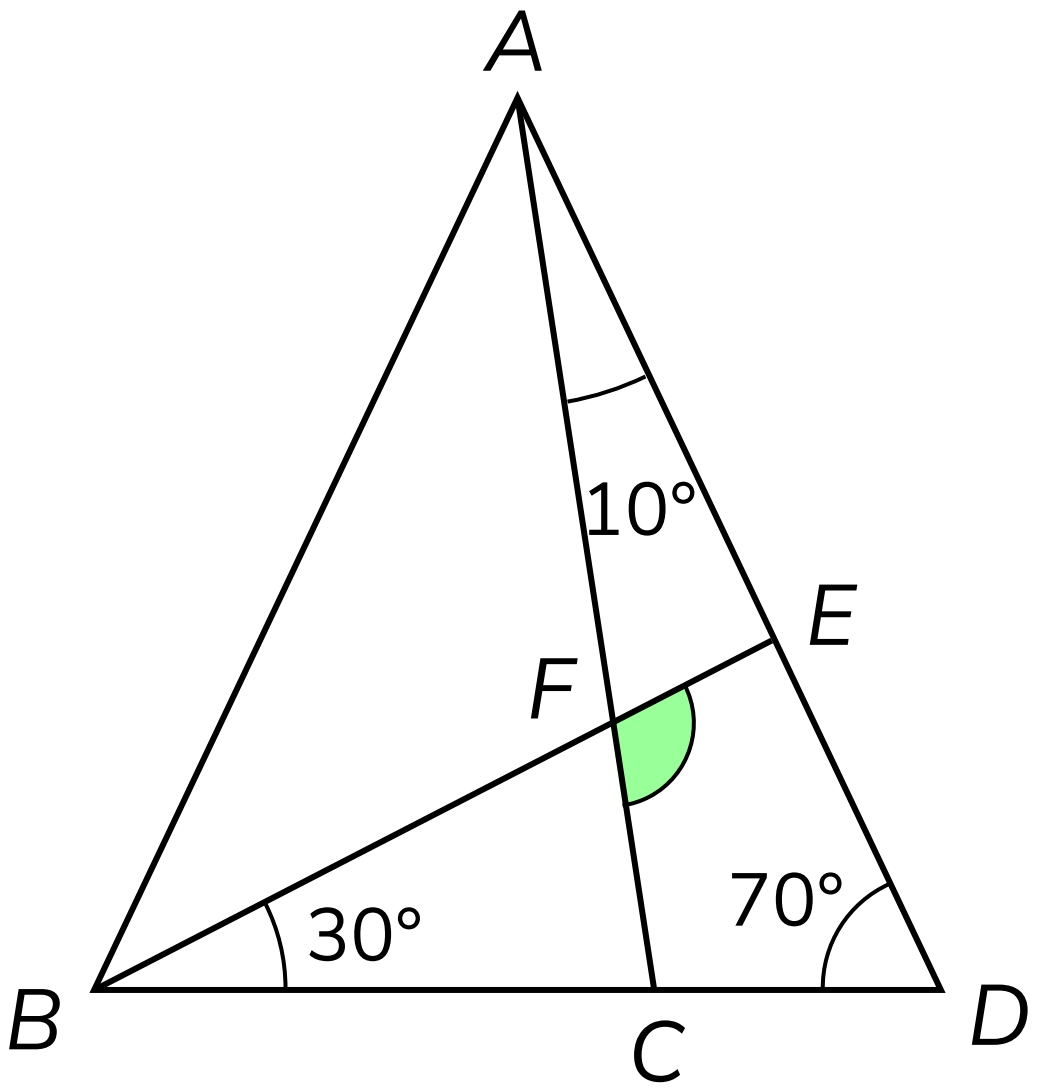
The lengths AB and AD are equal.

Three angles are given:

$\angle FAE = 10°$

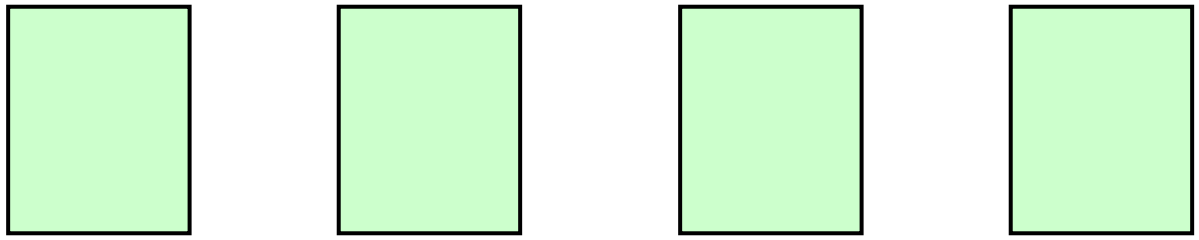
$\angle EDC = 70°$

$\angle FBC = 30°$



What is the size of angle CFE?

ROUND 1, QUESTION 3



Work out four **different** integers which satisfy the following:

- Median = **6.5**
- Mean = **7**
- Highest number = 2 × lowest number

On the *Google* sheet, there are four spaces to enter the numbers. You may enter them in any order.

ROUND 1, QUESTION 4

Each letter in this multiplication represents a different digit.

Only the digits 1, 2, 3, 4 and 5 are used.

$$\begin{array}{rr} & A\ B \\ \times & \quad C \\ \hline & D\ E \\ \hline \end{array}$$

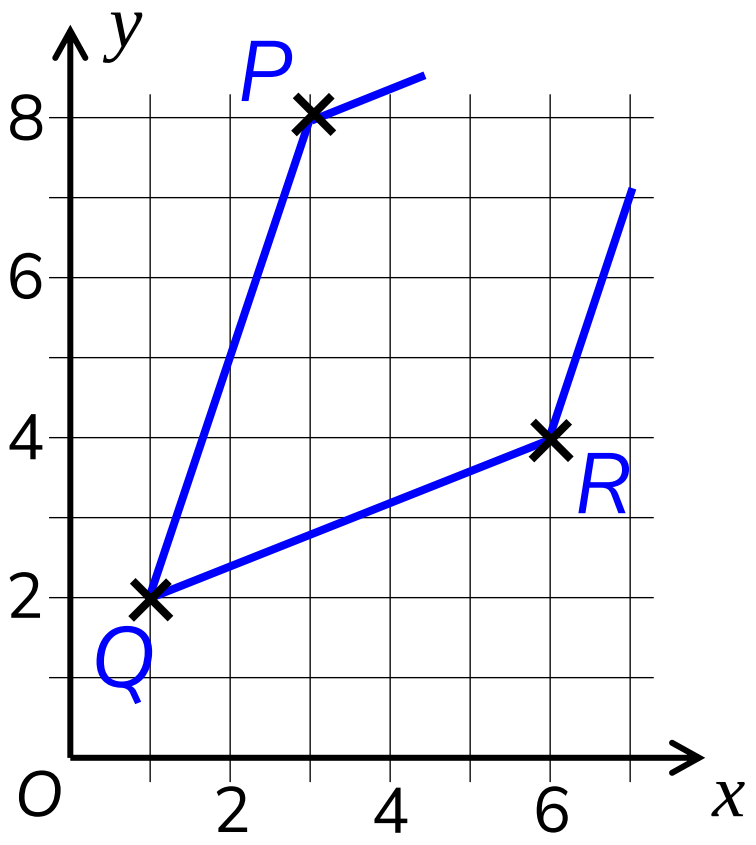
Find the digits represented by each of A, B, C, D and E.

On the *Google* sheet, there are five spaces to enter the numbers, clearly labelled with the five letters.

ROUND 1, QUESTION 5

P, *Q* and *R* are three vertices of a parallelogram.

The fourth vertex, *S*, does not fit on the diagram.



What are the coordinates of *S*?

There are separate spaces on the *Google* sheet for the x- and y-coordinate.

ROUND 1, QUESTION 6

Here are the six factors of the number *N*, listed in ascending order.

1 2 □ 17 □ *N*

(Two of the factors have been covered up.)

What is the number *N*?

End of Round 1

Please finalise your answers, and pass them to your teachers for entry onto the *Google* sheet.

ANSWERS TO ROUND 1

ROUND 1, QUESTION 1

What fraction is half-way between

$\frac{1}{2}$ and $1\frac{1}{4}$?

There are separate spaces on the *Google* sheet for the numerator and denominator of your fraction.

$\frac{7}{8}$ oe

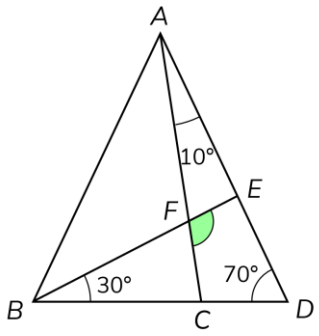
ROUND 1, QUESTION 2

This diagram is not drawn to scale.

The lengths *AB* and *AD* are equal.

Three angles are given:

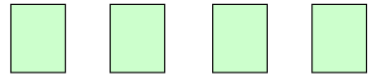
$\angle FAE = 10°$
$\angle EDC = 70°$
$\angle FBC = 30°$



What is the size of angle *CFE*?

110°

ROUND 1, QUESTION 3



Work out four **different** integers which satisfy the following:

- Median = **6.5**
- Mean = **7**
- Highest number = 2 × lowest number

On the *Google* sheet, there are four spaces to enter the numbers. You may enter them in any order.

5, 6, 7, 10

ROUND 1, QUESTION 4

Each letter in this multiplication represents a different digit.

Only the digits 1, 2, 3, 4 and 5 are used.

$$\begin{array}{cccc} & A & B \\ \times & & C \\ \hline & D & E \\ \hline \end{array}$$

Find the digits represented by each of *A*, *B*, *C*, *D* and *E*.

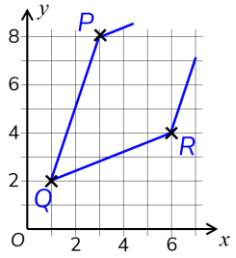
On the *Google* sheet, there are five spaces to enter the numbers, clearly labelled with the five letters.

$A = 1$, $B = 3$, $C = 4$, $D = 5$, $E = 2$

ROUND 1, QUESTION 5

P, *Q* and *R* are three vertices of a parallelogram.

The fourth vertex, *S*, does not fit on the diagram.



What are the coordinates of *S*?

There are separate spaces on the *Google* sheet for the *x*- and *y*-coordinate.

(8, 10)

ROUND 1, QUESTION 6

Here are the six factors of the number *N*, listed in ascending order.

1 2 ☐ 17 ☐ *N*

(Two of the factors have been covered up.)

What is the number *N*?

68

Round 2

Memory Round

ROUND 2

We are going to show a mathematical poster to two members of the team (the **observers**).

The other two members of the team (the **scribes**) will not see the poster. The observers must describe the poster from memory, and the scribes must draw it.

The observers are not allowed to draw the poster, or make notes when they are looking at the poster.

When describing the poster, observers must use words only. They are not allowed to draw anything, or use their hands in any way.

ROUND 2

The poster will be shown on the screen. The scribes must go into a different room, so they cannot see it.

The observers will have **four** chances to view the poster.

30 seconds to view
2 minutes to go and describe

30 seconds to view
2 minutes to describe

30 seconds to view
2 minutes to describe

30 seconds to view
2 minutes to describe

Scribes can draw at any time during the whole period.

ROUND 2

Hint for the observers

Don’t try to memorise the entire poster at once. The poster is in a number of sections, so focus on one or two parts at a time.

Note to the scribes

Place your piece of paper in **landscape** orientation (i.e. the same way up as the screen you are currently looking at).

ROUND 2

Note to supervising teachers

Each showing of the poster will be preceded by a 30-second warning, so that the observers can get themselves into position.

At the end, the finished poster should be photographed or scanned and sent in by e-mail.

(E-mail address to follow at end of round.)

ROUND 2

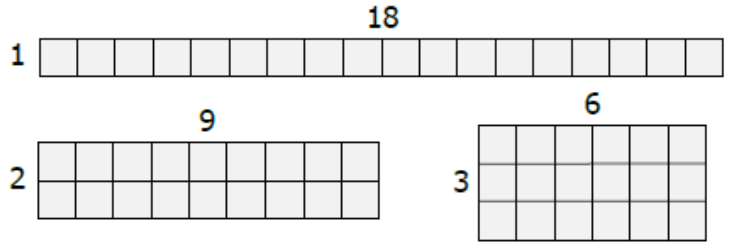
Pencils and rubbers only. No rulers or other drawing equipment.

You now have one minute to decide who will be the observers and who will be the scribes … and to get into position!

ROUND 2

Poster about to be displayed for the first time.

The six factors of 18 ...

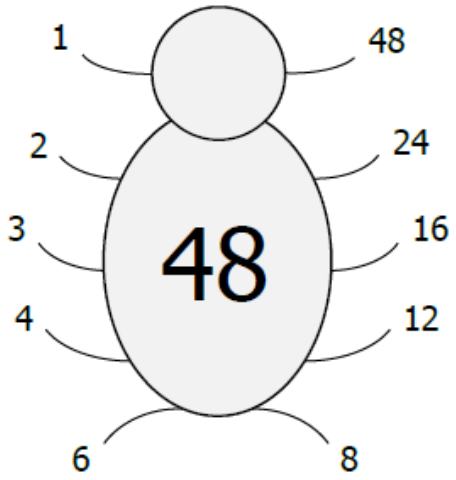


... are 1, 2, 3, 6, 9 and 18

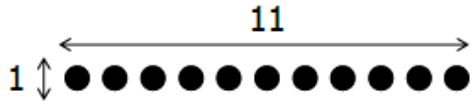
Common factors of 18 and 48:
1, 2, 3 and 6.

Highest common factor = **6**

The ten factors of 48



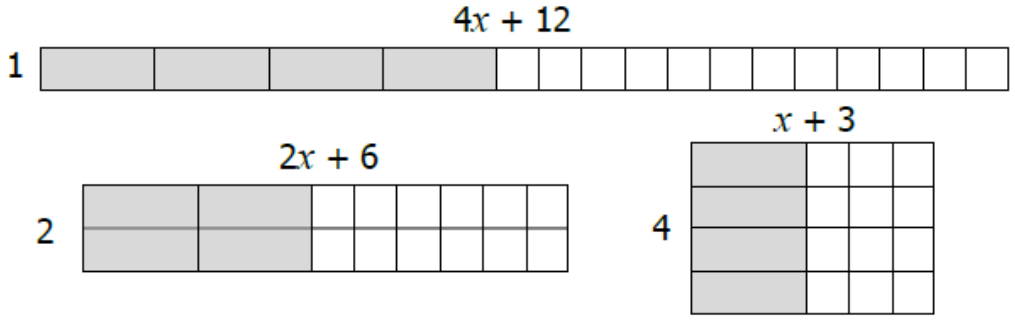
The two factors of 11



11 is an example of a **prime number**, a number with exactly two factors.

1 is the only number with only one factor

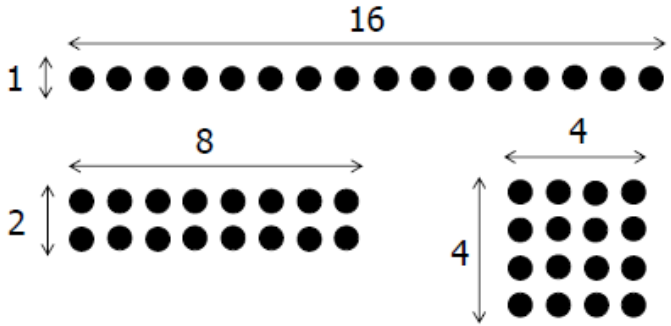
The six factors of $4x + 12$ ...



... are 1, 2, 4, $(x + 3)$, $(2x + 6)$ and $(4x + 12)$

Square numbers are the only numbers with an odd number of factors

For example, **16**:



(The factor 4 only counts once.)

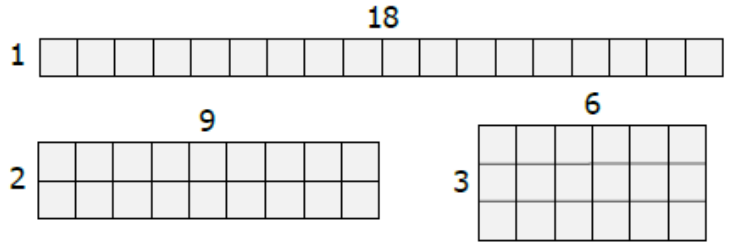
Round 2

Memory Round

ROUND 2

Second viewing of poster coming up!

The six factors of 18 ...



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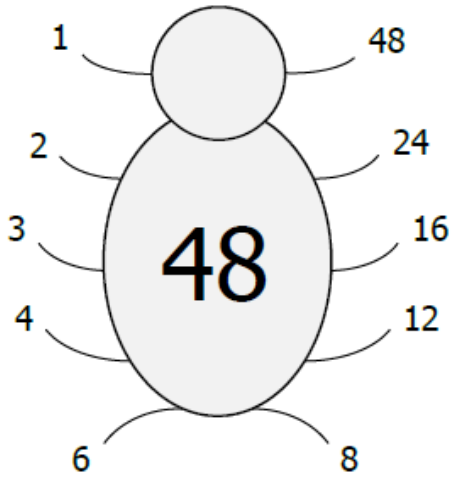

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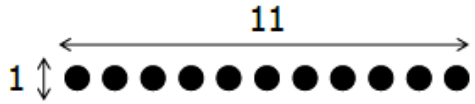

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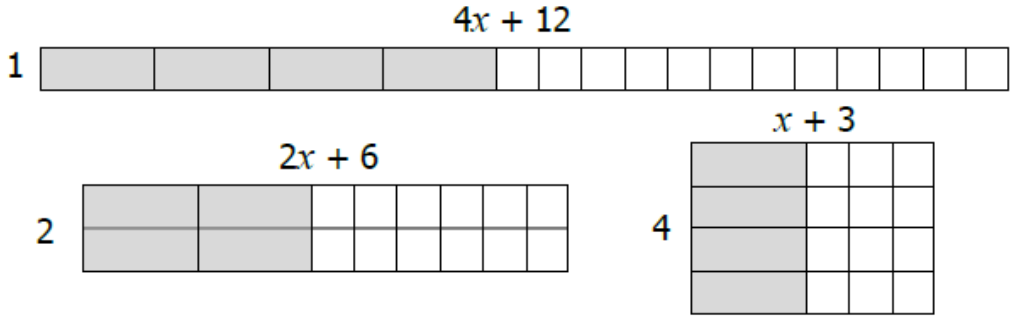

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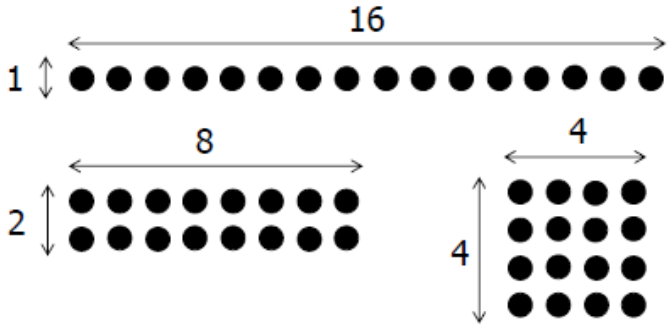

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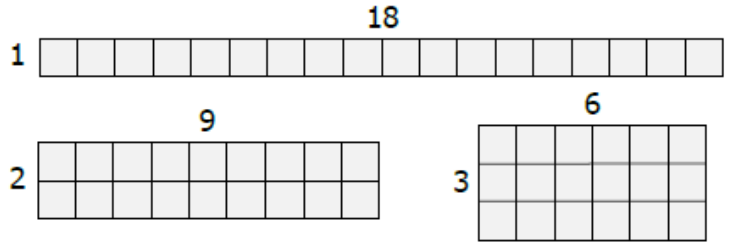
Round 2

Memory Round

ROUND 2

Third viewing of poster coming up!

The six factors of 18 ...



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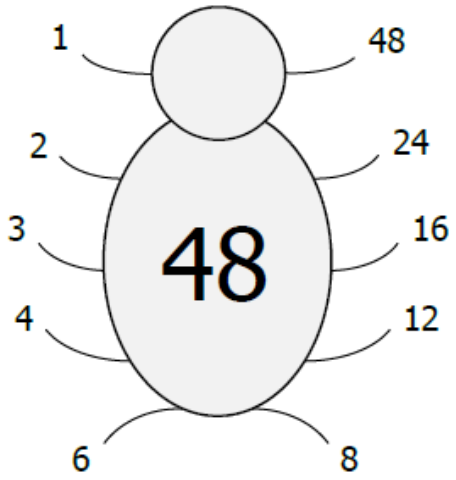
The ten factors of 48



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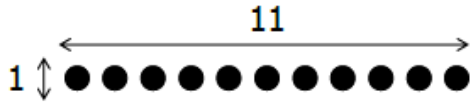

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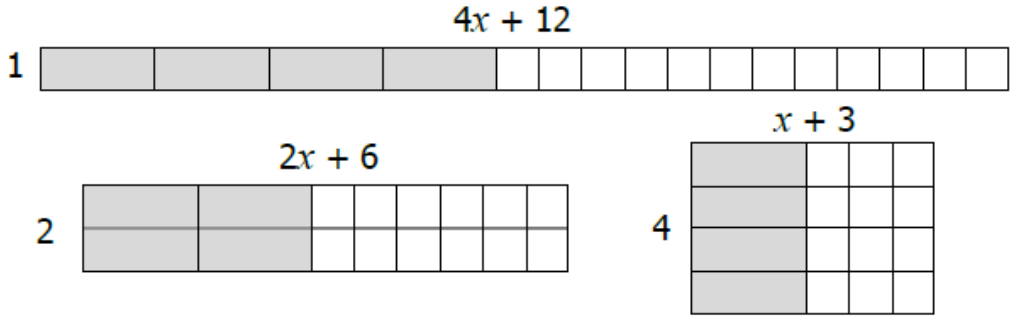

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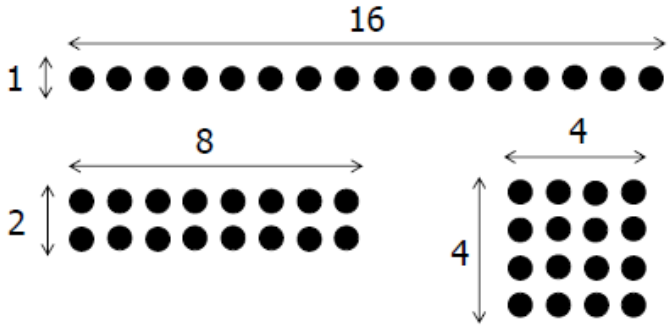


(The factor 4 only counts once.)

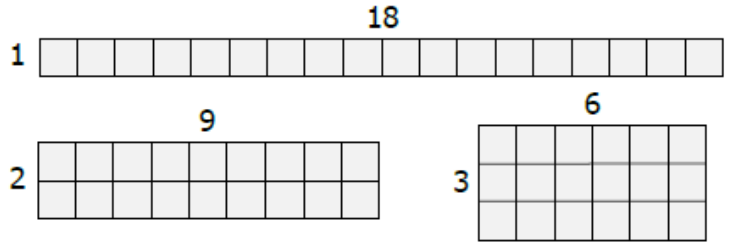
Round 2

Memory Round

ROUND 2

Fourth and final viewing of poster coming up!

The six factors of 18 ...



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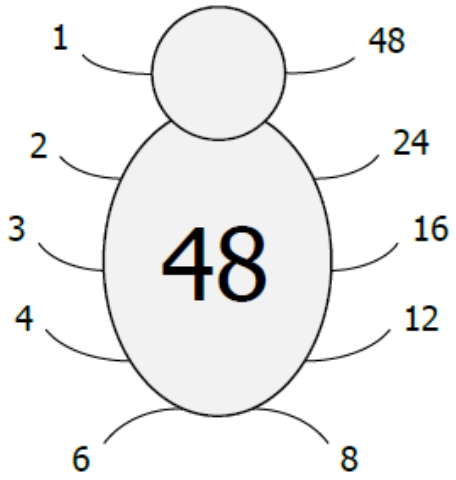
The ten factors of 48



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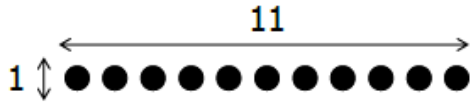

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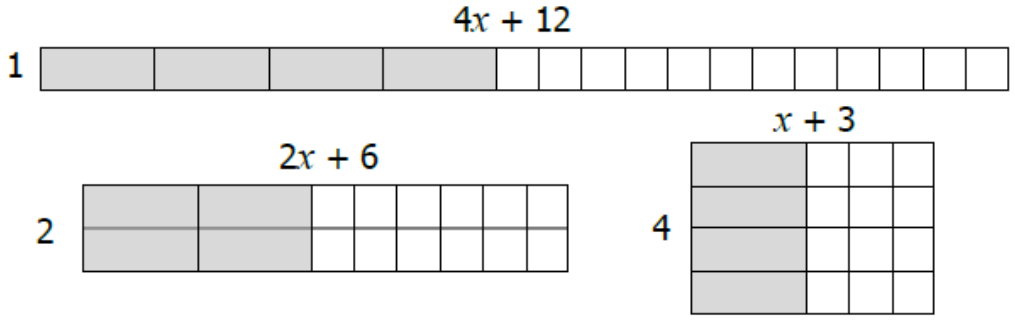

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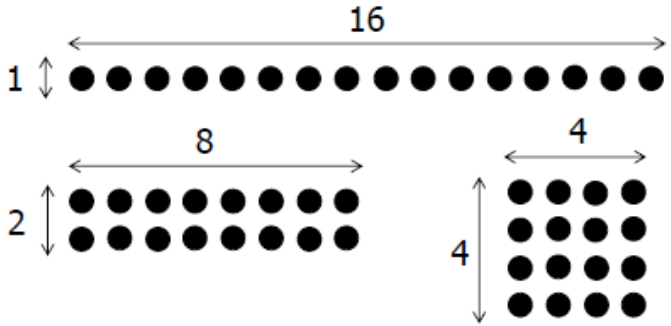


(The factor 4 only counts once.)

Round 2

Memory Round

ROUND 2

Time’s up!

Everyone should now come back into the main room.

Please photograph or scan the finished poster, and e-mail it to:

david.cook@hfleducation.org

End of Round 2

A reminder of the e-mail address to send the finished posters to:

david.cook@hfleducation.org

Round 3

Estimation Round

90 seconds for each question

ROUND 3, QUESTION 1

Estimate the height of the bus, in metres.

ROUND 3, QUESTION 2

Estimate, to the nearest million, the number of heartbeats per year for the average adult human.

Assume the average adult heart beats at a rate of 80 beats per minute.

On the *Google* sheet, enter the number of millions (e.g. for ’85 million’, please enter ‘85’.)

ROUND 3, QUESTION 3

Estimate the length of time, in seconds, for which this picture appears on the screen.

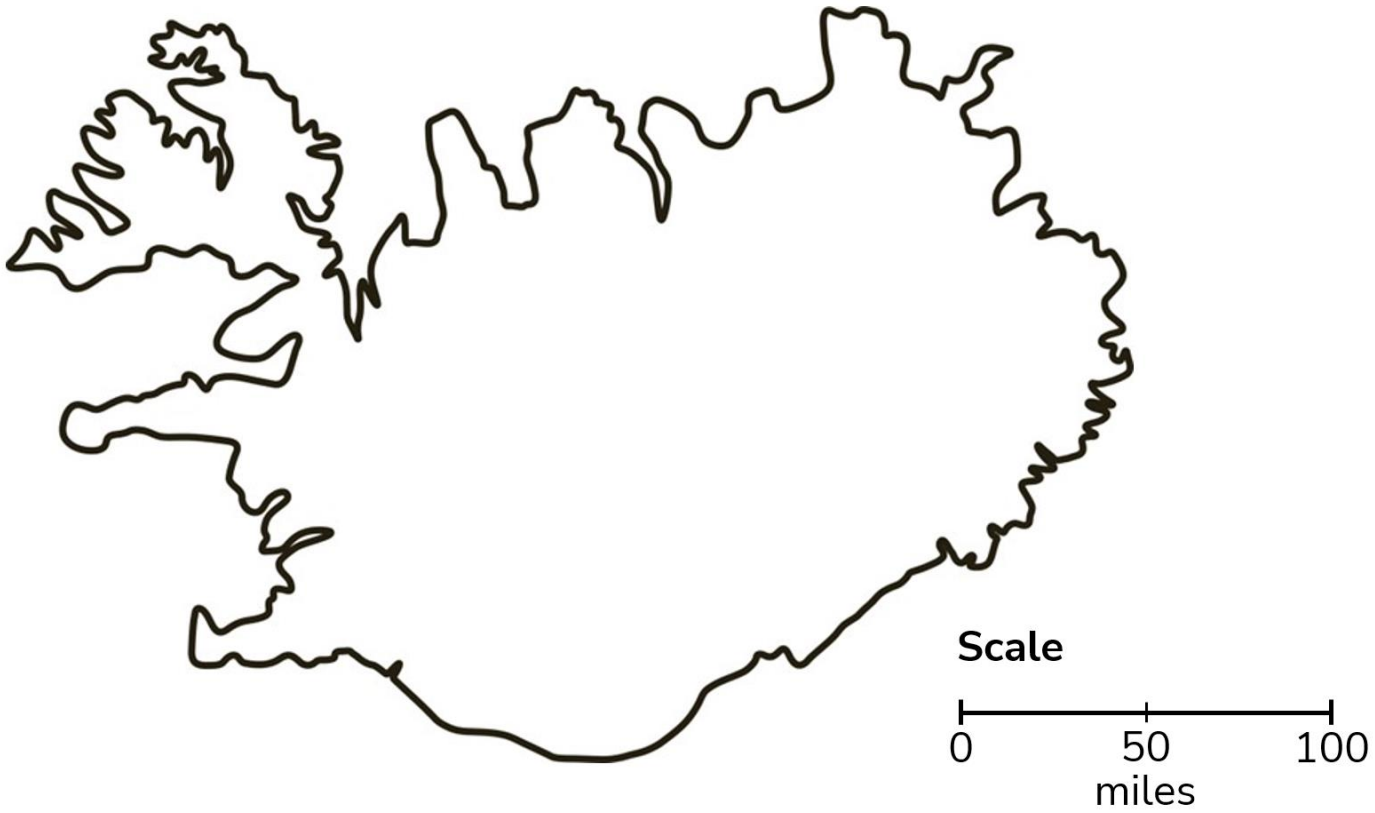
Acknowledgement:
Wikimedia Commons

ROUND 3, QUESTION 3

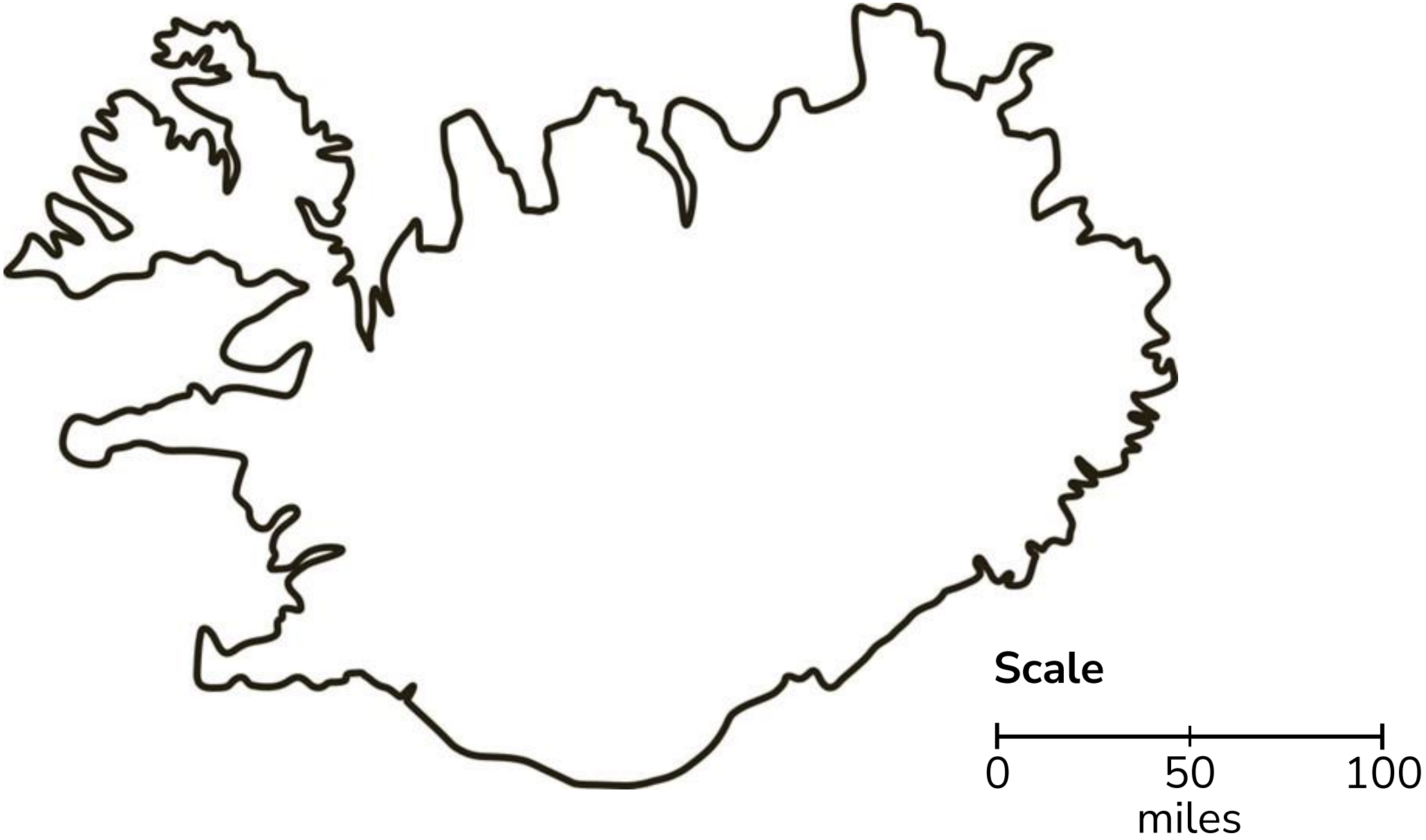
Decide on your estimate.

Question 4 coming up ...

ROUND 3, QUESTION 4

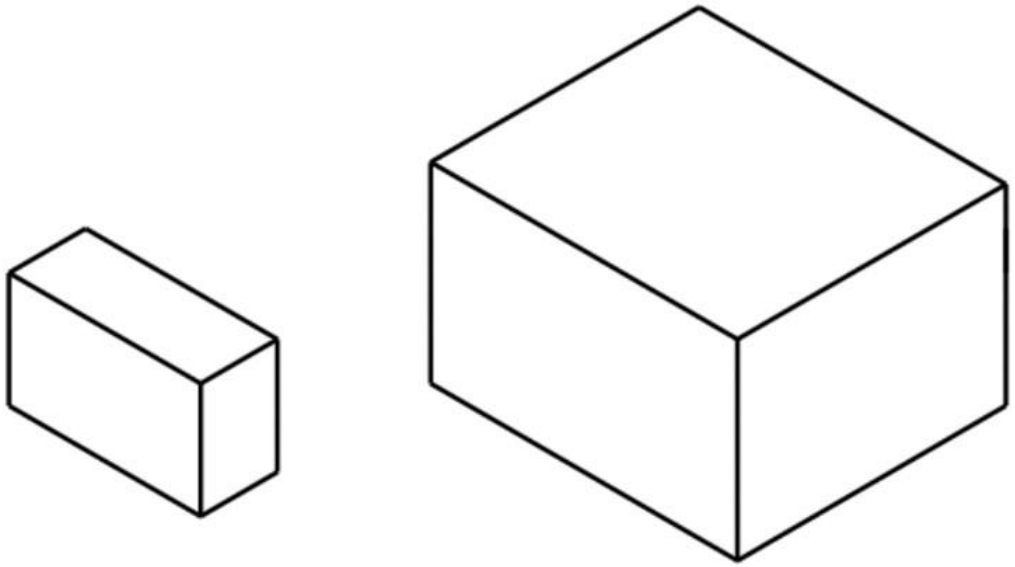


Estimate the area of Iceland, in square miles


Scale
0
50
100
miles

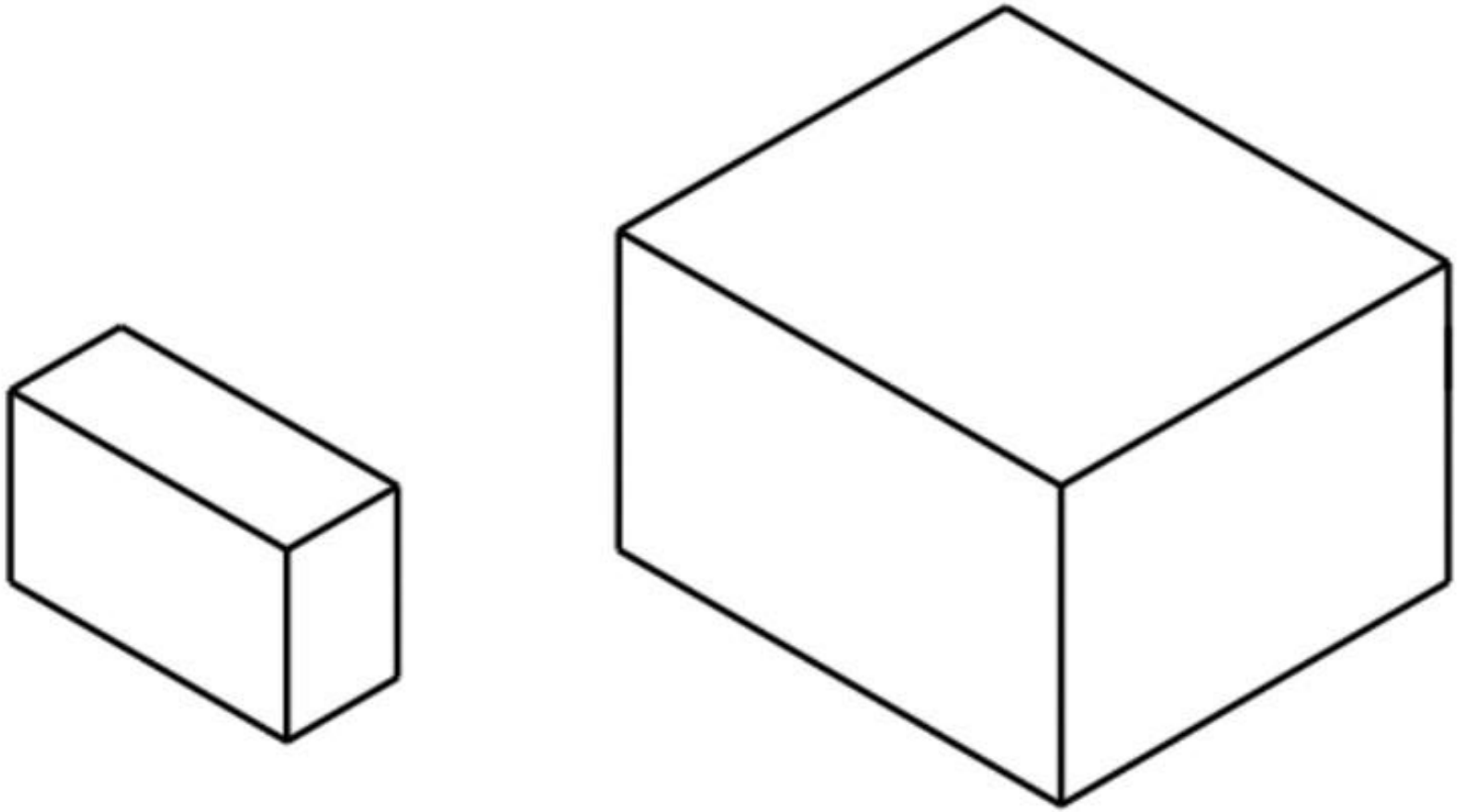
ROUND 3, QUESTION 5

Estimate the volume of the smaller cuboid as a fraction of the volume of the larger cuboid.



On the *Google* sheet, there are separate cells for the numerator and denominator of the fraction.

ROUND 3, QUESTION 5



On the *Google* sheet, there are separate cells for the numerator and denominator of the fraction.

ROUND 3, QUESTION 6

Arrange these expressions in increasing order of value, starting with the smallest.

A $\sqrt{14{,}000}$

B $\sqrt[3]{30{,}000}$

C $\dfrac{37.2}{0.058}$

D 196×2.39

On the *Google* sheet, write the four letters in the correct order, without spaces, e.g. **ABCD**.

End of Round 3

Please finalise your answers, and pass them to your teachers for entry onto the *Google* sheet.

ANSWERS TO ROUND 3

ROUND 3, QUESTION 1

Estimate the height of the bus, in metres.

4 m to 4.8 m

ROUND 3, QUESTION 2

Estimate, to the nearest million, the number of heartbeats per year for the average adult human.

Assume the average adult heart beats at a rate of 80 beats per minute.

On the *Google* sheet, enter the number of millions (e.g. for '85 million', please enter '85'.)

38 to 46 (million)

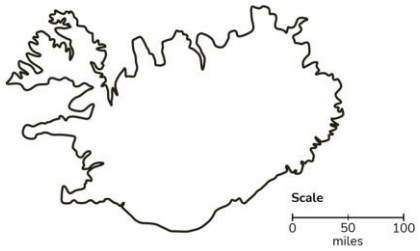
ROUND 3, QUESTION 3

Estimate the length of time, in seconds, for which this picture appears on the screen.

Acknowledgement: Wikimedia Commons

33 to 37 seconds

ROUND 3, QUESTION 4

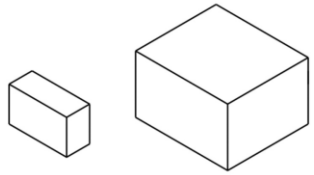


Estimate the area of Iceland, in square miles

35,000 to 45,000 km²

ROUND 3, QUESTION 5

Estimate the volume of the smaller cuboid as a fraction of the volume of the larger cuboid.



On the *Google* sheet, there are separate cells for the numerator and denominator of the fraction.

Any fraction between 0.097 and 0.117

ROUND 3, QUESTION 6

Arrange these expressions in increasing order of value, starting with the smallest.

A $\sqrt{14{,}000}$ **B** $\sqrt[3]{30{,}000}$

C $\frac{37.2}{0.058}$ **D** 196×2.39

On the *Google* sheet, write the four letters in the correct order, without spaces, e.g. **ABCD**.

BADC

Round 4

General Mathematics Questions

90 seconds for Questions 1 to 4

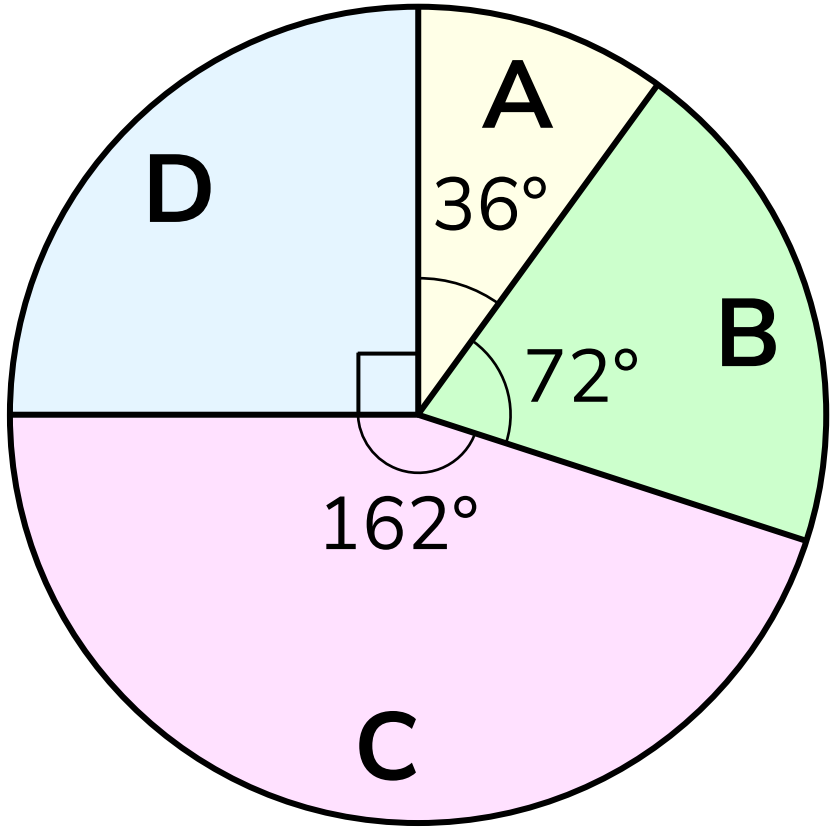
2 minutes for Questions 5 and 6

ROUND 4, QUESTION 1

$$12 - \frac{60}{3h - 1} = 9$$

What is the value of h?

ROUND 4, QUESTION 2



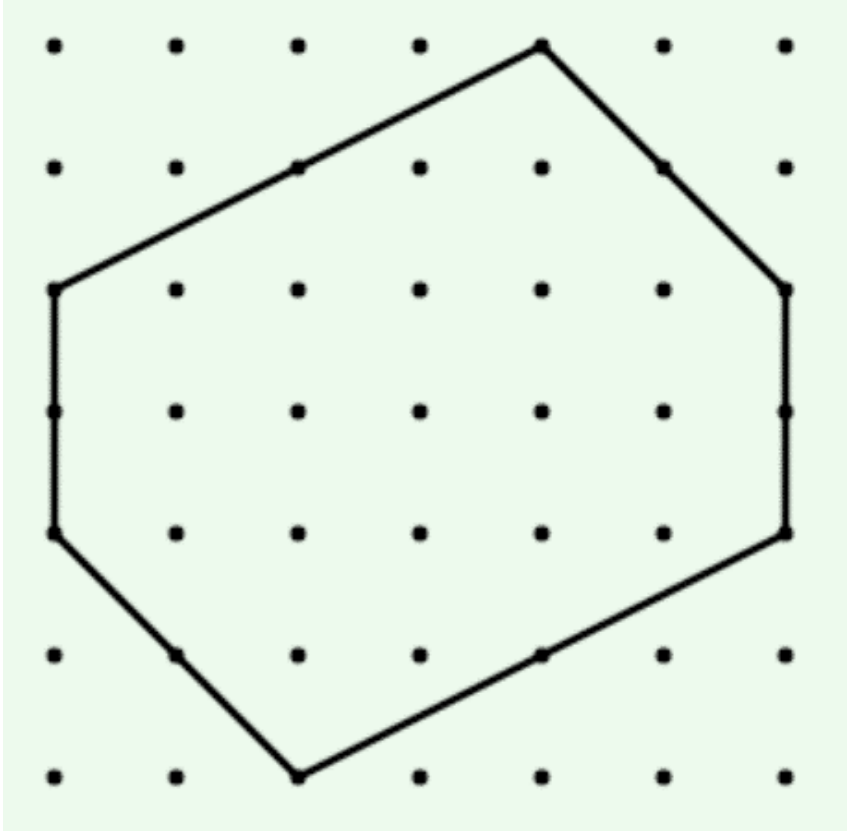
The pie chart shows the results of a survey into people's favourite football teams. The angles for each sector are shown.

35 people in the survey supported Team **D**.

How many **more** people supported Team **C** than supported Team **A**?

ROUND 4, QUESTION 3

Here is a hexagon, drawn on a centimetre-square dotty grid.



What is the area of the hexagon?

ROUND 4, QUESTION 4

$1^3 + 2^3 = \mathbf{9}$ $\qquad$ $1 + 2 = \mathbf{3}$

$1^3 + 2^3 + 3^3 = \mathbf{36}$ $\qquad$ $1 + 2 + 3 = \mathbf{6}$

$1^3 + 2^3 + 3^3 + 4^3 = \mathbf{100}$ $\qquad$ $1 + 2 + 3 + 4 = \mathbf{10}$

Use this pattern to help work out

$1^3 + 2^3 + 3^3 + 4^3 + \ldots + 14^3 + 15^3$

ROUND 4, QUESTION 5

60% of staff working in a school are male.

30% of the male staff are aged under forty.

25% of the non-male staff are aged forty or over.

What percentage of staff working in the school are aged under forty?

ROUND 4, QUESTION 6

In a farmyard, there are some chickens and horses (and no other animals).

Altogether, there are 17 heads and 38 legs in the farmyard

How many chickens and how many horses are there?

End of Round 4

Please finalise your answers, and pass them to your teachers for entry onto the *Google* sheet.

ANSWERS TO ROUND 4

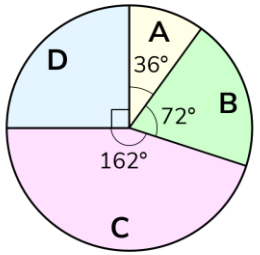
ROUND 4, QUESTION 1

$$12 - \frac{60}{3h - 1} = 9$$

What is the value of h?

7

ROUND 4, QUESTION 2



The pie chart shows the results of a survey into people's favourite football teams. The angles for each sector are shown.

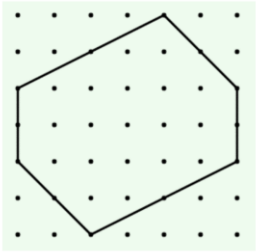
35 people in the survey supported Team **D**.

How many **more** people supported Team **C** than supported Team **A**?

49

ROUND 4, QUESTION 3

Here is a hexagon, drawn on a centimetre-square dotty grid.



What is the area of the hexagon?

24 cm²

ROUND 4, QUESTION 4

$1^3 + 2^3 = \mathbf{9}$ $\quad 1 + 2 = \mathbf{3}$

$1^3 + 2^3 + 3^3 = \mathbf{36}$ $\quad 1 + 2 + 3 = \mathbf{6}$

$1^3 + 2^3 + 3^3 + 4^3 = \mathbf{100}$ $\quad 1 + 2 + 3 + 4 = \mathbf{10}$

Use this pattern to help work out

$1^3 + 2^3 + 3^3 + 4^3 + \ldots + 14^3 + 15^3$

14,400 $(= 120^2)$

ROUND 4, QUESTION 5

60% of staff working in a school are male.

30% of the male staff are aged under forty.

25% of the non-male staff are aged forty or over.

What percentage of staff working in the school are aged under forty?

48%

ROUND 4, QUESTION 6

In a farmyard, there are some chickens and horses (and no other animals).

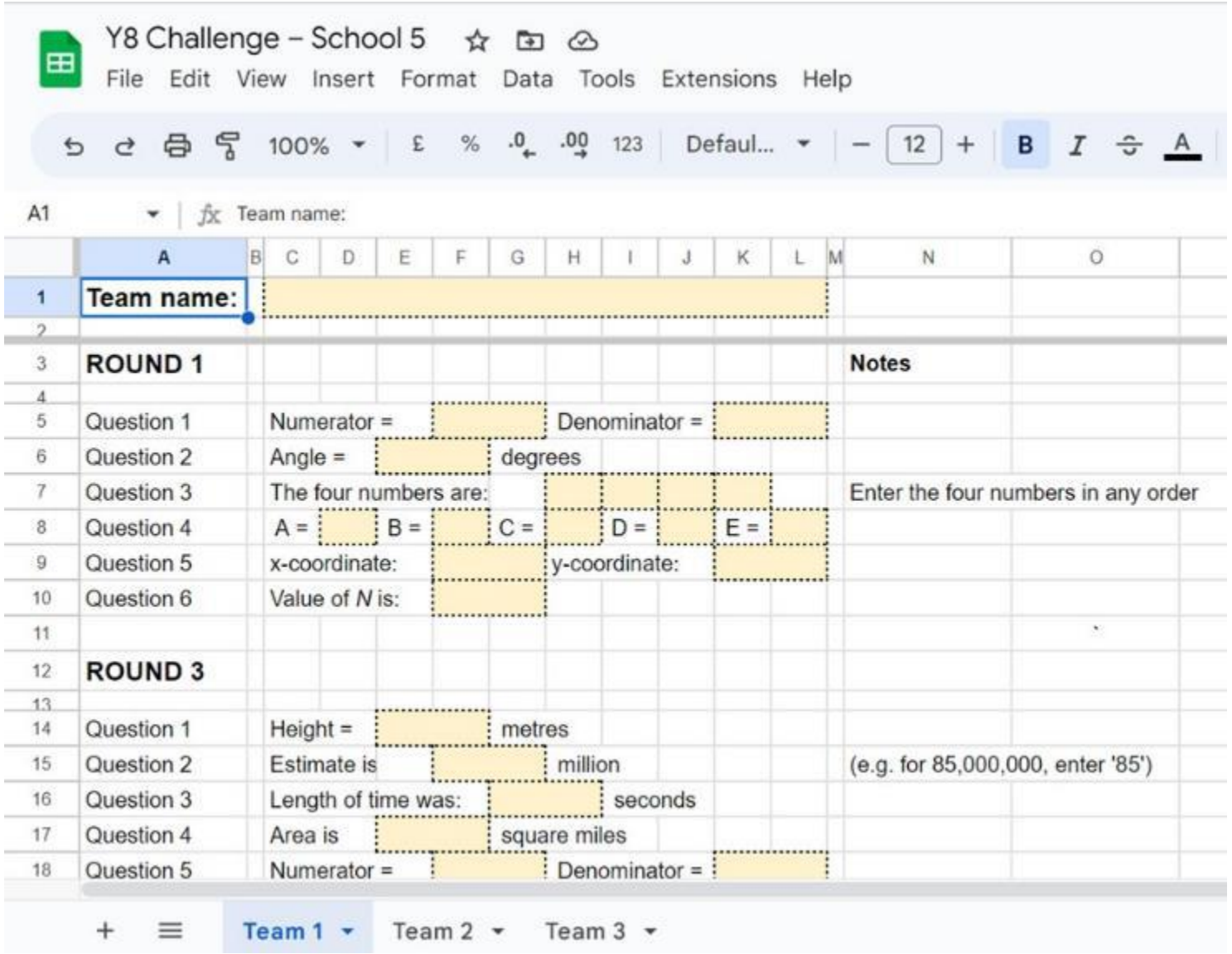
Altogether, there are 17 heads and 38 legs in the farmyard

How many chickens and how many horses are there?

15 chickens, 2 horses

YEAR 8 MATHS CHALLENGE 2023, HEAT 4

Please finalise your *Google* sheet as quickly as possible.



Y8 Challenge – School 5

File Edit View Insert Format Data Tools Extensions Help

	A	N	O
1	**Team name:**		
3	**ROUND 1**	**Notes**	
5	Question 1	Numerator = ____ Denominator = ____	
6	Question 2	Angle = ____ degrees	
7	Question 3	The four numbers are: ____ ____ ____ ____	Enter the four numbers in any order
8	Question 4	A = ____ B = ____ C = ____ D = ____ E = ____	
9	Question 5	x-coordinate: ____ y-coordinate: ____	
10	Question 6	Value of *N* is: ____	
12	**ROUND 3**		
14	Question 1	Height = ____ metres	
15	Question 2	Estimate is ____ million	(e.g. for 85,000,000, enter '85')
16	Question 3	Length of time was: ____ seconds	
17	Question 4	Area is ____ square miles	
18	Question 5	Numerator = ____ Denominator = ____	

Team 1 | Team 2 | Team 3

YEAR 8 MATHS CHALLENGE 2023, HEAT 4

Well done to all!

The results are ...

Thank you for taking part.

YEAR 8 MATHEMATICS CHALLENGE

Heat 4, via *Livestorm*

Tuesday 9th May 2023

William Thallon, Secondary Mathematics Adviser

David Cook, Lead Primary Mathematics Adviser