

# YEAR 8 MATHEMATICS CHALLENGE

Heat 4, via *Livestorm*

Wednesday 8th May 2024

William Thallon, Secondary Mathematics Adviser

Charley McKay, 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 15 teams (or so) 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 Wednesday 19th 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. It should include the name of your school (e.g. Sandringham Team A).
- 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.)

Y8 Challenge – School 20

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S15

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Team name:														
3	ROUND 1													Notes	
5	Question 1	Number is:													Enter a number between 0 and 9
6	Question 2	Number of different numbers is:													
7	Question 3	Shapes are:													Enter one letter in each cell, in any order
8	Question 4	Missing number is:													
9	Question 5	Number of integer terms is:													
10	Question 6	Numerator =					Denominator =								
12	ROUND 3														
14	Question 1	Estimate is:													
15	Question 2	Height is:													metres
16	Question 3	Estimate is:													letters
17	Question 4	Angle is:													degrees
18	Question 5	Area is:													cm <sup>2</sup>
19	Question 6	Length of time was:													minutes

+ ≡ Team 1 Team 2 Team 3

Round 1

# General Mathematics Questions

**90 seconds for each question**

# ROUND 1, QUESTION 1

20 is the sum of two primes:  $20 = 3 + 17$

So is 21:  $21 = 2 + 19$

Find a number between 20 and 30  
which is not the sum of two primes.

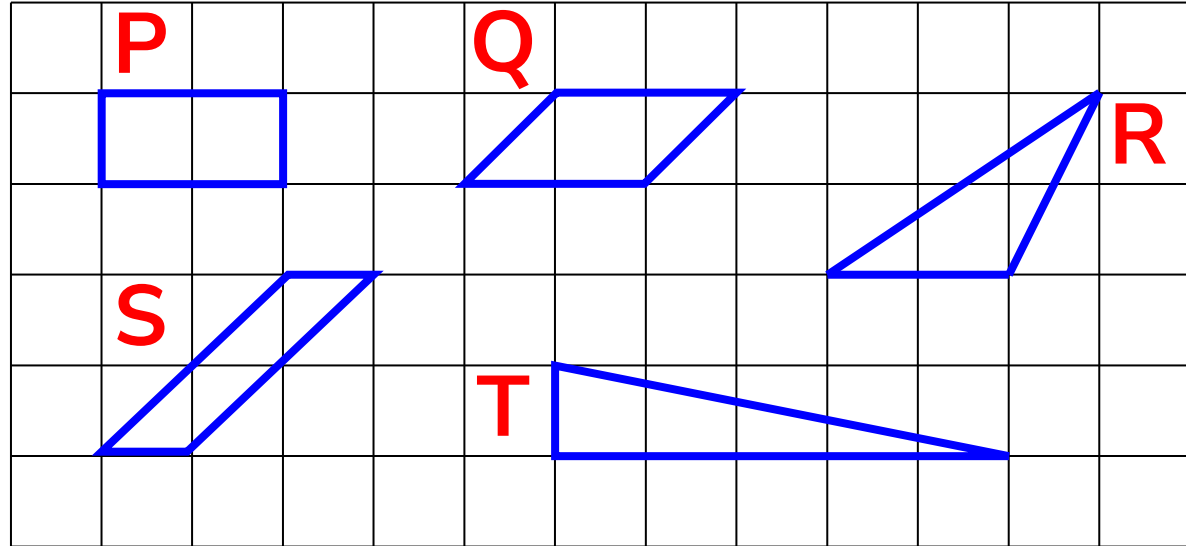
(There are actually three numbers; you only need to find one.)





## ROUND 1, QUESTION 2

Here are five shapes, drawn on a centimetre square grid.



Which shape has an area different to the other four?

What is the area of the 'odd one out'?



## ROUND 1, QUESTION 3

Look at this pattern of calculations.

$$2 \times 3 \times 4 = 3^3 - 3 = 24$$

$$3 \times 4 \times 5 = 4^3 - 4 = 60$$

$$4 \times 5 \times 6 = 5^3 - 5 = 120$$

etc ...

Work out the value of  $39 \times 40 \times 41$ .



## ROUND 1, QUESTION 4

These points are three vertices of a rectangle:

$(34, -10)$        $(71, 48)$        $(71, -10)$

What are the coordinates of the fourth vertex?

On the *Google* sheet, enter the  $x$ - and  $y$ -coordinates in separate cells, as indicated.

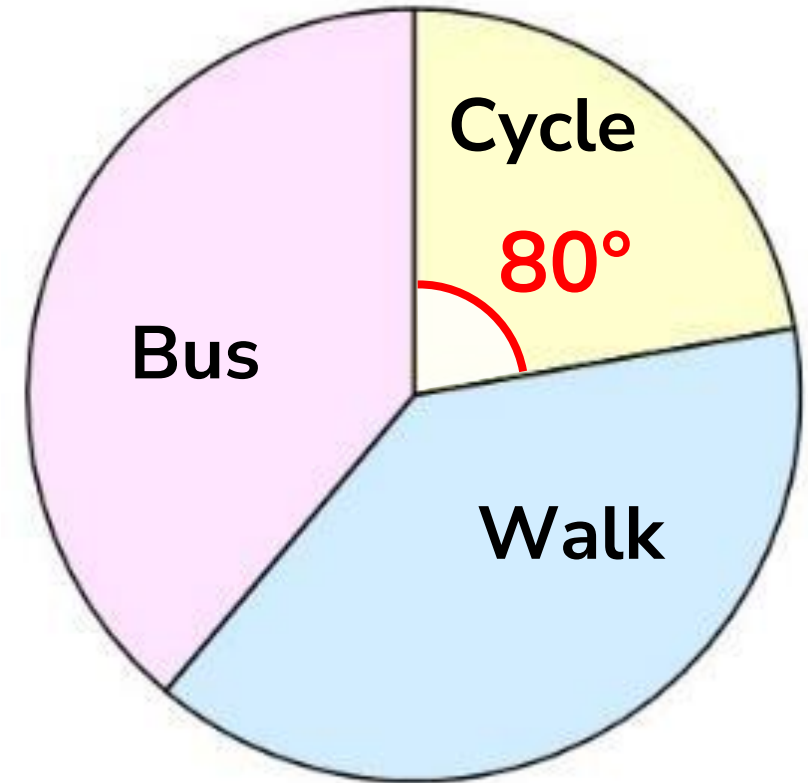


## ROUND 1, QUESTION 5

The pie chart shows how students travel to school.

180 people cycle.

The number of students who walk is equal to the number of students who come by bus.



How many people walk to school?





## ROUND 1, QUESTION 6

Place these expressions in increasing order.

<b>A</b> 0.45%	<b>B</b> $\frac{1}{200}$	<b>C</b> 0.004	<b>D</b> $\frac{11}{2500}$
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On the *Google* sheet, enter the **letters** of the expressions, one letter per cell.



# 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

20 is the sum of two primes:  $20 = 3 + 17$

So is 21:  $21 = 2 + 19$

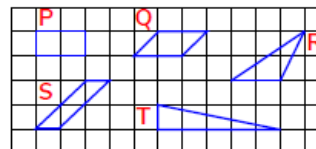
Find a number between 20 and 30 which is not the sum of two primes.

(There are actually three numbers; you only need to find one.)

**23, 27 or 29**

## ROUND 1, QUESTION 2

Here are five shapes, drawn on a centimetre square grid.



Which shape has an area different to the other four?

What is the area of the 'odd one out'?

**T,  $2.5 \text{ cm}^2$**

## ROUND 1, QUESTION 3

Look at this pattern of calculations.

$$2 \times 3 \times 4 = 3^3 - 3 = 24$$

$$3 \times 4 \times 5 = 4^3 - 4 = 60$$

$$4 \times 5 \times 6 = 5^3 - 5 = 120$$

etc ...

Work out the value of  $39 \times 40 \times 41$ .

**63,960**

## ROUND 1, QUESTION 4

These points are three vertices of a rectangle:

**(34, -10) (71, 48) (71, -10)**

What are the coordinates of the fourth vertex?

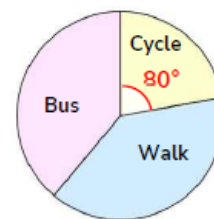
On the Google sheet, enter the x- and y-coordinates in separate cells, as indicated.

**(34, 48)**

## ROUND 1, QUESTION 5

The pie chart shows how students travel to school.  
180 people cycle.

The number of students who walk is equal to the number of students who come by bus.



How many people walk to school?

**315**

## ROUND 1, QUESTION 6

Place these expressions in increasing order.

<b>A</b> 0.45%	<b>B</b> $\frac{1}{200}$	<b>C</b> 0.004	<b>D</b> $\frac{11}{2500}$
----------------	--------------------------	----------------	----------------------------

On the Google sheet, enter the **letters** of the expressions, one letter per cell.

**CDAB**

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.

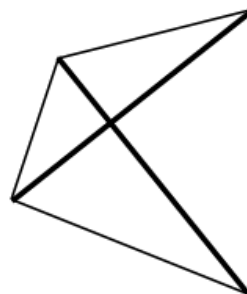
You now have one minute to decide who will be the observers and who will be the scribes ... and to get into position!

## ROUND 2

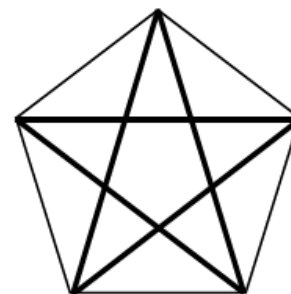
Poster about to be  
displayed for the first  
time.

# D I A G O N A L S

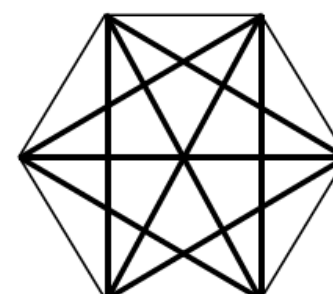
A **diagonal** of a polygon is a straight line joining two vertices, running through the inside of the polygon.



Quadrilateral  
2 diagonals

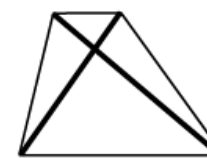
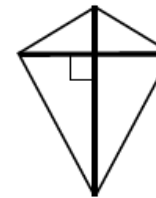
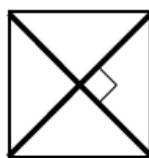


Pentagon  
5 diagonals



Hexagon  
9 diagonals

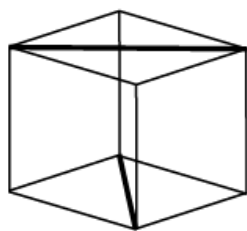
Diagonals in  
different types of  
quadrilateral



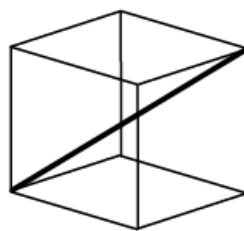
Shape	Square	Rectangle	Rhombus	Parallelogram	Kite	Trapezium
Equal length?	✓	✓	✗	✗	✗	✗
Intersect at right-angles?	✓	✗	✓	✗	✓	✗

In a **cube** there are ...

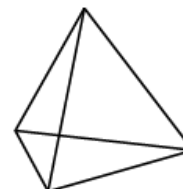
12 'face  
diagonals',  
like these



4 'space  
diagonals',  
like this  
one

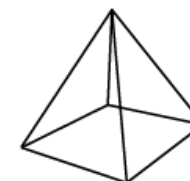


**Tetrahedron**



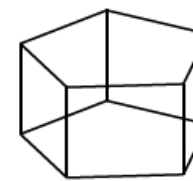
No diagonals

**Square-based  
pyramid**



2 face diagonals +  
0 space diagonals

**Pentagonal  
prism**



20 face diagonals +  
10 space diagonals

Round 2

# Memory Round

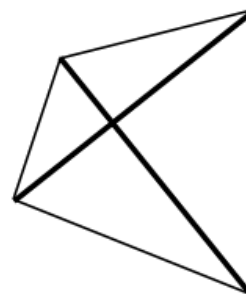


## ROUND 2

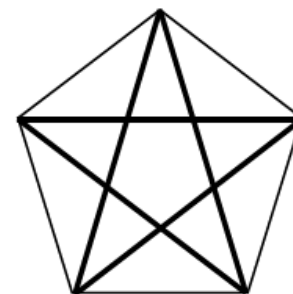
Second viewing of  
poster coming up!

# D I A G O N A L S

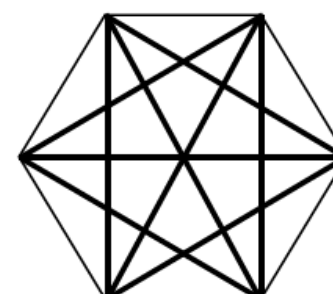
A **diagonal** of a polygon is a straight line joining two vertices, running through the inside of the polygon.



Quadrilateral  
2 diagonals

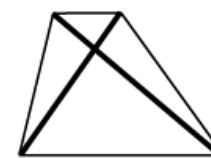
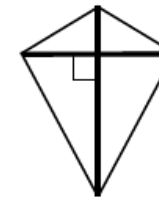
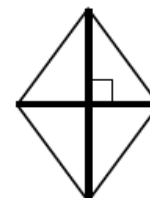
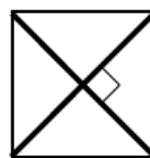


Pentagon  
5 diagonals



Hexagon  
9 diagonals

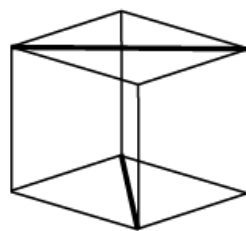
Diagonals in  
different types of  
quadrilateral



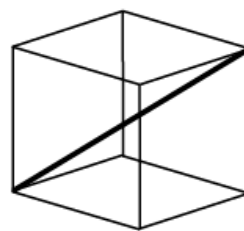
Shape	Square	Rectangle	Rhombus	Parallelogram	Kite	Trapezium
Equal length?	✓	✓	✗	✗	✗	✗
Intersect at right-angles?	✓	✗	✓	✗	✓	✗

In a **cube** there are ...

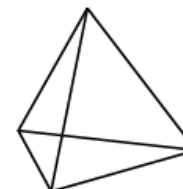
12 'face  
diagonals',  
like these



4 'space  
diagonals',  
like this  
one

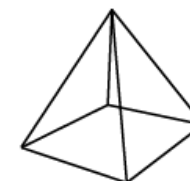


**Tetrahedron**



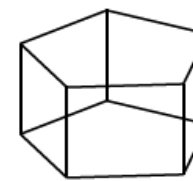
No diagonals

**Square-based  
pyramid**



2 face diagonals +  
0 space diagonals

**Pentagonal  
prism**



20 face diagonals +  
10 space diagonals



Round 2

# Memory Round

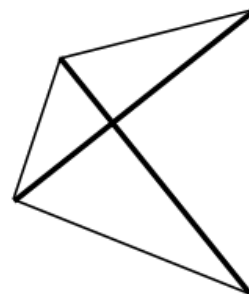


## ROUND 2

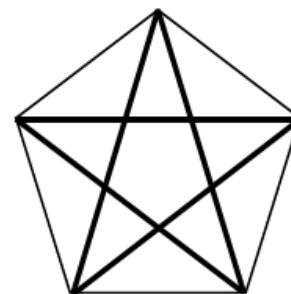
Third viewing of  
poster coming up!

# DIAGONALS

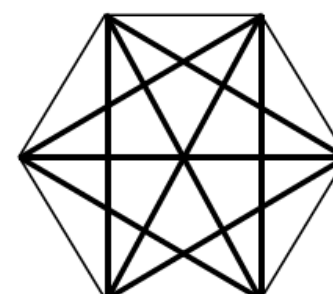
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Quadrilateral  
2 diagonals

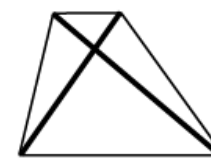
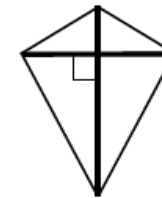
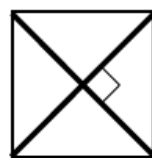


Pentagon  
5 diagonals



Hexagon  
9 diagonals

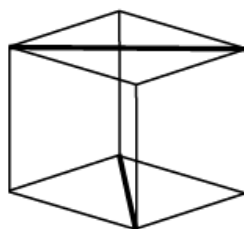
Diagonals in different types of quadrilateral



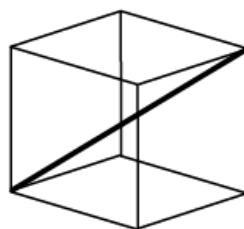
Shape	Square	Rectangle	Rhombus	Parallelogram	Kite	Trapezium
Equal length?	✓	✓	✗	✗	✗	✗
Intersect at right-angles?	✓	✗	✓	✗	✓	✗

In a **cube** there are ...

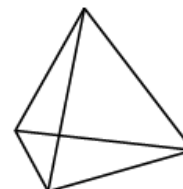
12 'face diagonals', like these



4 'space diagonals', like this one

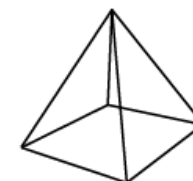


**Tetrahedron**



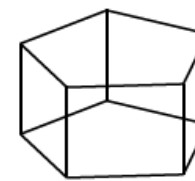
No diagonals

**Square-based pyramid**



2 face diagonals +  
0 space diagonals

**Pentagonal prism**



20 face diagonals +  
10 space diagonals

Round 2

# Memory Round

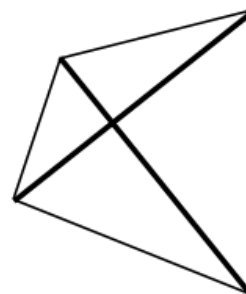


## ROUND 2

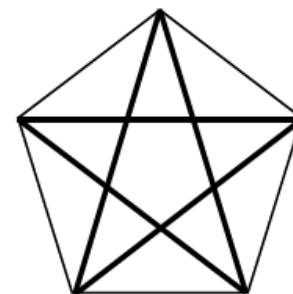
Fourth and final viewing  
of poster coming up!

# DIAGONALS

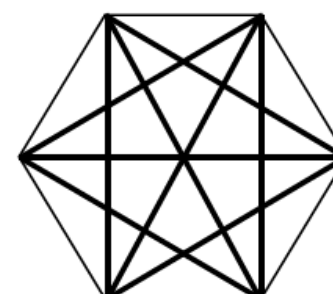
A **diagonal** of a polygon is a straight line joining two vertices, running through the inside of the polygon.



Quadrilateral  
2 diagonals

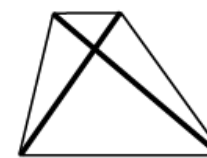
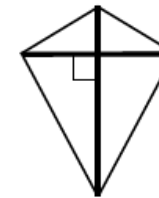
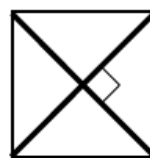


Pentagon  
5 diagonals



Hexagon  
9 diagonals

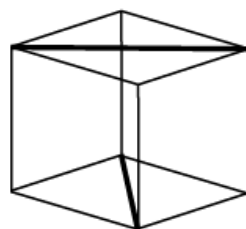
Diagonals in different types of quadrilateral



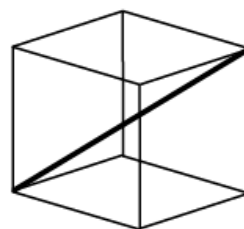
Shape	Square	Rectangle	Rhombus	Parallelogram	Kite	Trapezium
Equal length?	✓	✓	✗	✗	✗	✗
Intersect at right-angles?	✓	✗	✓	✗	✓	✗

In a **cube** there are ...

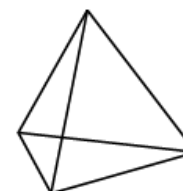
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4 'space diagonals', like this one

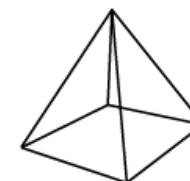


**Tetrahedron**



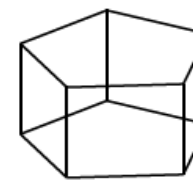
No diagonals

**Square-based pyramid**



2 face diagonals +  
0 space diagonals

**Pentagonal prism**



20 face diagonals +  
10 space diagonals

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:

**[Charley.Mckay@hfleducation.org](mailto:Charley.Mckay@hfleducation.org)**



# End of Round 2

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

**Charley.Mckay@hfleducation.org**



HFL

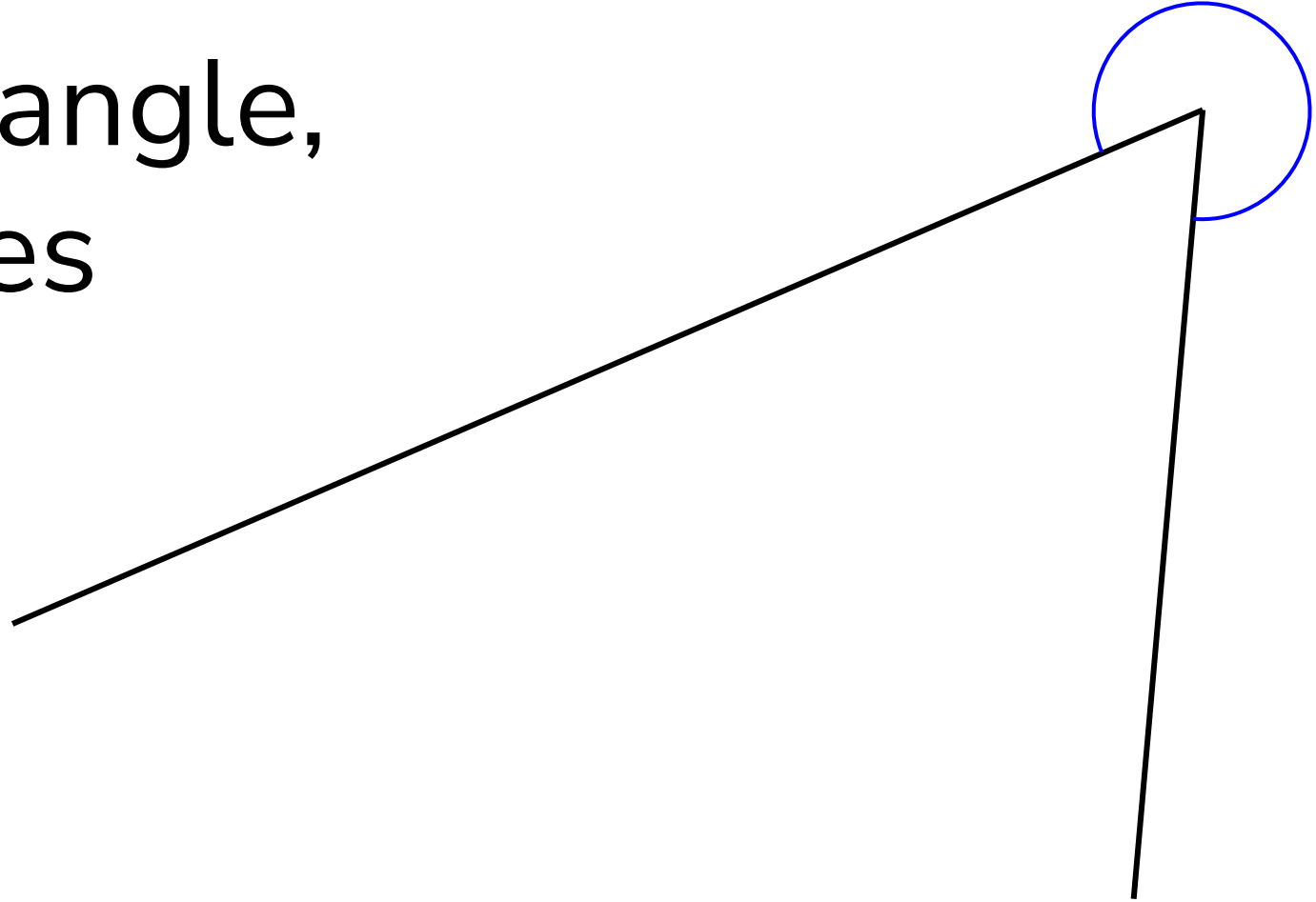
Round 3

# Estimation Round

**90 seconds for each question**

## ROUND 3, QUESTION 1

Estimate the size  
of the reflex angle,  
in degrees

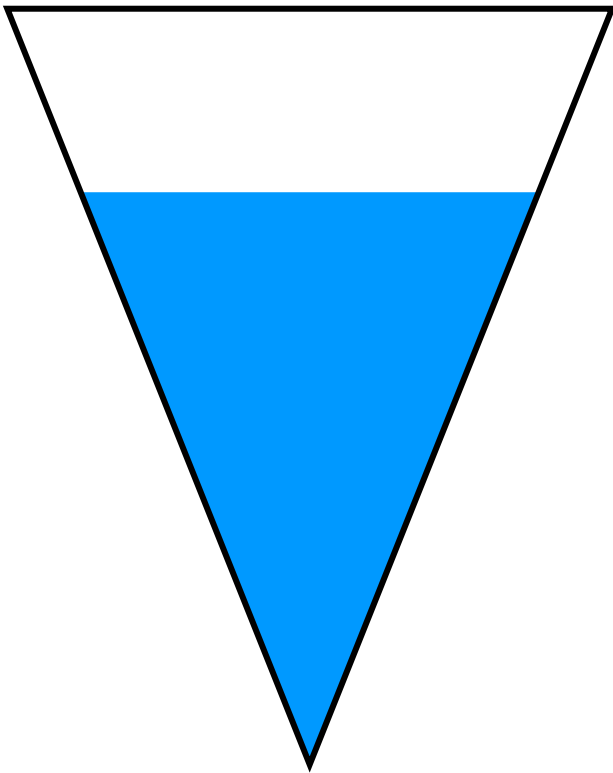




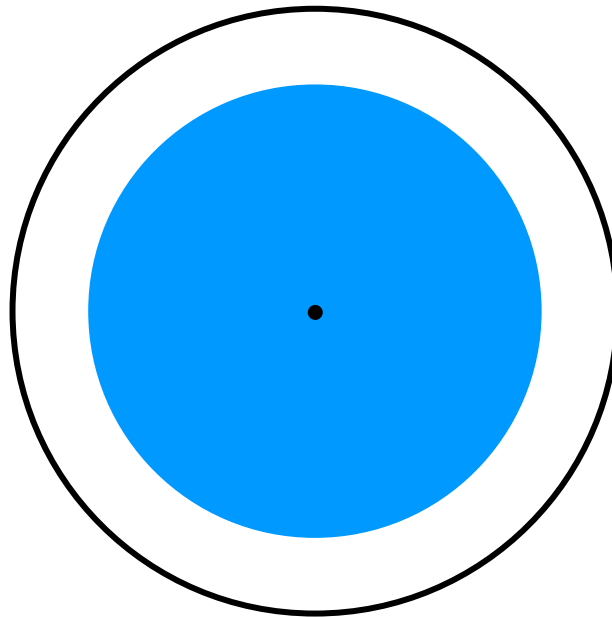
## ROUND 3, QUESTION 2

The diagrams show a cone partly filled with a blue liquid.

View from the side



View from  
above



Estimate the fraction of the cone that is filled with the liquid.



## ROUND 3, QUESTION 3

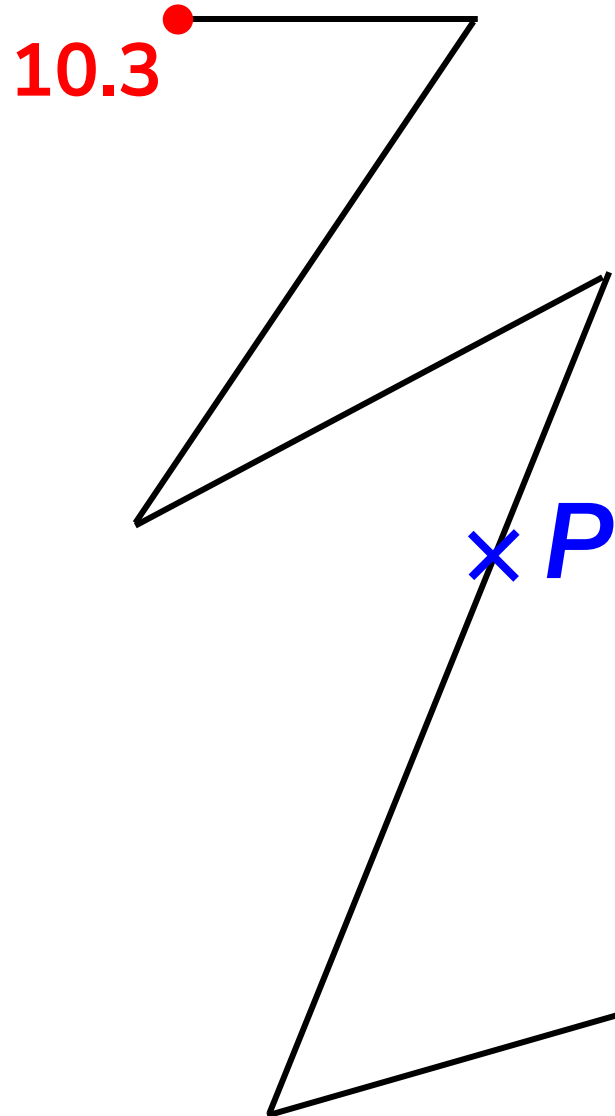
Estimate the value of:

$$\sqrt{17.1 \times 47.5}$$





## ROUND 3, QUESTION 4



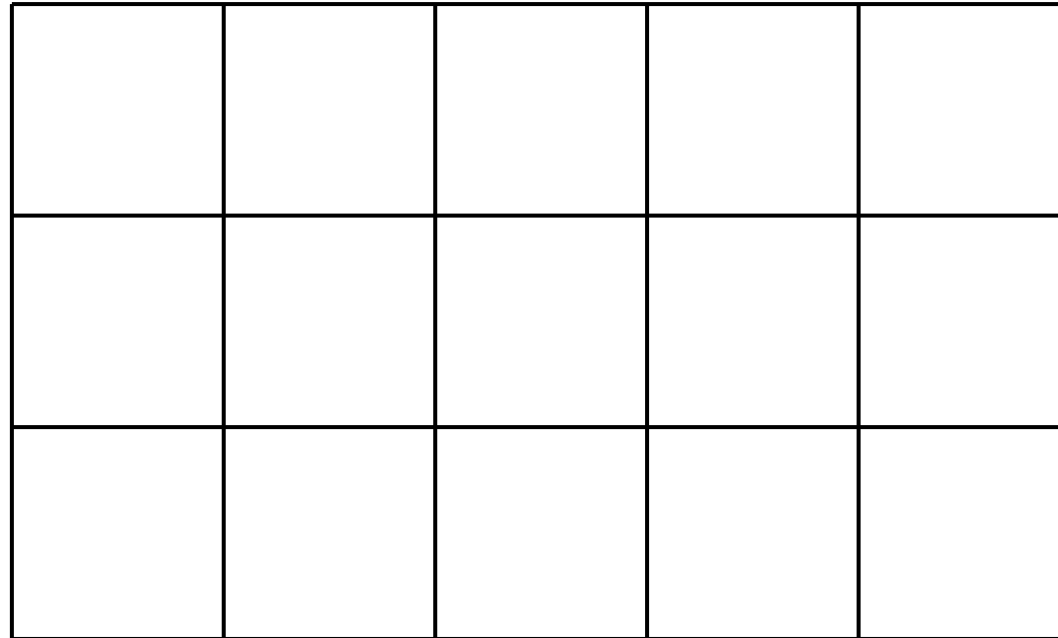
Here is a number line with a difference.

Estimate the number on the line represented by the point  $P$ .



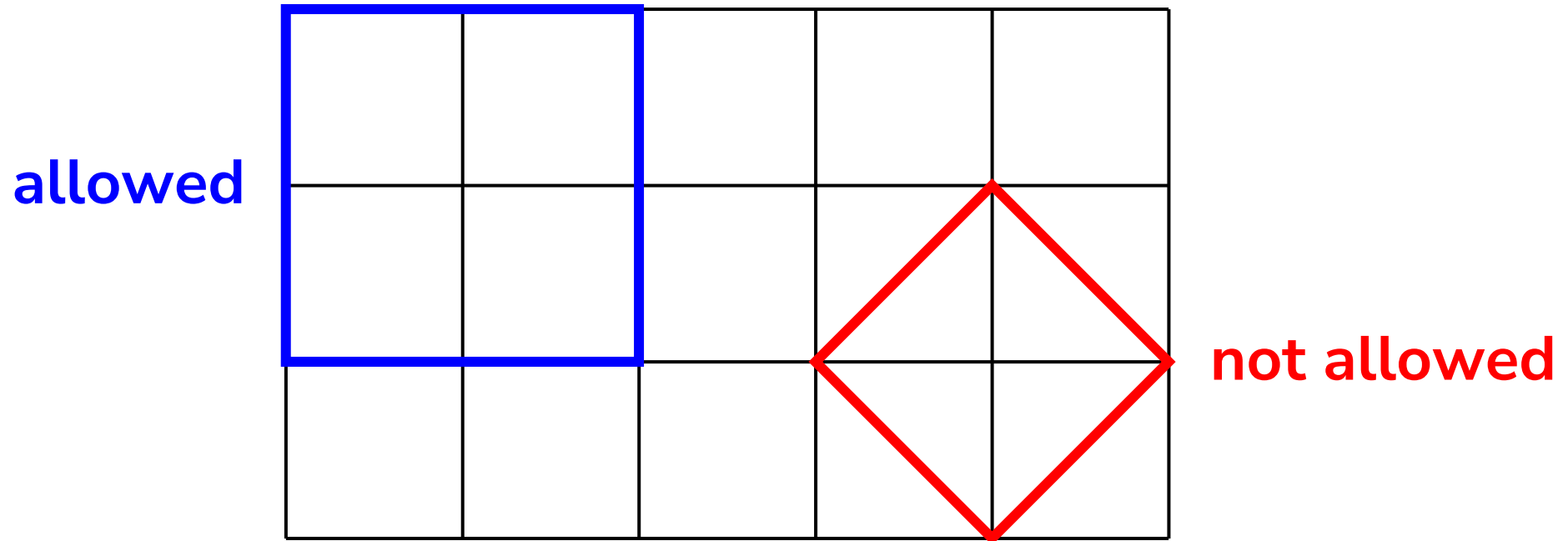
## ROUND 3, QUESTION 5

What is the total number of squares of different sizes in this grid?



## ROUND 3, QUESTION 5

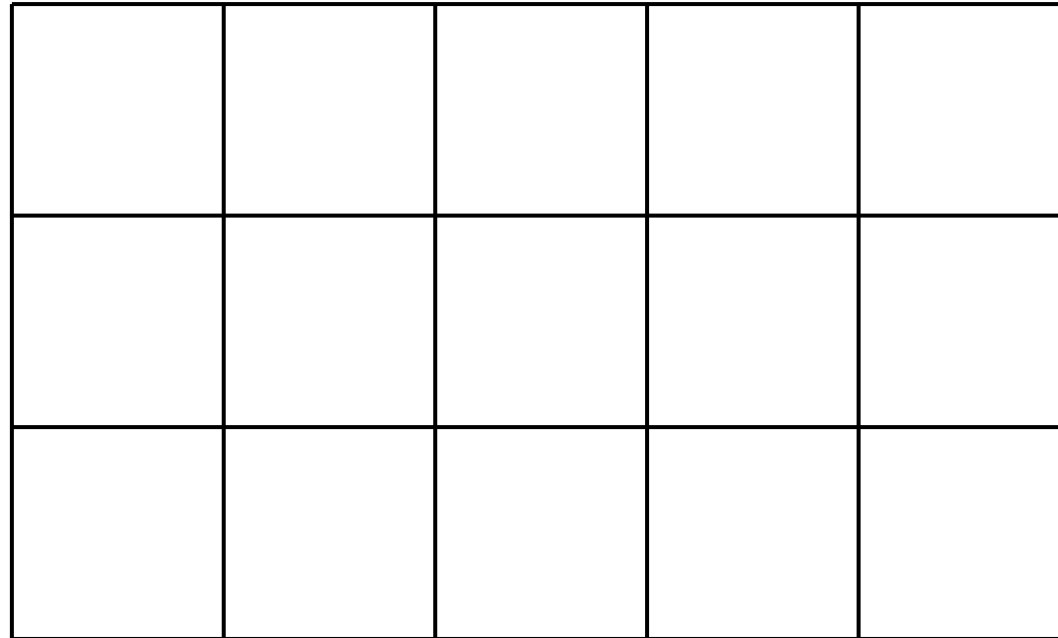
What is the total number of squares of different sizes in this grid?



## ROUND 3, QUESTION 5

What is the total number of squares of different sizes in this grid?

Please note:  
the **total number**  
**of squares**, not  
the number of  
different sizes.





## ROUND 3, QUESTION 6

The green curve is drawn on a centimetre square grid.

Estimate the length of the curve, in cm.







# End of Round 3

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

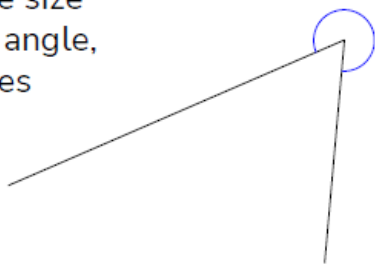


HFL

# ANSWERS TO ROUND 3

## ROUND 3, QUESTION 1

Estimate the size of the reflex angle, in degrees



**295 to 301°**

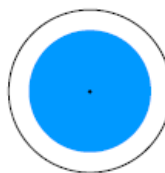
## ROUND 3, QUESTION 2

The diagrams show a cone partly filled with a blue liquid.

View from the side



View from above



Estimate the fraction of the cone that is filled with the liquid.

**Any fraction between 0.4 and 0.45**

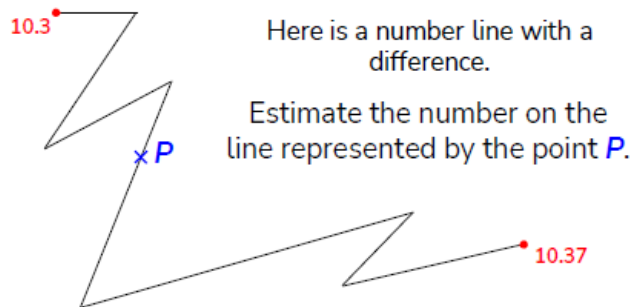
## ROUND 3, QUESTION 3

Estimate the value of:

$$\sqrt{17.1 \times 47.5}$$

**27 to 30**

## ROUND 3, QUESTION 4

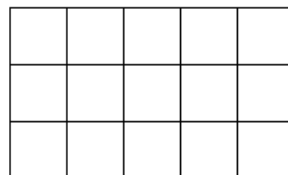


**10.324 to 10.328**

## ROUND 3, QUESTION 5

What is the total number of squares of different sizes in this grid?

Please note: the total number of squares, not the number of different sizes.

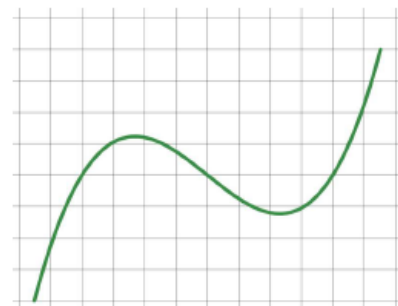


**26**

## ROUND 3, QUESTION 6

The green curve is drawn on a centimetre square grid.

Estimate the length of the curve, in cm.



**17 to 19.2 cm**

Round 4

# General Mathematics Questions

**90 seconds for each question**

## ROUND 4, QUESTION 1

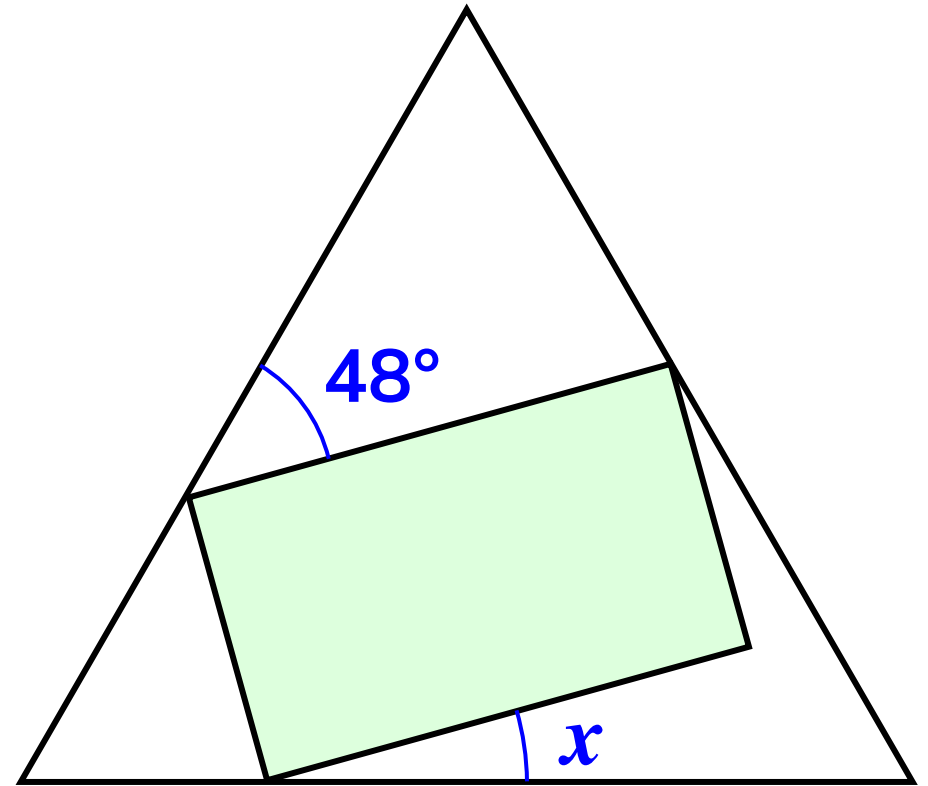
How many common multiples of 2 and 3 are there between 1 and 50?



## ROUND 4, QUESTION 2

The diagram shows a rectangle inside an equilateral triangle.

Three vertices of the rectangle lie on the perimeter of the triangle.

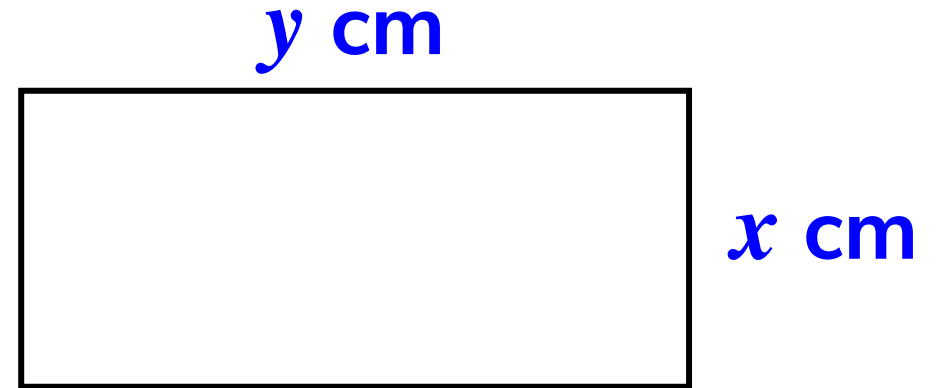


What is the size of the angle marked  $x$ ?



## ROUND 4, QUESTION 3

The diagram shows a rectangle with perimeter  $P$  cm.



Which of these formulas are correct?

<b>A</b> $P = 2(x + y)$	<b>B</b> $x = \frac{P}{y}$	<b>C</b> $P = xy$
<b>D</b> $y = \frac{P + 2x}{2}$	<b>E</b> $x = \frac{2y - P}{2}$	<b>F</b> $y = \frac{P}{2} - x$

On the Google sheet, enter the letters of the **correct** formulas.





## ROUND 4, QUESTION 4

Abi and Billie share £90.

Abi gets five times more money than Billie.

In £, what is the difference between the amounts Abi and Billie receive?



## ROUND 4, QUESTION 5

Here is a pattern of nine fractions:

$$\frac{1}{4} \quad \frac{2}{5} \quad \frac{3}{6} \quad \frac{4}{7} \quad \frac{5}{8} \quad \frac{6}{9} \quad \frac{7}{10} \quad \frac{8}{11} \quad \frac{9}{12}$$

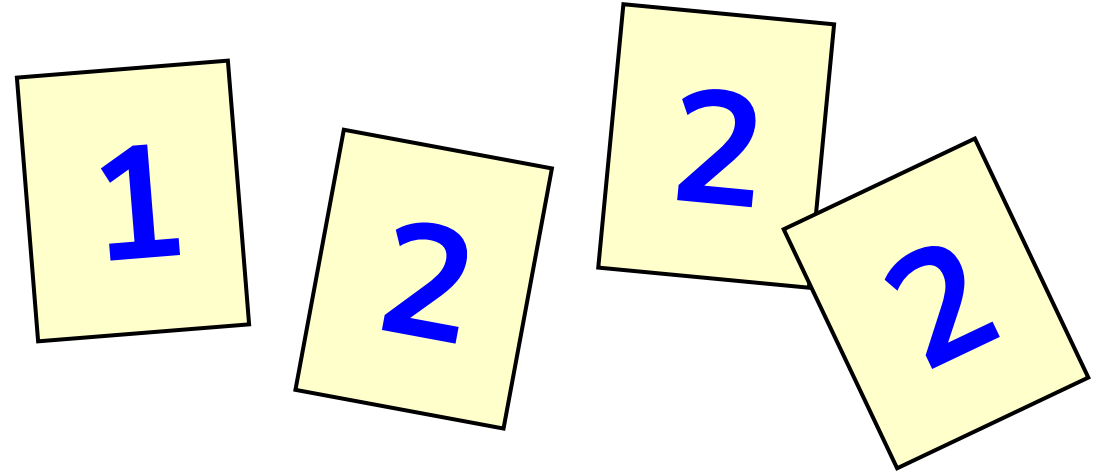
How many of these fractions, when converted to a percentage, give integers?

On the *Google* sheet, enter a number between 0 and 9.



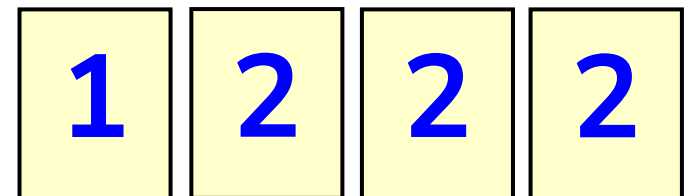
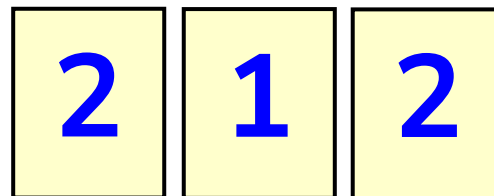
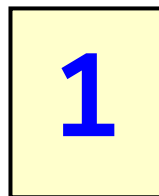
## ROUND 4, QUESTION 6

Here are four number cards.



How many **different** numbers can be made using some or all of these four cards?

Examples:





# End of Round 4

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



HFL



# ANSWERS TO ROUND 4

## ROUND 4, QUESTION 1

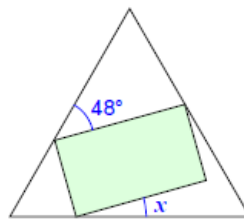
How many common multiples of 2 and 3 are there between 1 and 50?

8

## ROUND 4, QUESTION 2

The diagram shows a rectangle inside an equilateral triangle.

Three vertices of the rectangle lie on the perimeter of the triangle.

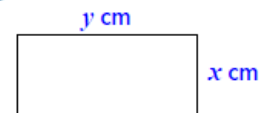


What is the size of the angle marked  $x$ ?

12°

## ROUND 4, QUESTION 3

The diagram shows a rectangle with perimeter  $P$  cm.



Which of these formulas are correct?

A $P = 2(x + y)$	B $x = \frac{P}{y}$	C $P = xy$
D $y = \frac{P + 2x}{2}$	E $x = \frac{2y - P}{2}$	F $y = \frac{P}{2} - x$

On the Google sheet, enter the letters of the correct formulas.

A and F

## ROUND 4, QUESTION 4

Abi and Billie share £90.

Abi gets five times more money than Billie.

In £, what is the difference between the amounts Abi and Billie receive?

£60

## ROUND 4, QUESTION 5

Here is a pattern of nine fractions:

$\frac{1}{4}$   $\frac{2}{5}$   $\frac{3}{6}$   $\frac{4}{7}$   $\frac{5}{8}$   $\frac{6}{9}$   $\frac{7}{10}$   $\frac{8}{11}$   $\frac{9}{12}$

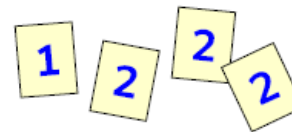
How many of these fractions, when converted to a percentage, give integers?

On the Google sheet, enter a number between 0 and 9.

5

## ROUND 4, QUESTION 6

Here are four number cards.



How many **different** numbers can be made using some or all of these four cards?

Examples:



13

# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

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

Y8 Challenge – School 20

File Edit View Insert Format Data Tools Extensions Help

100% £ % .0 .00 123 Arial 10 B I

S15

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1	Team name:															
2																
3	ROUND 1													Notes		
4																
5	Question 1	Number is:													Enter a number between 0 and 9	
6	Question 2	Number of different numbers is:														
7	Question 3	Shapes are:										Enter one letter in each cell, in any or				
8	Question 4	Missing number is:														
9	Question 5	Number of integer terms is:														
10	Question 6	Numerator =				Denominator =										
11																
12	ROUND 3															
13																
14	Question 1	Estimate is:														
15	Question 2	Height is:				metres										
16	Question 3	Estimate is:				letters										
17	Question 4	Angle is:				degrees										
18	Question 5	Area is:				cm <sup>2</sup>										
19	Question 6	Length of time was:				minutes										

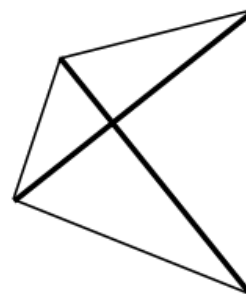
+ ≡ Team 1 Team 2 Team 3

# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

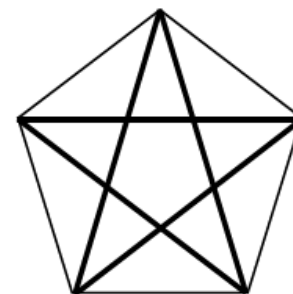
Results imminent!

# D I A G O N A L S

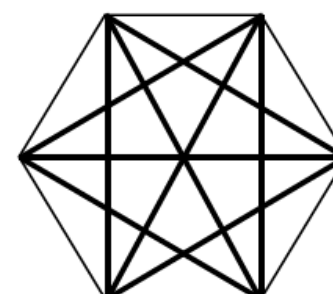
A **diagonal** of a polygon is a straight line joining two vertices, running through the inside of the polygon.



Quadrilateral  
2 diagonals

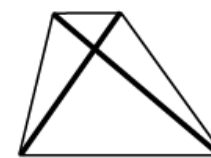
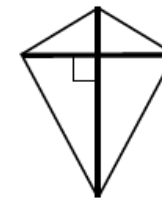
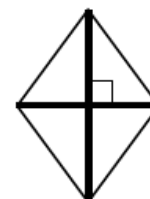
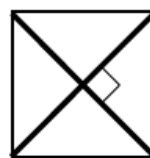


Pentagon  
5 diagonals



Hexagon  
9 diagonals

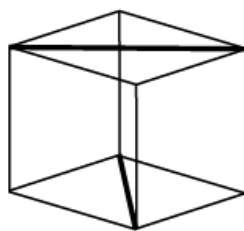
Diagonals in  
different types of  
quadrilateral



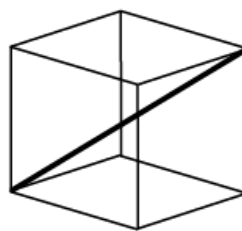
Shape	Square	Rectangle	Rhombus	Parallelogram	Kite	Trapezium
Equal length?	✓	✓	✗	✗	✗	✗
Intersect at right-angles?	✓	✗	✓	✗	✓	✗

In a **cube** there are ...

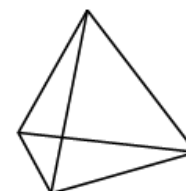
12 'face  
diagonals',  
like these



4 'space  
diagonals',  
like this  
one

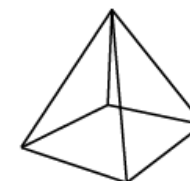


**Tetrahedron**



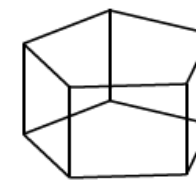
No diagonals

**Square-based  
pyramid**



2 face diagonals +  
0 space diagonals

**Pentagonal  
prism**



20 face diagonals +  
10 space diagonals

# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

Results imminent!

# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

Firstly, well done  
to all!



# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

**Well done to all!**



Every team will receive a breakdown of their results by e-mail this evening (or first thing tomorrow morning).

# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

**Well done to all!**



The results are ...



# YEAR 8 MATHS CHALLENGE 2024, HEAT 4

Thank you for taking  
part.

# YEAR 8 MATHEMATICS CHALLENGE

Heat 4, via *Livestorm*

Wednesday 8th May 2024

William Thallon, Secondary Mathematics Adviser

Charley McKay, Primary Mathematics Adviser



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