YEAR 8 MATHEMATICS CHALLENGE

Final, Oak Room (Hertfordshire Development Centre) Wednesday 19th June 2024

William Thallon and Karen Gordon Secondary Mathematics Advisers

FORMAT OF CHALLENGE

- Round 1 General Maths questions
- Round 2 Memory Round
- Round 3 Estimation and Problem-Solving Round
- Round 4 General Maths questions

60 marks for each round



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 should include the name of your school. Include the team name on all the Answer Sheets you hand in.



PRELIMINARIES

• Don't leave any answers blank. 'Near misses' or partially correct answers may score points.



 Where necessary, make sure you include the correct units. If you forget to do this, you will not gain full marks for the question, even if the numerical answer is correct.



Round 1

General Mathematics Questions

90 seconds for each question

HFI

1 2 3 4 5 6 7 8 9

Group the integers from 1 to 9 into three groups of three, so that the sum of the numbers in each group is the same.

Group A	Group B	Group C

(Give the groups in any order. There is more than one possible solution – just find one.)

If you draw three straight lines, there are at most **3** different crossing-points.



What is the maximum possible number of crossing-points when **five** straight lines are drawn.

The highest common factor of **three 2-digit** numbers is **3**.

The lowest common multiple of the same three numbers is **90**.

What could the three numbers be?

Write the three numbers on the Answer Sheet in any order. (There is more than one possible solution; you only need to find one.)

This population pyramid shows the ages of people in a village.



What percentage of people under 40 are male?

This diagram is deliberately not drawn to scale.

ABCD is a kite

ABC is an equilateral triangle BD = AB

Work out the size of the angle marked *x*.



Find a pair of **different** numbers whose sum is equal to their product.

Hint: at least one of the numbers will not be an integer.

There are many different possible solutions. See if you can find **two** of them.

End of Round 1

HFL

ANSWERS TO ROUND 1



<mark>40%</mark>

<mark>15°</mark>

e.g. 3 and 1½; 4 and 1⅓; -1 and ½

Round 2

Memory Round

HFL

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 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.



<u>Hint for the observers</u>

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

Memory Round

HFL

End of Round 2

HFL









Round 3

Estimation and Problem-Solving

HFL

The area of Portugal is 92,000 km².

Estimate the area of France, in km².





How many capfuls would it take to fill the bottle?

ROUND 3, QUESTION 3 D Estimate how many minutes it has been since this diagram first appeared on the screen.

R

Rishi always tells lies on Mondays, Tuesdays and Wednesdays, but always tells the truth on the other days of the week.

Keir always tells lies on Thursdays, Fridays and Saturdays, but always tells the truth on the other days of the week.

One day, Rishi said to Keir: "Yesterday, I was lying."

Keir replied: "So was I."

On which day of the week did this conversation take place?

In this problem, all triangles have sides of integer length.

There are only two different triangles 4 cm/ with a perimeter of **10 cm**.



Side lengths (cm)			
2	4	4	
3	3	4	

Find all the different triangles with a perimeter of **15 cm**.

Record the side lengths in the table on the Answer Sheet

Put numbers in the empty circles of both stars so that the numbers along each line of **both** stars have the same total.



End of Round 3

HFL

ANSWERS TO ROUND 3



552,000 km² ± 10,000

ROUND 3, QUESTION 4

Rishi always tells lies on Mondays, Tuesdays and Wednesdays, but always tells the truth on the other days of the week.

Keir always tells lies on Thursdays, Fridays and Saturdays, but always tells the truth on the other days of the week.

One day, Rishi said to Keir: "Yesterday, I was lying."

Keir replied: "So was I."

On which day of the week did this conversation take place?





<mark>106 ± 10</mark>

Side lengths (cm)			
1	7	7	
2	6	7	
3	5	7	
3	6	6	
4	4	7	
4	5	6	
5	5	5	





Round 4

General Mathematics Questions

90 seconds for Questions 1 to 4 2 minutes for Questions 5 and 6

HFL

Find the smallest integer value of *n* for which

$$\sqrt{5 + \sqrt{5 + n}}$$

is an integer.

The term-to-term rule for a sequence is:

divide 12 by the previous term

The first term of the sequence is 8. So the second term is: $\frac{12}{8} = 1.5$

(a) Work out the third term of the sequence.

(b) Add up the first 100 terms of the sequence.

Karen drives to see her friend, who lives 60 miles away.

Her average speed for the whole journey is 45 miles per hour.

The first 30 miles of the journey take 30 minutes.

What was Karen's average speed for the second half of the journey?

 $2^7 = 128$

The power of 10 which is closest to 2^7 is 10^2 .

Which integer power of 10 is closest in value to 2^{100} ?

Here are two sets of numbers.



The **modes** of the two sets of numbers are equal. The **median** of Set B is **3 more** than the median of Set A. The **mean** of Set B is **10 more** than the mean of Set A.

Work out the numbers *a*, *b* and *c*. (You may give the numbers in any order.)

This diagram is not drawn to scale. All lengths are in cm.

The diagram shows two right-angled triangles, ABC and DEF.

ADEB is a straight line. CB and FE are horizontal.



Work out the area shaded green.

End of Round 4

HFL

ANSWERS TO ROUND 4



(a)

(a)

(b)

<mark>(a) 8 (b) 475</mark>

Work out the third term of the sequence.

Add up the first 100 terms of the sequence.

The term-to-term rule for a sequence is:

divide 12 by the previous term

ROUND 4, QUESTION 2

The first term of the sequence is 8.

So the second term is: $\frac{12}{8} = 1.5$



<mark>8, 8, 14</mark>

ROUND 4, QUESTION 3

Karen drives to see her friend, who lives 60 miles away.

Her average speed for the whole journey is 45 miles per hour.

The first 30 miles of the journey take 30 minutes.

What was Karen's average speed for the second half of the journey?

<mark>36 mph</mark>







<mark>30</mark>

 $2^7 = 128$

The power of 10 which is closest to 2^7 is 10^2 .

Which integer power of 10 is

closest in value to 2¹⁰⁰?

ROUND 4, QUESTION 4

YEAR 8 MATHS CHALLENGE 2024, FINAL

Firstly, well done to all!



The results are ...

YEAR 8 MATHS CHALLENGE 2024, FINAL

Thank you for taking part.

YEAR 8 MATHEMATICS CHALLENGE

Final, Oak Room (Hertfordshire Development Centre) Wednesday 19th June 2024

William Thallon and Karen Gordon Secondary Mathematics Advisers