



# Mathematics Department

Mrs F Campbell

## UKMT Maths Challenges

The UKMT Maths Challenges are lively, intriguing multiple choice question papers, which are designed to stimulate interest in mathematics. There are three levels of challenge Junior, Intermediate and Senior. Students are not permitted to use a calculator, only a pencil and eraser.

The papers contain 25 multiple choice questions. Of these, the first 15 are more accessible whilst the final 10 will provide more food for thought. Gold, silver and bronze certificates are awarded to 40% of participants nationally and the most successful participants at each level are invited to enter follow-on rounds.

## Junior Maths

### Sample Question

In a group of 48 children, the ratio of boys to girls is 3:5. How many boys must join the group to make the ratio of boys to girls 5:3?

A. 48 B. 40 C. 32 D. 24 E. 8

### Solution - C

Initially there were 48 children of which  $\frac{3}{8}$  were boys and  $\frac{5}{8}$  were girls, so there were 18 boys and 30 girls. When more boys join, there are still 30 girls who are  $\frac{3}{8}$  of the total. So the total number of pupils must increase to 80. So there must be  $80 - 30 = 50$  boys now and  $50 - 18 = 32$  boys have to join.

Last year a total of 100 pupils in Years 8 and 9 entered the Junior Maths challenge. Nine students were awarded a Gold Certificate, 22 students a Silver Certificate and 23 a Bronze Certificate. Jude Kennedy in Year 9 was awarded Best in School with a score of 96 whilst Daniel Brown was the highest scoring Year 8 student with 90 points. Well done to both students.

## Intermediate Maths Challenge

### Sample Question

Tegwen has the same number of brothers as she has sisters. Each one of her brothers has 50% more sisters than brothers. How many children are in Tegwen's family?

A. 5 B. 7 C. 9 D. 11 E. 13

### Solution - D

Let there be  $g$  girls and  $b$  boys in Tegwen's family.

Then, as she has the same number of brothers as she does sisters,  $b = g - 1$ .

Also, each of her brothers has 50% more sisters than brothers. Therefore  $g = \frac{3}{2}(b - 1)$ .

So  $b + 1 = \frac{3}{2}(b - 1)$  and hence  $2b + 2 = 3b - 3$ . Rearranging this equation gives  $b = 5$ .

So  $g = 5 + 1 = 6$ . Therefore there are  $5 + 6 = 11$  children in Tegwen's family.

Forty Year 11 pupils and forty Year 12 pupils were entered for the Intermediate Challenge.

Twelve students were awarded Gold Certificates, 27 Silver Certificates and 20 Bronze Certificates.

In Year 12, Michael Rogan achieved "Best in School" with a score of 95. In Year 11 Aaron Brown and Remi McNearney were both awarded the "Best in Year" with a score of 73. Well done to all involved.

## Senior Maths Challenge

### Sample Question

The Knave of Hearts tells only the truth on Mondays, Tuesdays, Wednesdays and Thursdays.

He tells only lies on all the other days.

The Knave of Diamonds tells only the truth on Fridays, Saturdays, Sundays and Mondays.

He tells only lies on all the other days.

On one day last week, they both said, "Yesterday I told lies."

On which day of the week was that?

A. Sunday B. Monday C. Tuesday  
D. Thursday E. Friday

### Solution - E

|                 | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Mon |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Knave of Hearts | T   | T   | T   | L   | L   | L   | T   |     |
| Diamonds        | T   | L   | L   | L   | T   | T   | T   | T   |

When a knave says, "Yesterday I told lies" it could be that today he is telling the truth and he did indeed tell lies yesterday. In

# Mathematics Department

the table, this is a T preceded by an L. It could also be that today he is lying, in which case he was in fact telling the truth yesterday. In the table, this is an L preceded by a T. The only day when one or the other of these options applies to each knave is Friday

Twenty five Year 13 students and twenty five Year 14 students were entered for the Senior Challenge. Six students were awarded a Gold Certificate, 14 were awarded a Silver Certificate and 22 a Bronze Certificate. Andrew Rutledge in Year 14 was "Best in School" with a score of 96. David Jones was "Best in Year 13" with a score of 90. Andrew Rutledge, Michael Young and David Jones all qualified for the Senior Kangaroo competition. Well done to all involved.

## The Children In Crossfire Maths Challenge

"Children in Crossfire" is a charity that focuses on Early Childhood development in Tanzania, Ethiopia and The Gambia. They work alongside local organisations to make better Healthcare, Nutrition and Education available to young children.



The eight classes competed against each other as well as pupils from other schools and each class then entered their answers online to the organising body. The pupils each donated £1.00 to compete, with all proceeds going to the charity Children in Crossfire. The classes all seemed to enjoy the challenge and it was a great opportunity to promote group work, problem solving and communication within Mathematics.

4m and 7m respectively, turning it into a square and increasing its area by 137m<sup>2</sup>. What are dimensions of the original pen?



### Solution

Let the original pen measure  $x$  by  $y$ . So the new pen measures  $x + 4$  by  $y + 7$ .

The new pen is a square so  $x + 4 = y + 7$ , so  $y = x - 3$ .

The area of the original pen was  $xy = x(x - 3)$

The area of the new pen is  $(x + 4)(x + 4)$

Therefore  $x(x - 3) + 137 = (x + 4)(x + 4)$

Giving  $x = 11$ , so the original dimensions of the pen were 11m X 8m.



In February, all Year 10 pupils took part in the Children in Crossfire Maths Challenge. The students worked in teams to solve a range of mathematical problems involving much discussion, agreement (at times!) and compromise.

### Sample Question

Joshua keeps ostriches in a rectangular pen. He decides to change the dimensions of the pen to accommodate more ostriches.

The sides of the pen are increased by

