The Scottish Mathematical Council

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MATHEMATICAL CHALLENGE 2010−2011

Entries must be the unaided efforts of individual pupils.
Solutions must include explanations and answers without explanation will be given no credit.
Do not feel that you must hand in answers to all the questions.

CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE
The Edinburgh Mathematical Society, Professor L E Fraenkel,
The London Mathematical Society and The Scottish International Education Trust.
The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.
Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, St Andrews, Strathclyde, and to Preston Lodge High School, Bearsden Academy, Beaconhurst School, St Aloysius College and Turriff Academy.

Middle Division: Problems 1

M1. Amanda, Brian and Claire enter the school talent contest. They each perform in one of three rooms in the morning and in a different one of the three rooms in the afternoon.

We know that

- Amanda's act is maths magic,
- one pupil moves from the hall to the gym,
- Claire is in the drama studio after lunch,
- Brian's morning room is taken by the singer in the afternoon,
- one pupil's act is juggling.

Find out where each person performs in the morning and in the afternoon, and what their act is.

Justify your answer.

M2. Write down any whole number containing four digits. Now write down a second number containing the same digits in a different order. Show that, when you take the smaller number from the larger number, you obtain a multiple of 9.

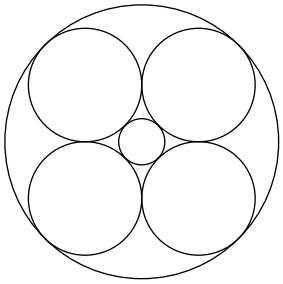
Explain why this always works for any four-digit number.

M3. In the diagram there are six circles: one small, four medium and one large, touching as shown.

The radius of each of the medium circles is 1cm.

What is the radius of the large circle?

What is the radius of the small circle?



M4. Katie had a collection of red, green and blue beads. She noticed that the number of beads of each colour was a prime number and that the numbers were all different. She also observed that if she multiplied the number of red beads by the total number of red and green beads she obtained a number exactly 120 greater than the number of blue beads. How many beads of each colour did she have?

M5. Ant and Dec had a race up a hill and back down by the same route. It was 3 miles from the start to the top of the hill. Ant got there first but was so exhausted that he had to rest for 15 minutes. While he was resting, Dec arrived and went straight back down again. Ant eventually passed Dec on the way down just half a mile before the finish.

Both ran at a steady speed uphill and downhill and, for both of them, their downhill speed was one and a half times faster than their uphill speed. Ant had bet Dec that he would beat him by at least a minute.

Did Ant win his bet?

Explain your answer.

END OF PROBLEM SET 1