The Scottish Mathematical Council

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MATHEMATICAL CHALLENGE 2019−2020

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, The Maxwell Foundation, Professor L E Fraenkel, The London Mathematical Society and The Scottish International Education Trust.

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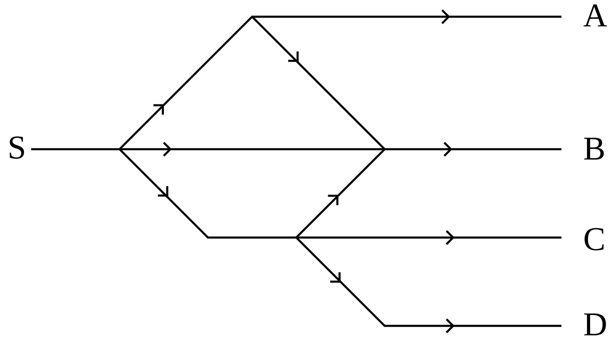
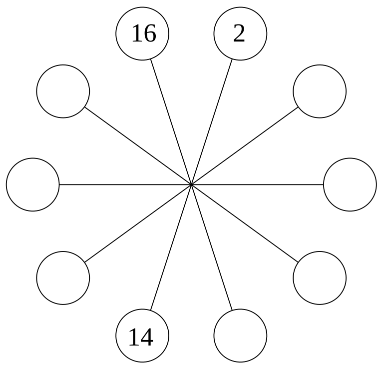
Middle Division: Problems 1

M1. Rhoda Rat is put in a maze at the start, S. She can move forward only in the direction of the arrows. At each junction she is equally likely to choose any of the forward paths. What is the probability that she ends up at B?



M2. A contestant in a game show is offered three identical sealed boxes and asked to choose one. He knows that one of the boxes contains £1000 and each of the other two contains a pebble. The contestant chooses one of the boxes, but, before he opens it, the show host makes him an offer. “I know the contents of the three boxes, and will open one of the other two boxes to show you that there is a pebble inside it.” He does this and then says, “ If you wish, you can now change your mind about which of the boxes you want to open.” The contestant is really keen to win the money so he says he will stick with his original choice of box. Was he wise? **Explain your answer**.

M3. Place different integers in each of the remaining circles so that the sum of the squares of the two numbers in adjacent circles is equal to the sum of the squares of the numbers in the two diametrically opposite circles.

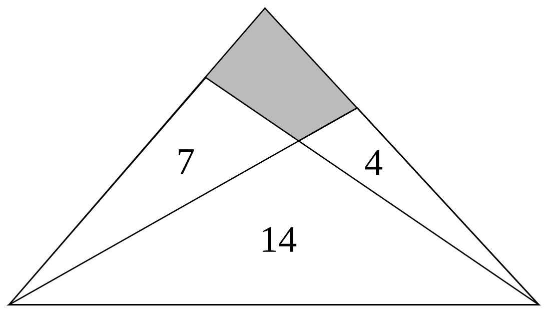


M4. There are 10 lockers in a row, numbered from 1 to 10. Each locker is to be painted red or blue or green, subject to the following rules:

- two lockers with numbers n and m are painted different colours whenever $n - m$ is odd
- it is not necessary to use all 3 colours;

In how many different ways can the row of lockers be painted? Justify your answer.

M5. In the diagram (which is not drawn to scale) the small triangles each have the area shown.
Find the area of the shaded quadrilateral.



END OF PROBLEM SET 1