The Scottish Mathematical Council

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MATHEMATICAL CHALLENGE 2017-2018

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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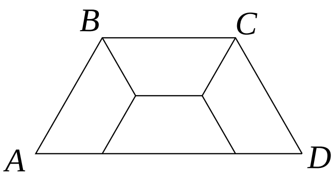
Middle Division: Problems 2

M1. A strange announcement was made on the radio about a local election with three candidates: Mrs Allan, Mr Baxter and Ms Campbell.
"Mrs Allan beat Mr Baxter by one eighth of the total votes cast.
Mr Baxter beat Ms Campbell by a seventh of the total votes cast.
The votes cast for Mrs Allan was 350 fewer than 3 times Ms Campbell's votes."

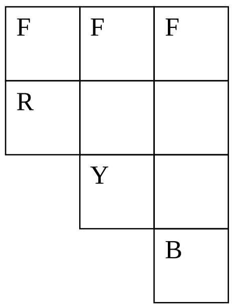
How many votes did each candidate get?

M2. A trapezium *ABCD* is split into four identical trapezia as shown below.



Given that *AB* has length 6 cm, find the area of *ABCD*.

M3. Red, yellow and blue counters are placed on a board as shown, and they 'race' to the finish (F) by moving up one square at a time. The moves are determined by picking a bead at random from a bag containing one red bead, two yellow beads and three blue beads. After the colour of the bead which has been drawn is noted, the bead is returned to the bag before the next bead is picked. The race is over as soon as one of the counters lands on the square marked F. Find the probability of winning for each of the counters.



M4. Goliath and David play a game in which there are no ties. Each player is equally likely to win each game. The first player to win 4 games becomes the champion, and no further games are played. Goliath wins the first two games. What is the probability that David becomes the champion?

M5. Let n be a three-digit number and let m be the number obtained by reversing the order of the digits in n. Suppose that m does not equal n and that $n + m$ and $n - m$ are both divisible by 7. Find all such pairs n and m.

END OF PROBLEM SET 2