

The Scottish Mathematical Council

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MATHEMATICAL CHALLENGE 2013–2014

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

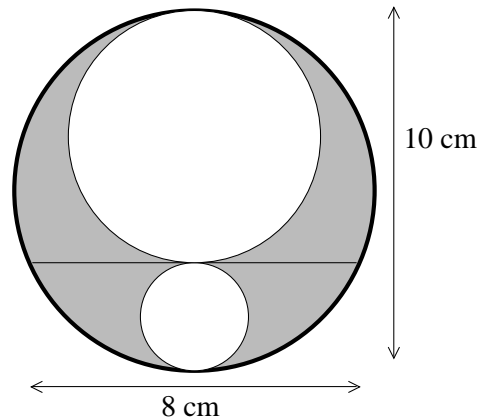
*The Edinburgh Mathematical Society, The Maxwell Foundation, Professor L E Fraenkel,
The London Mathematical Society and The Scottish International Education Trust.*

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, Heriot Watt, Stirling, Strathclyde and to Preston Lodge High School, Bearsden Academy, Beaconsfield School and Northfield Academy.

Middle Division: Problems 1

- M1.** In a recent election, six candidates stood and a total of 51880 votes were cast. The winning candidate beat the others by 1336, 7085, 15333, 15654 and 17102 votes respectively. Candidates lose their deposit if they fail to get more than 5% of the total number of votes cast. How many candidates lost their deposits?
- M2.** In a tennis tournament, each match is played between two players, and the winner proceeds to the next round whereas the loser is eliminated. There are no draws. If necessary, in the first round only, a number of players do not participate.
- (a) A particular tournament starts with 256 players and proceeds until there is one overall winner. How many matches are played in this tournament?
- (b) If the tournament starts with 296 players and proceeds until there is one overall winner. How many matches are played in this tournament?
- M3.** A jeweller has been asked to make a pendant in the shape of the shaded area shown. The height of the pendant is 10 cm and the distance across at the point where the two smaller circles touch is 8 cm.



- Find the area of the pendant.
- M4.** On a tiny remote island where the death sentence still exists a man can be granted mercy after receiving the death sentence in the following way:
- he is given 18 white balls and 6 black balls.
 - he must divide them between three boxes with at least one ball in each box.
 - he is then blindfolded and must choose a box at random and then a single ball from within this box.

He receives mercy only if the chosen ball is white.

Find the probability that he receives mercy when he distributes the balls in the most favourable manner.

- M5.** Three types of item, A, B and C, are for sale. Items of type A sell at 8 for £1. Items of type B sell for £1 each. Items of type C sell for £10 each. A selection of 100 items which includes at least one of each type costs £100. How many items of type B are there in the selection?

END OF PROBLEM SET 1