

The Scottish Mathematical Council

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MATHEMATICAL CHALLENGE 2009–2010

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,

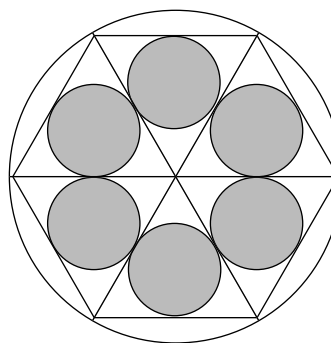
The London Mathematical Society and The Scottish International Education Trust.

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.

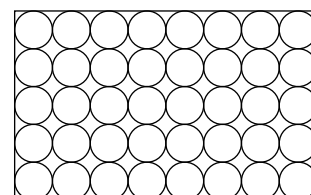
Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, St Andrews, Strathclyde, and to Preston Lodge High School, Bearsden Academy, Beaconsfield School, St Aloysius College and Turriff Academy.

Senior Division: Problems 2

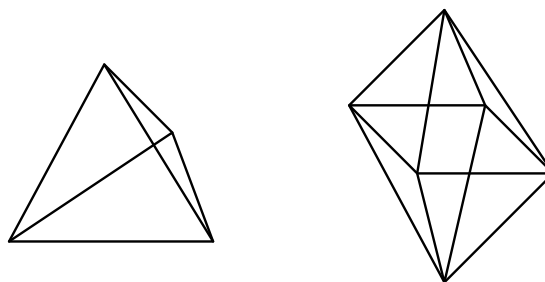
- S1.** The diagram shows a regular hexagon with its diagonals drawn and six circles fitted into the regions created. What fraction of the circumscribing circle is shaded?



- S2.** Forty cylindrical tubes, each with diameter one inch and equal lengths, are packed as shown snugly in 5 rows of 8 each in a box so that they may be transported without rattling. Show that the box could be repacked with forty-one of the same sized cylindrical tubes. Will they now rattle?



- S3.** A regular tetrahedron and a regular octahedron have edges of the same length. Find the ratio of their volumes.

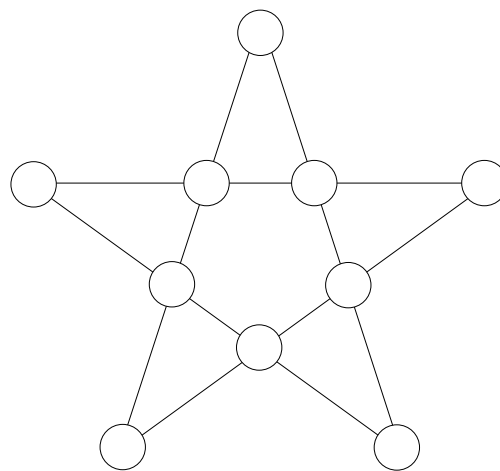


- S4.** A stall at a Farmers' Market sells chocolate truffles, tablet and Turkish delight. Each is sold per piece and the price of each is different. A customer purchased as many pieces of each sweet as its price per sweet in pence and paid an average of 7p per sweet.

Truffles cost the most, tablet costs less and Turkish delight is the cheapest. Turkish delight costs at least 4p per piece. One of tablet or Turkish delight costs 3p less than a truffle.

The customer spent less than £1.50. How many of each kind of sweet did he buy?

- S5.** The diagram shows a Magic Star, which is similar to a Magic Square, the numbers 1 to 10 have to be placed in the circles so that the sum of the numbers on each line is the same. Prove that this cannot be done.



END OF PROBLEM SET 2