

The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2015-2016

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.*

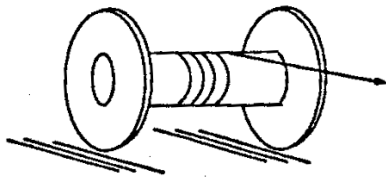
The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.

Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, St Andrews, Stirling, Strathclyde and to Bearsden Academy, Kelvinside Academy and Northfield Academy.

Middle Division: Problems 1

- M1.** On July 1st, Bill started to read a book recommended by friends, and, by reading the same number of pages each day of the month, managed to finish it on the 31st.
Another friend, Clare, also started reading the book at the same time. She read a quarter of that number of pages on the first of the month and, on each following day, one more page than on the previous day. She also finished on the 31st.
How many pages did the book contain?

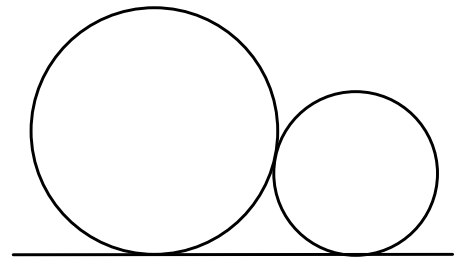
M2.



An almost empty bobbin is pulled along a flat surface by a thread which is wrapped around it, as shown in the diagram. The diameter of the inner reel is 5 cm and that of each outer wheel is 10 cm. Assuming no slipping or sliding, how far has the bobbin moved when the end of the thread has moved 12 cm?

- M3.** Two cylinders, with diameters 12 cm and 8 cm, rest on a flat surface touching each other with their axes parallel. The diagram shows their cross-section.

What is the height of their point of contact above the surface?



- M4.** I have two blue dice and one red die.
I use the blue dice to play a simple game: if I roll a double six, I win. Otherwise, I lose.
I also roll the red die. If I roll a one, I'll lie about whether I've won or lost the game; if I roll any other number, I'll tell the truth.

I roll all three dice.

I turn to you and say "I won!".

What is the probability that I did in fact win the game?

- M5.** A coach travels over a hilly route from town A in the highlands to town B by the coast. Going uphill it travels at 42 mph, going downhill it travels at 56 mph and on level ground it travels at 48 mph. It takes 2 hours and 20 minutes to travel from A to B and 2 hours and 40 minutes to travel back. Find the distance between A and B.

END OF PROBLEM SET 1