

# The Scottish Mathematical Council

www.scot-maths.co.uk

## MATHEMATICAL CHALLENGE 2014–2015

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, St Andrews, Stirling, Strathclyde and to Bearsden Academy, Beaconsfield School and Northfield Academy.

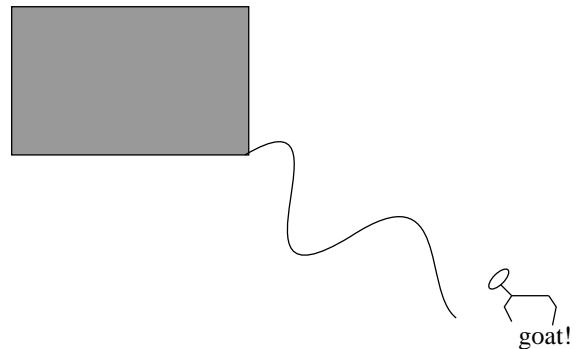
### Middle Division: Problems 1

- M1.** A shop sells sweets in bags of 7 and 20. What is the largest number of sweets that cannot be purchased exactly? **Justify your answer.**
- M2.** If a year had only 364 days then we could use the same calendar every year. But actually most years have 365 days, and leap years have 366 days. For the relevant years, a leap year occurs when the year is divisible by 4.

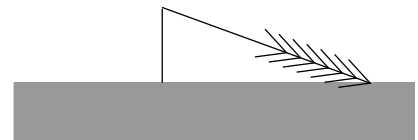
I was just about to throw away my calendar for 2014 when I wondered when I would first be able to reuse it. In which year will that be?

Finding I had a copy of each calendar from the year 2000, I wondered further about this problem. What would be the greatest amount of time I would have to keep any calendar until it could be re-used? **Justify your answer.**

- M3.** A goat is tied to the corner of a rectangular shed as shown. The shed is 9 metres long and 7 metres wide and the rope is 10 metres long. The shed is surrounded by grass. Find the area of grass that the goat can graze on.



- M4.** During a hurricane, a telegraph pole was broken in such a way that the top struck the level ground at a distance of 20 feet from the base of the pole. It was replaced by an identical pole which was broken by another gale at a point 5 feet lower down and the top struck the ground a distance of 30 feet from the base. What was the original height of the poles?



- M5.** Two ferry boats set out at the same time from opposite banks of a loch. One boat is faster than the other and they pass each other at a point 650 metres from the nearer bank. After arriving at their destinations, each boat remains for 15 minutes to change passengers and then sets out on the return journey. This time, they meet at a point 350 metres from the other bank. How wide was the loch?

END OF PROBLEM SET 1