The Scottish Mathematical Council
www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2012–2013

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.

Middle Division: Problems 2

M1. *PQ* and *QR* are diagonals on two faces of a cube as shown. What is the size of $\angle PQR$?
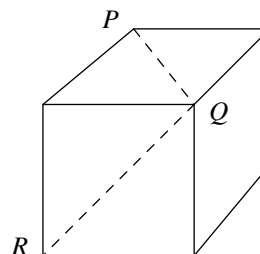
M2. Very shortly after leaving Elmouth by bus on the half-hour ride to Elwick one day, we met a bus coming towards us. I wondered to myself how many such buses we should meet before we reached our destination. There is a ten minute service each way.

I assumed that all buses concerned travelled on time and at a constant speed. How many buses should we have met before we reached our destination?

M3. Susan has 20 coins in her purse. She has only 10p, 20p and 50p coins and their total value is £5. She has more 50p coins than 10p coins. How many coins of each type does she have?

M4. *PQRS* is the diameter of a circle whose radius is *r*.
The lengths *PQ*, *QR* and *RS* are equal.
Semicircles are drawn on *PQ* and *QS* to create the shaded figure shown in the diagram. Find the perimeter of the shaded figure.
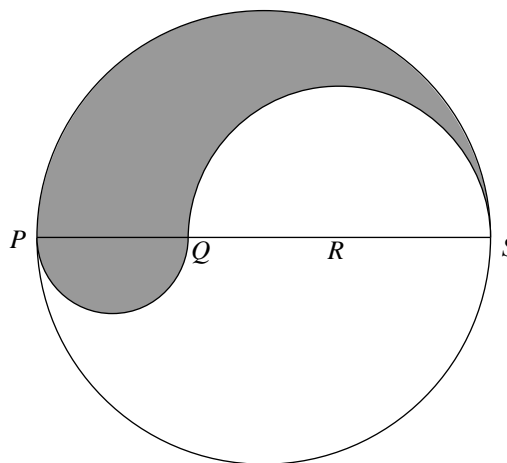
M5. Show that the maximum range of an aeroplane is extended by a factor of $\frac{1}{3}$ when there is a second identical support plane which sets off at the same time to provide in-air refuelling. The support plane must return safely to the starting point.

Now consider the situation where there are two identical support planes which can (instantaneously) refuel each other or the original plane as required. The support planes set off at the same time as the original plane and both must return safely to the starting point. By how much can the maximum range of the plane be extended?

END OF PROBLEM SET 2