The Scottish Mathematical Council

MATHEMATICAL CHALLENGE 2018–2019

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.

Junior Division: Problems 1

J1. Early on a very hot day, a greengrocer places 20 kilograms of courgettes on display outside his shop. At that moment, the courgettes are 99% water. It turns out to be the hottest day of the year, and as a result, the courgettes dry out a bit. At the end of the day, the greengrocer has not sold a single courgette, and the courgettes are only 98% water. What weight of courgettes does he have at the end of the day?

J2. On a coastline there are three lighthouses.
The first light shines for 3 seconds, then is off for 3 seconds.
The second light shines for 4 seconds, then is off for 4 seconds.
The third light shines for 5 seconds, then is off for 5 seconds.
All three lights have just come on together.

When is the first time that all three lights will be off?
When is the next time that all three lights will come on at the same moment?

J3. Two people are jogging back and forth on a straight road between two places which are 11 miles apart. One jogs at 5 miles per hour and the other at 6 miles per hour. They set off from opposite ends of the road at the same time. Determine where they are when they meet for the second time and how long it has taken them.

J4. A beam of light shines from point S, reflects off a reflector at point P, and reaches point T so that PT is perpendicular to RS and $\angle RSP = 26°$ as shown below. Find angle $x°$.
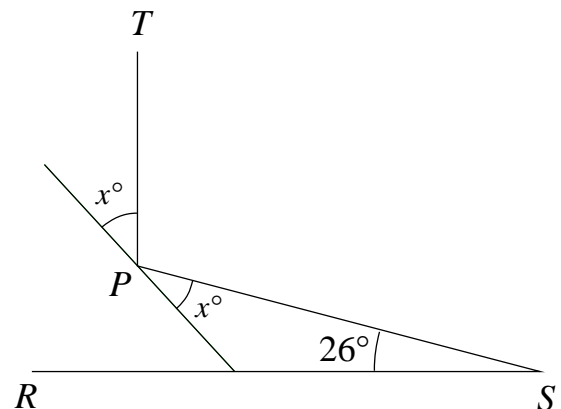
J5. Emma started with a rectangle of paper. With one straight cut she divided it into a rectangle and a square. She took the rectangle and with one straight cut divided it into a rectangle and a square, which was smaller than the previous one. She kept repeating this process until eventually the final rectangle was a square with sides 1 centimetre and she was left with a pile of squares of paper. The average area of the squares was a two digit number of square centimetres.

What were the dimensions of the original rectangle?