MATHEMATICAL CHALLENGE 2008–2009

Entries must be the unaided efforts of individual pupils. Solutions must include explanations.

Answers without explanation will be given no credit.

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.

Junior Division: Problems 2

J1. Two ferry terminals are directly opposite each other on the Hudson River. At the same instant, a ferry leaves each terminal to cross to the other side. One boat is faster than the other and they meet at a point 650 metres from one bank. After arriving at their destinations, each boat remains for 10 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 is the river?

J2. A contractor was planning a small extension to a house and was subcontracting out the work. For some peculiar reason, he worked out what he would have to pay in total to various pairings of subcontractors as follows:

a)   £1,000 to the wall-paperer and the painter,

b)   £1,700 to the painter and the plumber,

c)   £1,100 to the plumber and the electrician,

d)   £3,300 to the electrician and the joiner,

e)   £5,300 to the joiner and the mason,

f)   £3,200 to the mason and the painter.

How much did he pay to each tradesman?

J3. A man who has stolen a horse, rode away on its back. He had gone 6 miles when the owner discovered the theft and started to pursue the thief on his other horse. He chased the thief for 20 miles before he gave up believing that he would be unable to catch the thief.

But it turned out that when he gave up, the thief was only 2 miles in front of him. If he had continued to chase the thief, how many more miles would he have had to ride to catch up with the thief? (The thief and the owner ride at constant speeds).

J4. Shaun starts to write down the natural numbers in the square cells of a very large piece of graph paper. He starts at the bottom left corner and writes down the numbers using the following arrangement.

We will identify each of the cells using co-ordinates (x, y) where x is the number of positions to the right and y is the number of position up from the bottom. For example, the cell containing the number 8 has the co-ordinates $(3,2)$.
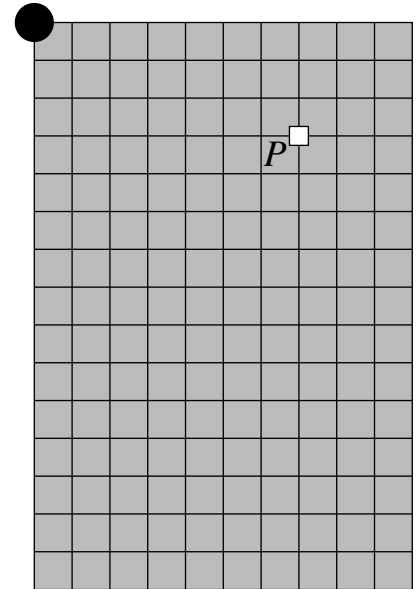

If N is an even number, what number appears in the cell with co-ordinates $(1, N)$? In what cell does the number 2009 appear? Explain your answers.
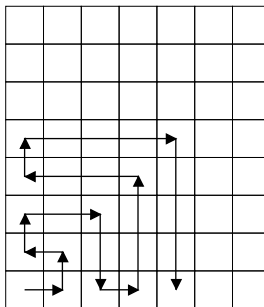
J5. The street system in New York is built up as a series of blocks. The section in which Gordon works is 10 blocks wide and 15 blocks long and Grand Central Station is located in the top north-west corner of the section. When asked where exactly he worked, he would not specify the location, but said that from Grand Central station, starting on January 1st 2009, he could take a different route to work every day except Christmas Day (which he took off anyway!) but that on the January 1st 2010, he would need to repeat a route already used. If Gordon only walks either south or east, find out where he works.

Give your answer as grid location from the station, for example, P is 3 blocks south, 7 blocks east.

END OF PROBLEM SET 2