MATHEMATICAL CHALLENGE 2009–2010

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. How many squares, of *all* sizes, are seen on a standard, 9×9 Sudoku grid?

**M2.** I took the same route when I cycled to and from work today. Due to a strong headwind on the way home, the return journey took twice as long as the journey to work. If my average speed for the whole journey was 16 km/h what were my average speeds to and from work?

M3. The diagram below illustrates a spiral sequence A_0, A_1, A_2, A_3, ... which starts at the origin. The first leg of the spiral has length 1 and after the that, the length increases by one each time.
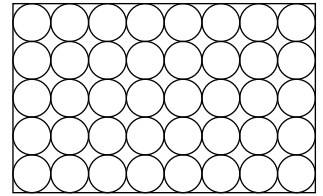What is the sum of the 6 coordinates of A_{2001}, A_{2002} and A_{2003}?
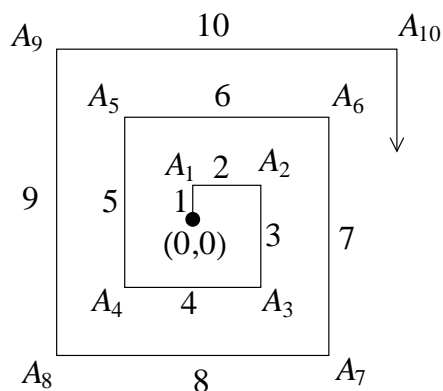
M4. The diagram shows a regular hexagon with its diagonals drawn and six circles fitted into the regions created. What fraction of the circumscribing circle is shaded?
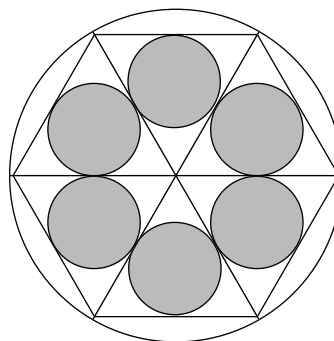
M5. Forty cylindrical tubes, each with diameter one inch and equal lengths, are packed as shown snugly in 5 rows of 8 each in a box so that they may be transported without rattling. Show that the box could be repacked with forty-one of the same sized cylindrical tubes. Will they now rattle?

END OF PROBLEM SET 2