

# The Scottish Mathematical Council

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## 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.

*CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE*

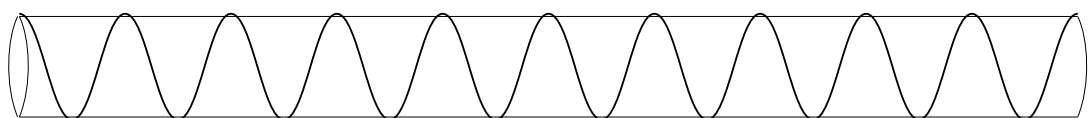
*The Edinburgh Mathematical Society, Professor L E Fraenkel,*

*The London Mathematical Society and The Scottish International Education Trust.*

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### Senior Division: Problems 1

- S1.** 
- Ten turns of a wire are helically wrapped round a cylindrical tube with outside circumference 4 inches and length 9 inches. At the start and the finish, the end of the wire is at the top. Find the length of the wire.
- S2.** A sequence of numbers  $\{a_n\}$  starts as follows:  
1, 3, 4, 7, 11, 18, 29, 47, 76, 123,.....  
So  $a_1 = 1$ ,  $a_2 = 3$ ,  $a_3 = 4$ , etc  
Identify numbers in the sequence which are in the sequence are
- (a) multiples of 3? (c) multiples of 7?  
(b) multiples of 5? (d) multiples of 21?
- S3.** How many zeroes are there at the end of the number which is the product of the integers 1 to 200? Justify your answer.
- S4.** Sitting on the train I asked my travelling companion how far he had to go after he got off the train. He said “If I get off at Udnie, or if I continue to the next station at Vernon, another 15 miles down the line, I have the same distance to travel home. In fact, if I changed at Udnie and took the branch line to Waterhall, a further 13 miles by train, I would still have the same distance to travel home after I got off the train.” I know that it is 14 miles from Waterhall to Vernon. How far was my companion's home from the stations?  
(Assume that all distances are ‘as the crow flies’.)
- S5.** In a two-dimensional space invaders game, all the players are circular. A large player is chasing a smaller one inside a rectangular arena. If two players touch, the smaller one is eaten. The smaller player stops right in a corner. What ‘size’ must it be in relation to the larger player if it is to survive?

END OF PROBLEM SET 1