

8.

A revolver sits on the mantelpiece in the study, between two clocks. Every time either clock displays an “o’clock” time, it chimes the relevant number of times (e.g. when it shows 7 o’clock, it chimes 7 times). The left-hand clock keeps perfect time; however, the right hand clock gains seven minutes every hour. The clocks are correctly synchronised so that they both simultaneously chime the same number of times as each other at 6am on April 5th. When will they next both simultaneously chime the same number of times as each other?

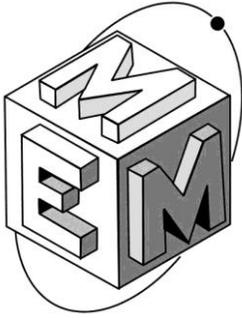
9. Supplementary Question

Whodunnit? Where and with what?

The competition is promoted by
Mathematical Education on Merseyside (MEM)
Registered Charity No 517028
The Department of Mathematical Sciences,
University of Liverpool,
Liverpool,
L69 7ZL.

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MATHEMATICAL EDUCATION ON MERSEYSIDE

Sponsored by **MERCER**

Senior Challenge '10 For Year 10 or below

Illustrations by Peter H Ackerley

Rules

- 1) It should be attempted at home during February half term.
- 2) Your entry must be your own work, though of course you may ask for help on how to start or for the meanings of unfamiliar words.
- 3) Entries without any working out at all or written on this sheet will not be marked.
- 4) It is possible to win a prize even if you have not completed all of the questions, so hand in your entry even if it is not quite finished.
- 5) You must write **your name and school in neat writing on every page.**

Either you or your maths teacher needs to return your entry by 5th March to this address:

Senior Challenge '09 Entries,
Chris Marchant,
Department of Mathematical Sciences,
University of Liverpool,
Peach Street,
Liverpool.
L69 7ZL.

All of the prizes will be awarded at an evening of mathematical recreation at the University of Liverpool on 5th May. Solutions will be posted on www.maths.liv.ac.uk/~mem shortly afterwards. We hope that you enjoy the questions.

1.

Tidying the books in the library is a tedious chore, so Reverend Green wanted to do it as efficiently as possible. He decided that the best method to use was to take a pair of books off the shelf and swap them over. He needs to arrange the nine volumes of "Lead Piping: It's Usage and Disposal in the 19th Century" into the correct order. Initially they are ordered: 4, 5, 7, 6, 8, 1, 9, 2, 3. Show how they can be put into numerical order using 6 swaps or fewer.



2.

The candlestick has been broken in the dining room. The four servants present in the room each give a statement:

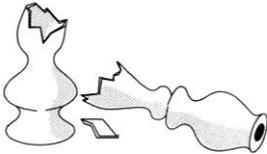
A: "I did not break the candlestick."

B: "The culprit is either C or D."

C: "D did not break the candlestick."

D: "Neither A nor B broke the candlestick."

One of these servants is lying. Assuming that only one person committed this dreadful deed, who broke the candlestick?



3.

Colonel Mustard wants to use the same batch of square tiles to tile the floors of both the conservatory and the hall. Both rooms are squares and are of a similar size, but the conservatory is larger than the hall. He notices that he could also make a different pair of squares which are quite different sizes with the same number of tiles.

Given that he has between 150 and 250 tiles, how big might the conservatory and the hall be?





4.

Professor Plum has ordered a box of 15 new red snooker balls for the billiard room. Unfortunately, someone has thrown a spanner in the works, as one of the new balls is faulty and is of a slightly different weight (heavier or lighter). Using only 4 balances on a set of balance scales, how could you identify the faulty ball?



5.

Miss Scarlet is planning to put coving around the edge of the ceiling of the lounge. She knows that the oak panelling along one side of the room has an area of 648ft^2 . The tapestry covering the end wall has an area of 288ft^2 and the carpet an area of 1296ft^2 . What length of coving will she need?



6.

Mrs White has a pair of scales in the kitchen for weighing cooking ingredients. She only has four masses, which weigh a total of 40oz. With these, she can correctly determine any whole number of ounces from 1 to 40. How heavy is each mass and how can she make each of the different weights?

7.

Three servants were separately sent to collect $x\%$ of a rope. Each servant does this, arriving one after another, and cutting the rope down to $(100-x)\%$ of the length they found. Given that the initial length was 500m and the final remainder was 108m, find the value of x .