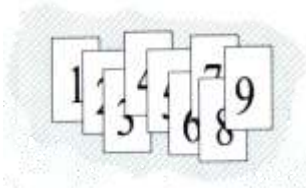
5. THE REGIMENTAL FLAG

The ladies at Reverend Green's church had agreed to make a new flag for Colonel Mustard's regiment. However, all Colonel Mustard could remember were the measurements of the four sides, namely 80 cm, 45 cm, 100 cm and 63 cm. "How can we work out the area of material to buy?" said Reverend Green. "There must be an infinite number of different shapes with those measurements." Professor Plum overheard their discussion and said "Bring the candlestick closer so I can see this more clearly. Aha! The centre of your badge is equidistant from all four corners and so it is easy to work this out." Can you do it?

6. GOING ROUND IN CIRCLES



Back in the study Professor Plum was upset about losing to the Reverend Green with the dice so he challenged him to a card problem. "I have nine cards here numbered 1 to 9. Can you arrange a number of them in a circle so that the sum of any three adjacent cards is equal to or differs by one from the sum of any other three adjacent cards?"
Can you show how this can be done?

!BONUS!

Who committed the murder, with what weapon and where did it take place?

The competition is promoted by
Liverpool Mathematical Society (LMS)
The Department of Mathematical Sciences,
University of Liverpool,
Liverpool,
L69 7ZL.

The Liverpool Mathematical Society incorporates the
Liverpool Branch of the Mathematical Association.
The MA is a Registered Charity (No. 313281).

LIVERPOOL MATHEMATICAL SOCIETY

Open Challenge '10

For Year 13 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.
3) For individual entries you should attempt any four questions plus the bonus. For team entries (two or more students) you should attempt all six questions plus the bonus.
4) Entries without any working out at all or written on this sheet will not be marked.
5) 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.
6) You must write **your name(s), date(s) of birth and school in neat writing on the front sheet.**
7) Pupils under 15 years of age should only attempt this in exceptional circumstances.

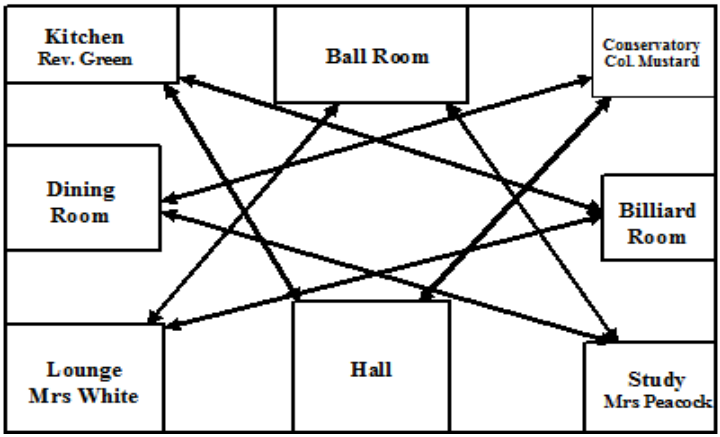
Either you or your maths teacher needs to return your entry by 5th March to this address:

Open Challenge '10 Entries,
Chris Marchant,
Department of Mathematical Sciences,
University of Liverpool,
Peach Street,
Liverpool.
L69 7ZL.

All of the prizes and certificates will be awarded at an evening of mathematical recreation at the University of Liverpool on 28 April. Solutions will be posted on www.maths.liv.ac.uk/lms.html shortly afterwards. We hope that you enjoy the questions.

1. CHANGING ROOMS

There are 8 rooms as shown with a gentleman in the kitchen and another in the conservatory. One lady is in the lounge and another in the study. Move one person at a time, in any order, along one of the straight lines from room to room until the men and women have exchanged places (i.e.: men ↔ women). No two, or more, people are allowed in any one room at a time.



2. HOW THICK CAN YOU BE?

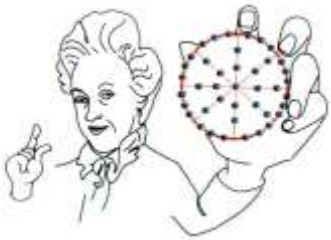
Professor Plum entered the kitchen and saw Mrs White with a spanner in her hand. “What are you doing?” he asked.
“This piece of lead pipe has come loose and there is water everywhere” she said. “Pass that new packet of kitchen towels will you, Professor? I hope they will be thick enough.”
“It’s easy enough to work out,” he replied.
“Just tell me what it says on the packet.”
“Well, there are 50 sheets, each 22 cm long.”
“Hmm, and their outside diameter is 11 cm with the diameter of the cardboard tube being 4 cm. That should be everything I need. I can even tell you how many turns of paper there are on the roll.”
Can you do the same?
Don’t use rope or string as you will tie yourself up in knots.

3. A CUT ABOVE THE REST

Professor Plum considered himself to be an expert at almost everything, so the Reverend Green thought he would try to outwit him. He had three six-sided normal dice, except they were numbered as follows:

The red die had 2 twos, 2 fours and 2 nines
The blue die had 2 threes, 2 fives and 2 sevens
The green die had 2 ones, 2 sixes and two eights.

Reverend Green let Professor Plum choose any die he liked first and roll it.
He would then choose one of the remaining dice which would give him a better chance of obtaining a higher score.
How could he do this?



4. THE MISSING JEWELS

Mrs. Peacock had a very expensive brooch which she had been given by Colonel Mustard. She had just received it back from the jewellers after it had been repaired. She was showing it to Colonel Mustard in the study. “It’s just as I remember it,” she said. “If you start at the centre and count up one line, along the outside, and down the next line there are always 8 diamonds.”
“It’s not right,” said Colonel Mustard, “there are four diamonds missing! It originally contained forty five diamonds and now there are only forty one.”
“But how did he do it?” she said.
“I know! Fetch my revolver – I’m going to see that jeweller!”
So how did he do it?