

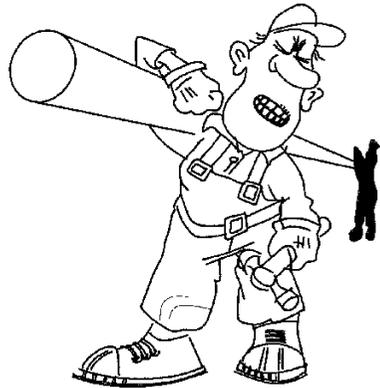


6. Matchmaking

An Olympic handball tournament was organised as follows: each day of 12 days, 5 teams were playing against each other. Any pair having met once could never meet again. The teams were chosen so that, on each day, all ten matched were allowed. Is it possible to do this with 20 teams taking part in the competition?

7. Pole Bearers

Two men are delivering flagpoles to the Olympic stadium. To enter the stadium, they have to carry each pole along a 3-metre wide corridor with a ceiling 2.5m high throughout. The corridor starts off straight, but then bend through 90 degrees, with the inside wall following an arc of a circle of radius 4m. The Bronze flag pole is 11.5m long, the Silver is 11.75m and the Gold is 12m long. Work out which poles can be carried through the corridor without bending the flag pole!

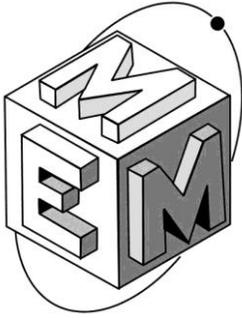


The competition is promoted by
Mathematical Education on Merseyside (MEM)
Registered Charity No 517028
The Department of Mathematical Sciences,
University of Liverpool,
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L69 7ZL.

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MATHEMATICAL EDUCATION ON MERSEYSIDE

Sponsored by **MERCER**

Senior Challenge '12 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.**

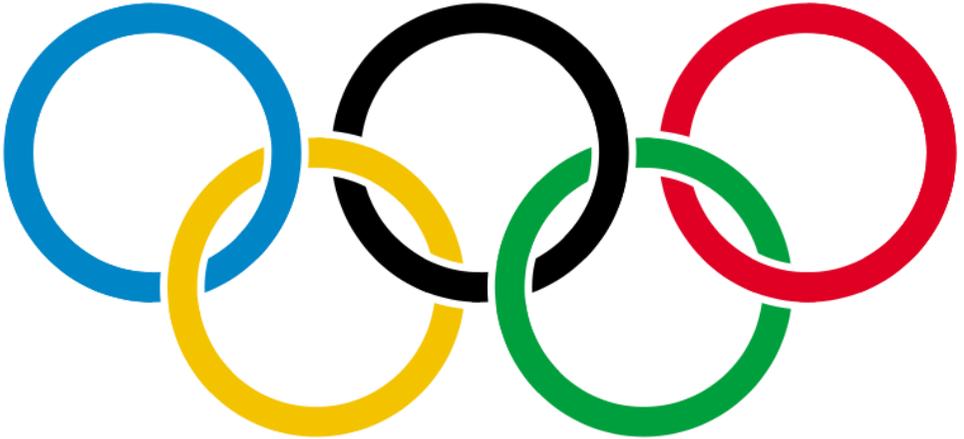
Either you or your maths teacher needs to return your entry by 9th March to this address:

Senior Challenge '11 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 2nd May. Solutions will be posted on www.maths.liv.ac.uk/~mem shortly afterwards. We hope that you enjoy the questions.

1. Ring Totals

Place the numbers 1 to 9 into the Olympic Rings, one in each white space, so that there is the same total inside each ring. Calculate each of the possible totals that satisfy this requirement.



2. Metal Medals

Gold costs twice as much as Silver, which costs $1\frac{1}{2}$ times as much as Bronze. Gold weighs $1\frac{1}{4}$ times as much as Silver, which weighs $1\frac{3}{4}$ as much as Bronze.

For the boxing medals, twice as many Bronze medals are required as Gold and Silver medals.

There are 10 boxing events. A Silver medal weighs 40g and costs £120. How much will all of the boxing medals weigh and cost?



3. Common or Uncommon

Four sportswomen meet. Any two of them have something in common: first name, country of origin or the sport they compete in. However, there is nothing that any group of three of them have in common. How is this possible?





4. Making Tracks

An 8-lane circular race track has a circumference of 400m in the centre of lane 1. Given that each lane is 122cm wide, how much further back does the runner in lane 1 start than the runner in each of the other lanes?

5. Medals Table Mayhem

In a particular Olympic games, the top 4 countries in the medal table were China, USA, Russia and Great Britain, in that order. (The order is determined by the number of Gold medals won.) Each country won more than 10 medals of each type.

China won two more Gold than Silver and Bronze combined in their total of 100 medals.

USA's number of Gold medals matched their number of Bronze (a square number) and they won 10 more medals than China in total.

Russia and China won the same number of Silver medals and the same number of Bronze medals, the latter being the same number of medals as GBR's total for Silver and Bronze combined.

Russia averaged 24 medals of each type.

GBR's numbers of Gold and Silver were prime, and their total number of medals was 4 fewer than the number of Gold medals won by China.

The USA earned twice as many Silver medals as GBR earned Gold medals.

The number of Bronze medals for each country is a triangle number.

Re-construct the medals table.