

CHALLENGE '04

1. This competition is open to all pupils at Schools in and around Merseyside who are under the age of thirteen and a half (born on or after 1 September, 1990). It is to be tackled at home, during half-term.
2. Your entry must be your own unaided effort, though of course you may refer to books, etc., for ideas on how to start, and may ask the meanings of unfamiliar words. *More marks will be given if you explain clearly how you get your answers.*
3. We hope that you enjoy the questions. It is possible to win a prize even though you may not have attempted all the questions, so do let us have your entry even if it is not quite finished!
4. Hand your neatly written entry, with your name on every page, to your class teacher as soon as possible after half-term.
5. Prizes for overall winners and many consolation prizes will be presented at an Evening of Mathematical Recreation at the University of Liverpool in May. Certificates will be awarded to all who do well.
6. Solutions will be posted on www.maths.liv.ac.uk/MEM/ early in March.

This competition is promoted by Mathematical Education on Merseyside (MEM).
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The drawings are by Peter H. Ackerley.

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1. THOSE WHO CAN, TEACH

According to the Education Secretary, the number of graduates joining mathematics teaching courses fell 34% between 1992 and 1998, but from 1998 to 2002 the figure rose by 50%. Suppose that 1000 trainee maths teachers joined in 1992. How many joined in 2002?



2. UNGOVERNABLE?

According to new regulations, the governing body of a community school, which must have no fewer than 9 and no more than 20 members, must comprise the following:

- i) One third or more must be parent governors.
- ii) At least two, but no more than one third, must be staff governors.
- iii) One fifth must be LEA governors.
- iv) One fifth or more must be community governors.

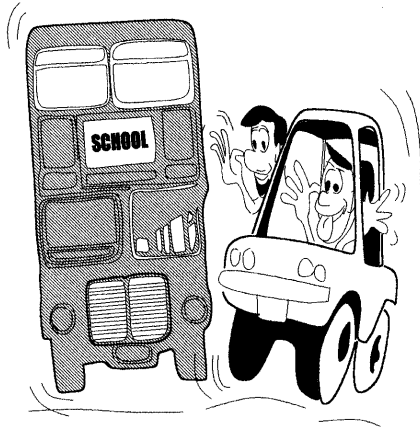
Fractions must be rounded to the nearest whole number; so, for example, a governing body of 11 needs exactly 2 LEA governors.

How many of each type of governor should be contained in a body of nine?

How many different ways can you fill a governing body of 20?

3. LINE THEM UP,

Connect Four is played on a 7 by 4 rectangular board; the object is to place four adjacent pieces in a straight line, vertically, horizontally or diagonally. How many possible winning lines are there on the board?

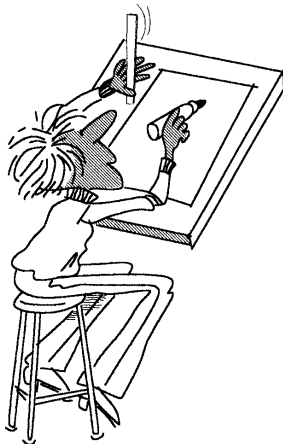


4. DRIVE OR BUSSED

A bus is 7 metres long, and can hold up to 70 children; a car is 4 metres long, and can hold up to 4 children. A school has 1400 children, who all travel to school either by car or by bus. How much extra space in metres is taken up on the roads if they all travel by car than if they all travel by bus? You may assume that the cars and buses are full, and ignore the distance between vehicles.

5. YO-YO

A lift can hold a maximum of twelve people. There are ten people waiting on each of the lower six floors of a building, all wanting to go up three floors. The lift starts from the ground floor. What is the smallest total number of floors that the lift must travel (up and down) in order to get these people where they want to be?



6. ALL THE ANGLES

Using six straight lines only, what is the largest number of identical angles that you can draw on a piece of paper? The angle you draw must be not greater than 90° .

Using a different angle this time, how many angles can you make with your six lines?

Repeat both parts of the questions with 12 lines.

7. MARBLE MADNESS

If you have ever played Chinese Checkers you will know that you can arrange 3, 6 or 10 marbles into a triangular formation. You can also arrange 7, 19 or 37 marbles into a hexagonal formation. We will call an equilateral triangle made out of ten marbles a 10-triangle, and so on.

It is possible to combine a number of triangular formations into a single hexagonal one. You can, for example, combine a 10-triangle, four 6-triangles and one 3-triangle to make a single 37-hexagon.

In how many different ways can you make a 37-hexagon out of marble triangles?