

CHALLENGE '03

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, 1989). 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.liv.ac.uk/maths/MEM/ early in March.

This competition is promoted by Mathematical Education on Merseyside (MEM).
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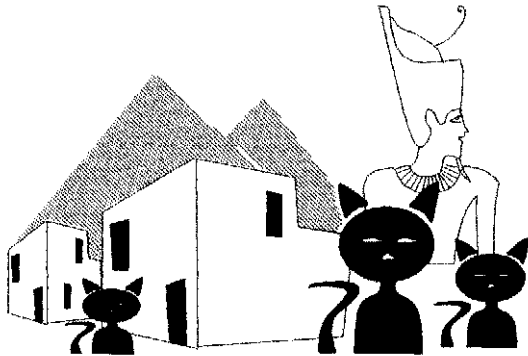
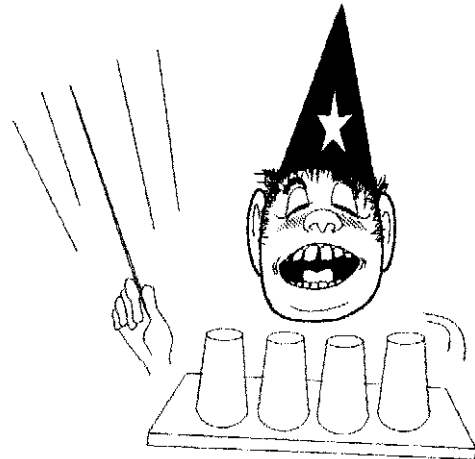
The Department of Mathematical Sciences, The University of Liverpool, Liverpool, L69 7ZL.
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1. CUP FINAL

A magic trick involves a set of four cups, which are all upside down at the start. The magician turns over three cups at a time, until they are all the right way up. How many goes does he need to finish the trick?



2. PHARAOH STREET

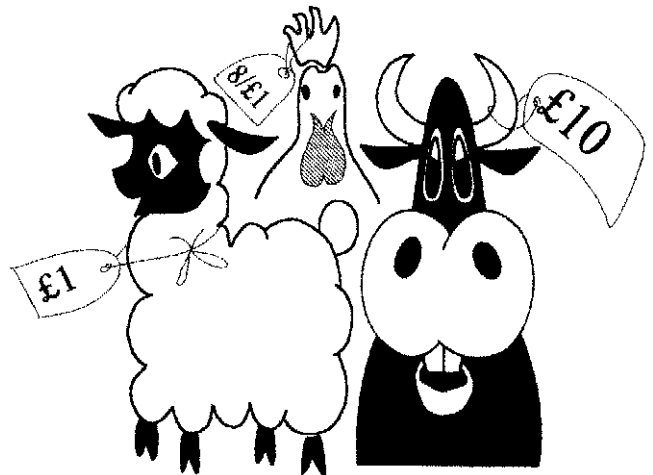
This problem was set to children in Ancient Egypt 4000 years ago.

Pharaoh Street contains seven houses and each house has seven cats. If a cat can catch seven mice in one day and a mouse can eat seven spoons of barley in one day, how many spoons of barley can be saved in Pharaoh Street by the cats in one day?

If one spoon of barley is enough to make seven bread rolls, how many bread rolls can the people living in Pharaoh Street make from the saved barley during one week?

3. FUNNY FARM,

Farmer Fred wants to celebrate the centenary of the family farm by buying 100 animals for exactly £100. He sends his daughter Freda down to the market with the money, where she finds that chickens are 8 for £1, lambs are £1 and cows are £10. What should she buy?





4. DIZZY SPELLS

In order to perform the Giddius Charm, Sally Plumber must spin seven times on the spot through a whole number of degrees; each time she must turn by the same angle. When she finishes, she must be facing the same way she started. What angle could she spin by each time?

5. PLATTER CLATTER

I have a pile of 8 plates, which are alternately blue and white. The pile is on a table with room for two piles of plates. I can move the plates by picking up as many plates as I like, and putting them on the table or on another pile. How many moves will it take me to make a single pile of plates with blue and white plates all together?

6. OMINOUS

Dippy Den Ominator can't add fractions, so his teacher has given him some examples with the bottoms filled in. He answers them all by adding the two top numbers to make the numerator of the answer, and amazingly gets five out of five! Fill in the missing numbers in the examples below to show how he achieved his record mark.

- a) $\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$
- b) $\frac{2}{7} + \frac{?}{7} = \frac{6}{7}$
- c) $\frac{1}{2} + \frac{1}{?} = \frac{2}{3}$
- d) $\frac{?}{4} + \frac{?}{20} = \frac{4}{5}$
- e) $\frac{?}{5} + \frac{?}{20} = \frac{?}{10}$



7. TOP SECRET?

Passwords at MI5 have to be changed at least every 90 days, and are not allowed to be the same as any of the last eleven you have used. Sally wants to be able to remember hers easily, so she has decided to use the name of the current month as her password; and not change it until she has to, that is after 90 days.

She started with the password 'January' on January 1st 2003. How long can she keep her system going?