LIVERPOOL MATHEMATICAL SOCIETY

OPEN CHALLENGE '07

First prize for teams £200 **First prize for individuals £100**

Prizes for runners-up

Teams can be of any size greater than one but the prize is independent of the number in the team

Certificates for good entries

Team Competition. Teams may be of any size (greater than one), but all members must be under 18 on 31.8.07. **Each team should submit a single set of answers to all SIX questions**. The first page should contain the **PRINTED** name and address of the school and printed names and dates of birth of all team members.

Individual Competition. The individual competition is open to anyone who is under 18 years of age on 31.8.07. **You should submit answers to FOUR questions only.** The first page of your entry must contain your **PRINTED** full name, **school (including school address)** and date of birth. If you are entering as a member of a team, you may **not** enter also as an individual.

Both competitions. Begin each problem on a separate sheet of paper. Credit will be given for partially correct working and bonus marks may be awarded for particularly good solutions.

A copy of our solutions will be sent to you if you enclose a stamped, addressed envelope, but we are not able to return entries.

Entries must be posted (either by teachers, or directly by individuals) no later than Friday 16 November 2007 to Mrs. A. Carter, The Queen's School, City Walls Road, Chester, Cheshire CH1 2NN.

Prizes and certificates will be presented at an evening of mathematical entertainment at the University of Liverpool next term to which all those who do well will be invited (including at least one from each school from which we receive entries).

LMS/BARCLAY'S SIXTH FORM POP MATHS QUIZ

Saturday 8 March 2008 10:00 a.m. – 2:00 p.m.
Liverpool John Moores University
FREE!
Teams compete in this Pub style Quiz
PRIZES GALORE!

1. RACING HOME

In the Isle of Man TT races, competitors start off in pairs at 10 second intervals. The winner of the race is the competitor who completes six laps of the course in the shortest time, each lap being 37.73 miles long. (The winner does not necessarily have to cross the finishing line first.) Competitors number 1 and 2 started a race at 10.30 a.m. Number 19 whose average speed was 115mph won the race. He crossed the finishing line at exactly the same time as number 6. Number 1's last lap was the fastest in the race, taking 19 minutes and 29 seconds. However, he did not finish the race until 23 seconds after numbers 19 and 6. From this information, discover all you can about this race. (All times are to be taken to the nearest second.)

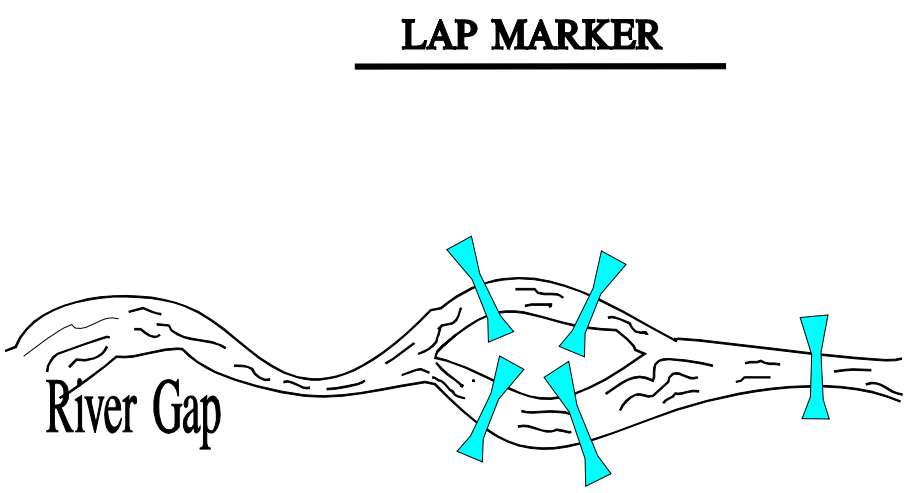
2. FORMATION FOOTBALL

To celebrate the City of Liverpool's anniversary this year a football match was arranged. The manager of Liverpool Football Club decided to play with an old-fashioned 2-3-5 line-up; i.e.: 2 in defence, 3 in midfield and 5 forwards, plus, of course, a goalkeeper. The players' shirts were each numbered with a different number from 1 to 11. It was noticed that the sums of the numbers on the defence (excluding the goalkeeper), the midfield and the forwards were all the same.

Their opponents, Everton Football Club, used a 4-3-3 line-up. Again, their shirts were numbered 1 to 11, and the sum of the numbers on the 3 forwards was the same as the sum on the 3 midfield men, but this sum was twice the sum on the defenders' shirts (again, excluding the goalkeeper). Every defender marked a forward with the same number.

Who played where?

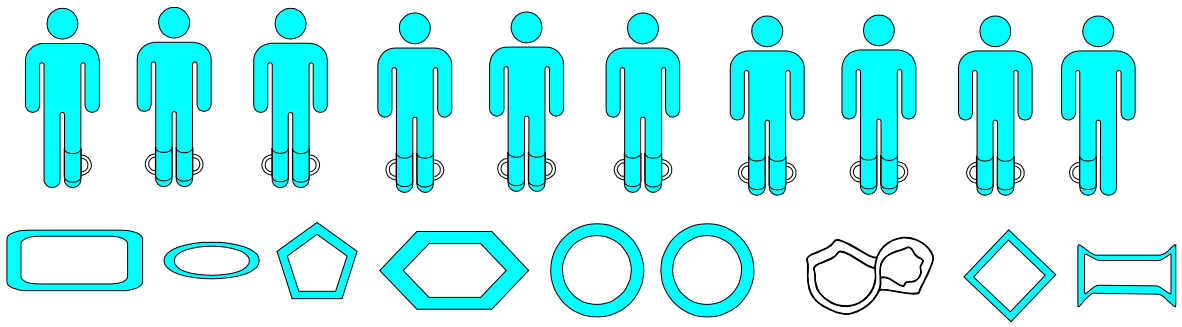
3. BRIDGE THE GAP



In a particular road race, a lap starts at the marker on one side of a river and, crossing each bridge once and once only, finishes at the lap marker on the other side of the river. As the lap can be run in a number of different ways, the winner is the competitor to complete every possible route in the shortest time. The reverse of a route is considered the same as the original route. Because of his family history the favourite for this competition is Euan Euler. How many laps constitute a complete race and on which side of the river is the finishing line?

4. SLAVE CHAIN

Ten slaves with shackles on their feet are linked with nine curious links. The following illustration shows the slaves and these nine links.



If the slaves stayed in the same position in how many ways could they be linked with the sole condition that no slave is to have both identical circular links connected to their feet? Remember that every link can be joined in one of two ways, just as you can put a ring on your finger in two ways. Fortunately it was the year of the abolition of the slave trade so all ten slaves were set free.

5. BE PREPARED

Nine scouts walk in formation three abreast. They can do this six times so that no two scouts walk alongside each other more than once. How could this be done? In preparation for the World Scout Jamboree, a troop of 21 scouts repeated the walk, three abreast. What is the maximum number of times they could do this whilst still having no two scouts walking alongside each other more than once?

6. FRAMING THE MONA LISA

When Leonardo da Vinci completed the Mona Lisa, his friend challenged him to frame the portrait so that the area of the frame was the same as the area of the portrait and the frame was the same width all round. He was to do this without using any measuring device other than a piece of string.
How could he achieve this?

!BONUS!

Each question this year celebrates an anniversary.
For a bonus mark what connects these anniversaries?

LIVERPOOL UNIVERSITY MATHS CLUB

This highly successful club has been running for many years. It is ideal for students of Year10 or above who are keen to take on substantial maths challenges.
Sessions are held once a month on Saturday mornings during term time at Liverpool University.
More details are available from:
David Lewis d.m.lewis@liv.ac.uk
www.maths.liv.ac.uk/~mathsclub/

The Liverpool Mathematical Society incorporates the Liverpool Branch of the Mathematical Association.
The MA is a Registered Charity (No. 313281).
Drawings by P. H. Ackerley