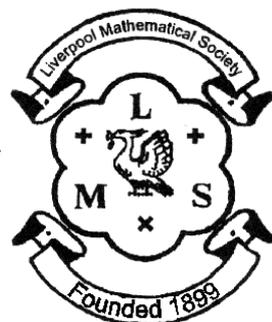# MATHEMATICAL EDUCATION ON MERSEYSIDE

Challenge '13
For Year 8 or below

Illustrations by Peter H Ackerley

Rules
1) Challenge '13 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 get started 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:
Challenge '13 Entries,
Chris Marchant,
Department of Mathematical Sciences,
University of Liverpool,
Peach Street,
Liverpool.
L69 7ZL.

A Prize Giving Evening will be held at the University of Liverpool on 1st May.
We hope that you enjoy the questions.

1. Black Magic

Egrun, the wild green witch of the Wirral, roars along its lanes at nightfall astride her wood-burning Kawasaki broomstick. One night, she rides from the former Cadbury's factory in Moreton at midnight to visit the Wizard of Oswestry for a short spell. But when she gets to Chester, her faithful catnav, Subordinate Claws, reminds her that she has forgotten the chocolate. So she goes all the way back for it. It's 20 miles from Moreton to Chester and 30 miles from Chester to Oswestry. Egrun always rides at a steady 120mph and nothing EVER gets in her way. At what time does she arrive in Oswestry?

2. Pick and Mix

Robert and Miriam need chocolates as prizes for a quiz: they decide on four bags of Revels, five Mars Bars and five Twix Bars. However, they don't coordinate their shopping!
Robert buys three bags of Revels, two Mars Bars and four Twix Bars for £5.85;
Miriam separately purchases two bags of Revels, four Mars Bars and three Twix Bars for £5.60.
They return the excess goodies to the shop, receiving £2.60 back. How much does each item cost?

3. Who'll Nut?

Fred and George are to share a chocolate bar made up of an 8 by 6-square rectangular array. The top-left & top-right squares each contain a visible nut. They take it in turns, starting with Fred, to snap the chocolate into 2 pieces along a line between 2 rows or 2 columns, & then eat 1 of the 2 pieces. Neither Fred nor George wants a nut. Which person can guarantee that they won't get the nut? Is this true for any size of bar?

4. All Because The Ladies Love…

Ingrid, Jean, Karen, Philippa and Shirley are sharing a box of chocolates.

There are 5 chocolates left in the box:
a Coffee Cream, an Orange Fondant,
a Hazelnut Praline, a Toffee Crunch &
a Nougat Supreme.

They agree to have one chocolate each.
Ingrid likes only Orange Fondants and Toffee Crunches; Philippa likes only Orange Fondants and Hazelnut Pralines; Jean and Shirley both like Coffee Creams, Hazelnut Pralines and Nougat Supremes; and Karen likes only Toffee Crunches and Nougat Supremes.

List all the possible ways that the chocolates can be shared such that all of the ladies get one that they like.

5. The Trouble With Truffles

There are 9 chocolates in a selection box: 3 white, 3 milk & 3 dark chocolates. There are 3 soft centres, 3 truffles & 3 pralines. Each chocolate is different. Using the clues below, arrange the chocolates in a 3 x 3 grid:
The 3 truffles are in the central column;
there is 1 of each colour in each column;
there are no 2 soft centres are next to each other horizontally, vertically or diagonally; the same applies for the pralines;
the white praline is in the bottom-right corner;
the 3 whites are arranged along a diagonal line;
there are no dark chocolates in the bottom row.
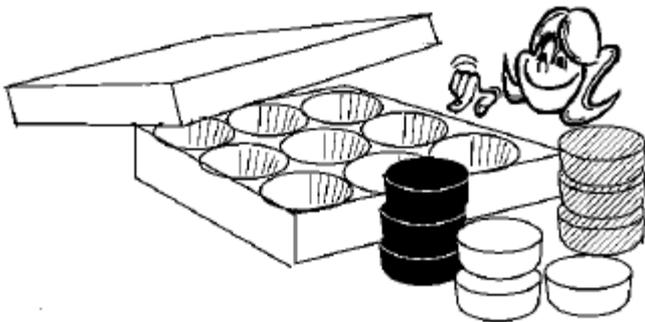
6. Be Twix and Between

How many different ways can you arrange the letters of the word CHOCOLATE?

7. Chocolate Brownies

Seven Brownies and three Leaders have baked 35 chocolate cupcakes and eaten them all.

One Leader ate one cupcake, another Leader ate two cupcakes, and the third Leader ate three cupcakes.

Only whole cupcakes may be eaten.

Show that at least one (greedy) Brownie ate at least 5 cupcakes.