

7. Space Men

Toy space men of different shapes are each formed from five 1cm cubes, with adjacent cubes firmly welded together face-to-face. To qualify for space flight, each space man has to be able to fit into a $3\text{cm} \times 3\text{cm} \times 3\text{cm}$ escape pod.

How many such space men are there, each distinct from the other?

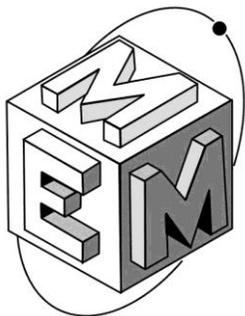


The competition is promoted by
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The Department of Mathematical Sciences,
University of Liverpool,
Liverpool,
L69 7ZL.

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MATHEMATICAL EDUCATION ON MERSEYSIDE



Sponsored by

Challenge '11

For Year 8 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.**

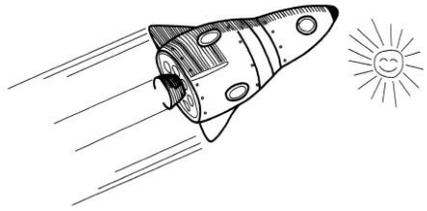
Either you or your maths teacher needs to return your entry by 11th March to this address:

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 18th May. Solutions will be posted on www.maths.liv.ac.uk/~mem shortly afterwards. We hope that you enjoy the questions.

1. Far, Far Away

Alpha Centauri, the closest star to the sun, is 4.3 light years away. A starship is travelling at 1516 times the speed of light. How long would it take for it to get from the sun to Alpha Centauri?



2. Ear We Go

Yuri and his space dog Laika travel to a moon base. Before they had arrived, there were 52 ears at the base; after they arrived, there were 43 pairs of legs at the base. How many cosmonauts and how many space dogs are there now at the base?

3. Prime Directive

Just before Jonathan and Jim step out for a space walk, Jean-Luc decides to give them a challenge:

'I'm thinking of a prime number less than 10000. The product of its digits is zero, and its first digit is equal to the sum of the other digits.'

Jonathan replies that this is insufficient information to work out the number.

Jean-Luc then adds:

'Reversing the digits gives you a number which is divisible by exactly three prime factors, two of which are 19 and 29.'

Jim states that this is now enough information.

What number is Jean-Luc thinking of?

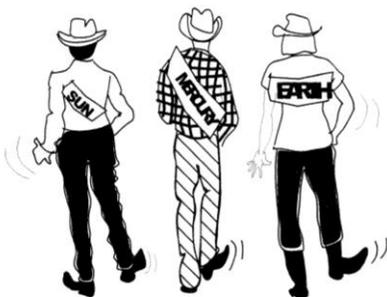


4. Trouble at Hubble

In 1990, the Hubble Space Telescope was launched. Twenty-one years on, it was in need of repair, and a rocket was sent into space to repair it. The rocket made good progress on the way up to the telescope, travelling at an average speed of 3,000mph. Whilst at the telescope, the rocket developed a fault and the rocket's speed on the return journey was reduced to 1,000mph. What was the overall average speed of the rocket?

5. Line Dancing

Mercury orbits the Sun in 89 days, Earth orbits in 365.25 days. If, at midnight on 21st December 2010, the planets are in alignment on the same side of the Sun, on which dates will Mercury pass between the Earth and the Sun during 2011?



6. Ma's Boys

Four astronaut brothers, Neil, John, Buzz, and Eugene, all do tours of duty on a space station. Neil returns to Earth every 9 weeks; John returns every 10 weeks; Buzz goes home every 11 weeks; and Eugene every 12 weeks. Each visit home is on a Friday for one day, and is included in the number of weeks above. They are all home for their mother's 50th Birthday party. How old will she be when she next has all four sons home together?