A cube has 48 symmetries

News

As we approach the summer holidays, many of us will be preparing for a trip away. Mathematicians are not always the most organised folk and packing can be a bit last minute, so here is the problem…

This summer I will be going on holiday for seven days. I own black socks and white socks and am doing my packing in the dark. What is the smallest number of socks that I should throw into my suitcase to be guaranteed a (clean!) matching pair for each day of my stay?[1]

Maths Words

Combinatorics is the branch of maths concerned with counting things. The **Pigeonhole Principle** is really useful for solving counting problems.

Basically it says if you have more pigeons than nests, some pigeons will have to share a nest. For example, if there are four pigeons and three nests, two pigeons will have to share.

We can apply this way of thinking to a simpler version of the sock problem: How many socks should I choose to be guaranteed **one** matching pair? In this scenario, we have two nests, one is black, the other white and the 'pigeons' are the socks. Choosing three socks will guarantee that I end up with two of the same colour.

Joke

What do you call a man who spent all summer at the beach?

A tanned gent.

Maths Quote

"There is no problem in the whole of mathematics which cannot be solved by direct counting."
Ernst Mach

However, if you have problem that you can't solve, even after you've tried counting, why not come along to maths workshop and tell us about it? It's still on, and it's still in room 13 every Monday lunchtime ☺

1. No self-respecting mathematician would be seen in sandals without socks!

Puzzles

Puzzle 1

Pick any five different integers from 1 to 8.

Show that, whatever five numbers you choose, two of your numbers will always add up to nine.

Puzzle 2

It's a sunny day and you've been invited to a barbeque. Each guest counts up how many of their friends are present. Show that there must be two guests who have exactly the same number of friends at the barbeque.

[Hint: You might like to start off by assuming there are 5 people at the barbeque. In this case, the maximum number of friends anyone could have would be? What if there is a guest with no friends?]

Puzzle 3

Here is a more difficult puzzle from the famous mathematician Edsger Dijkstra.

A bag contains some black and white balls.
The following process is to be repeated as long as possible (assuming that we have an infinite supply of black balls).

Randomly select two balls from the bag.
If they are the same colour, throw them out, but put an extra black ball in.
If they are different colours, place the white one back into the bag and throw the black one away.

The question is:
What, if anything, can be said about the colour of the final ball based on the number of white balls and the number of black balls initially in the bag?

Famous Mathematician

Johann Peter Gustav Lejeune Dirichlet (1805-1859) was a German mathematician.
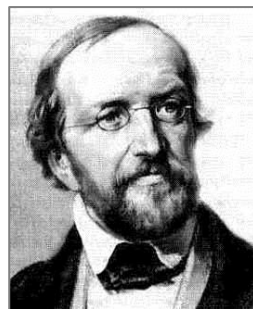
By the age of twelve he had developed a love of maths and saved his pocket money to buy maths books! His teachers included some famous mathematicians: Laplace, Legendre and Poisson[2]. Dirichlet's first paper published in 1825 was related to Fermat's Last Theorem and brought him instant fame. He investigated the case $x^5 + y^5 = z^5$, showing that there is no non-zero integer solution to this equation. Dirichlet is also considered to be the founder of the theory of Fourier series. Incidentally, he also lends his name to an alternative name for the Pigeonhole Principle, the 'Dirichlet Box Principle'.

Team Maths Challenge

On Monday 18th June, two year 8 students and two year 9 students travelled down to London with Mr Taylor to compete in the national final of the UKMT Team Maths Challenge, along with 86 other teams from around the country.[3] It was a fun day.

From left to right in the picture: Naina Gupta, Aahana Jain, a random person in a red top, Mushkan Pradhan, and Kiera Fernandes. Hopefully we will make the finals again next year!

2. Why not look a few of these people up and find out what they did?
3. Roughly 1600 teams enter this competition, meaning our team were in the top 4% of all the teams that entered.