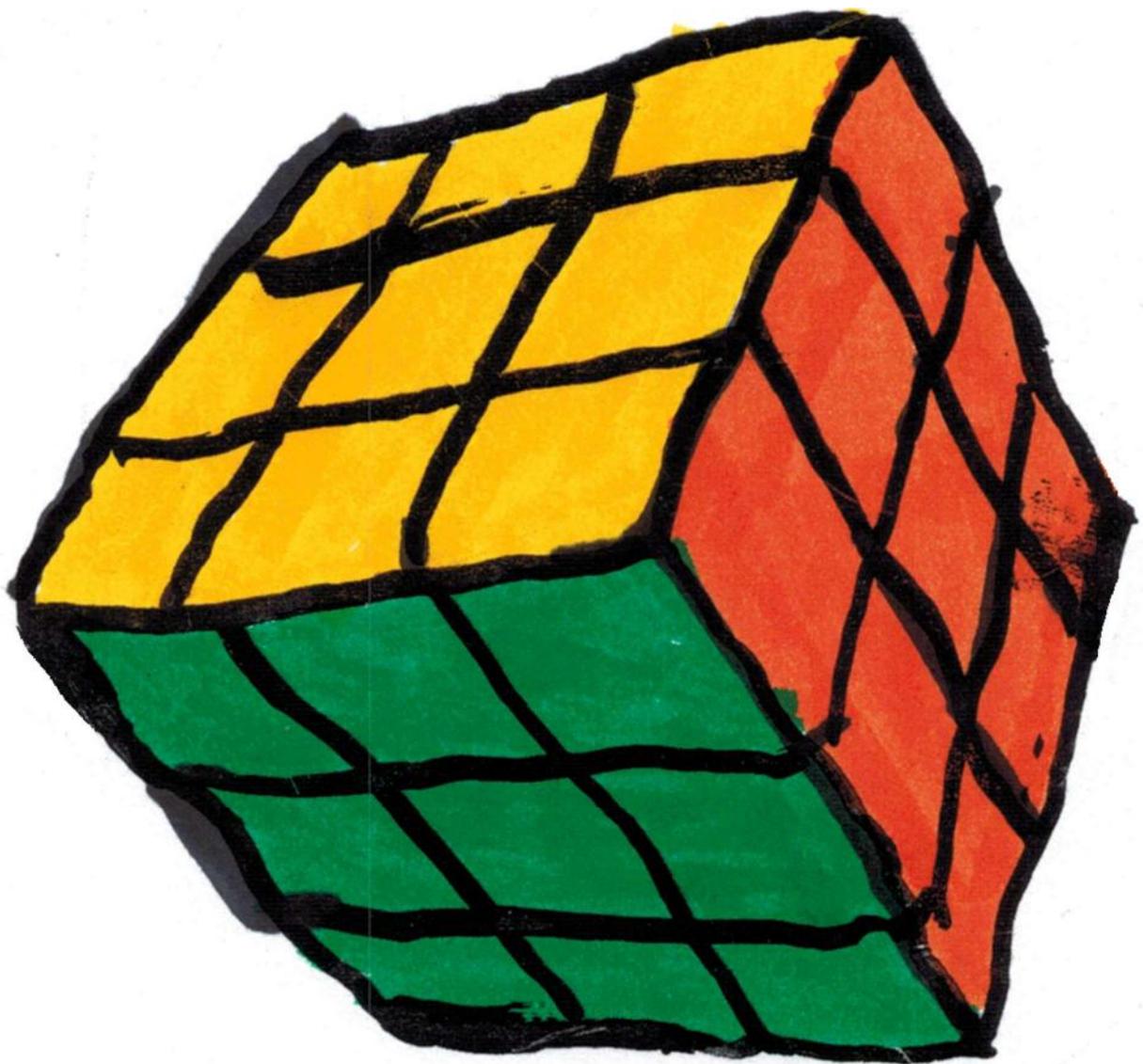# (CUBE)!


Illustrated and written by

**SAMUEL CURNOW**

WARRANDYTE PRIMARY SCHOOL

Leo attends Boylesberry Primary School and is in year 5. Leo thought he would bring his Rubik's Cube to school to share with his friends. It turns out that Leo's friends are not very nice. They stole his cube, threw it on the ground and broke it. Leo felt very disappointed and sad that his friends would deliberately break his cube.

NERD

WEIRDO

DORK
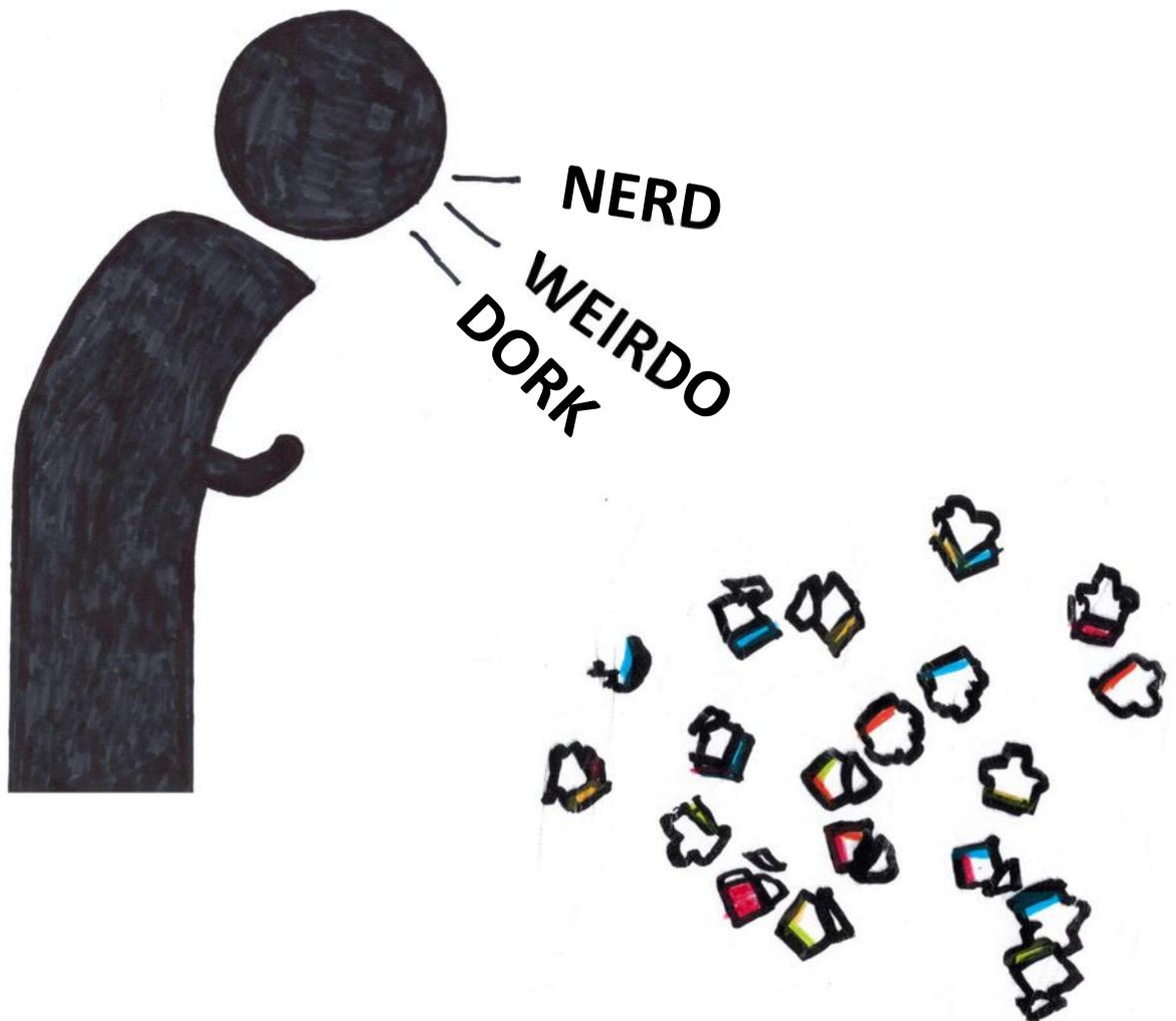
When Leo got home, he tried and tried to fix his cube, but it just would not go back together. Leo was just about to give up when a piece popped in. Leo was relieved that his cube may not be broken after all. He continued to add pieces one by one.
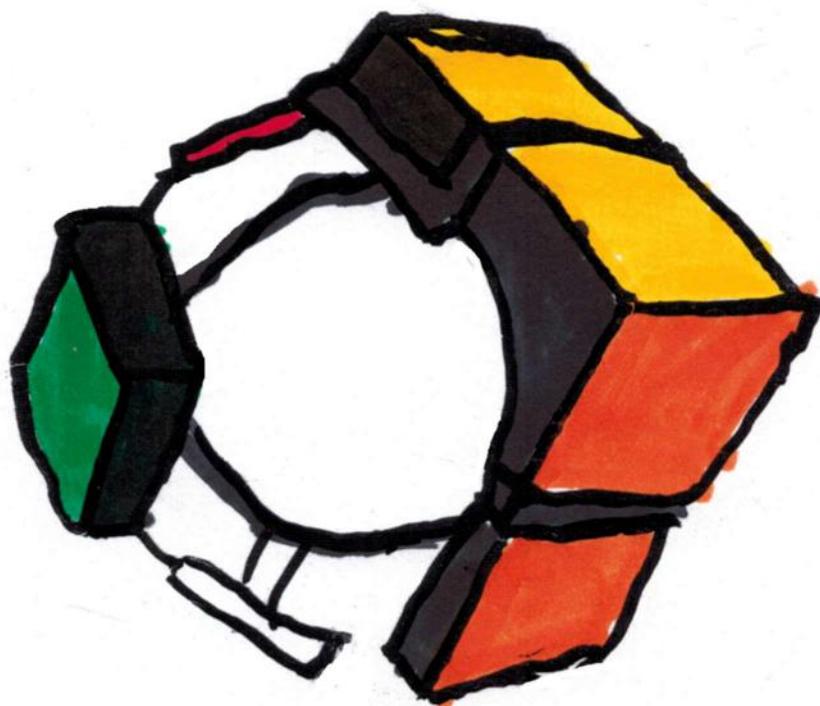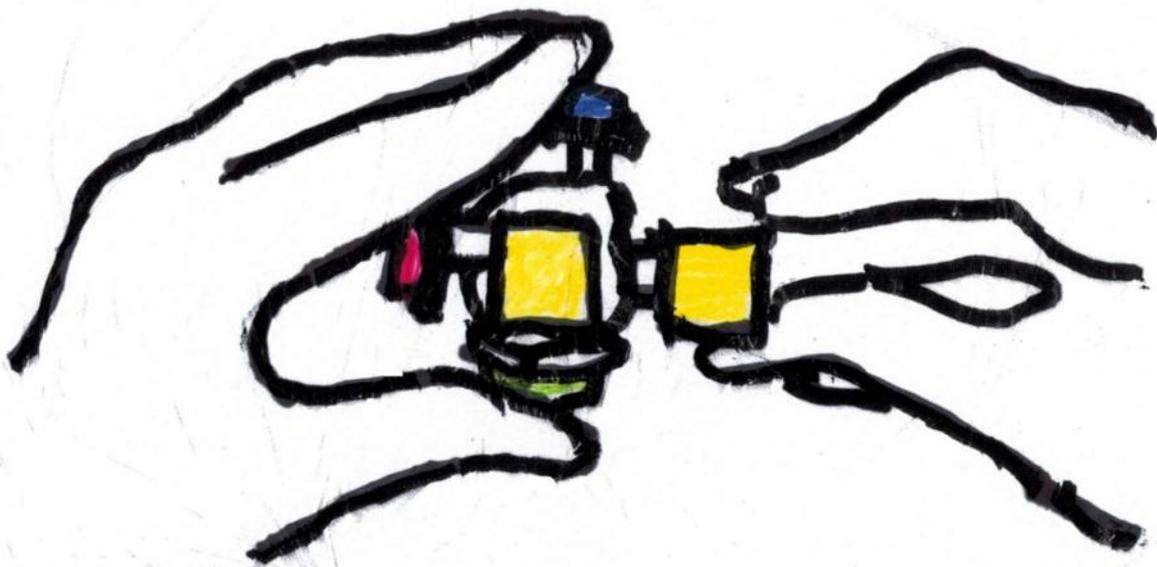
The satisfying clicks of putting each piece back together made Leo realise how many different states a Rubik's Cube can be in.
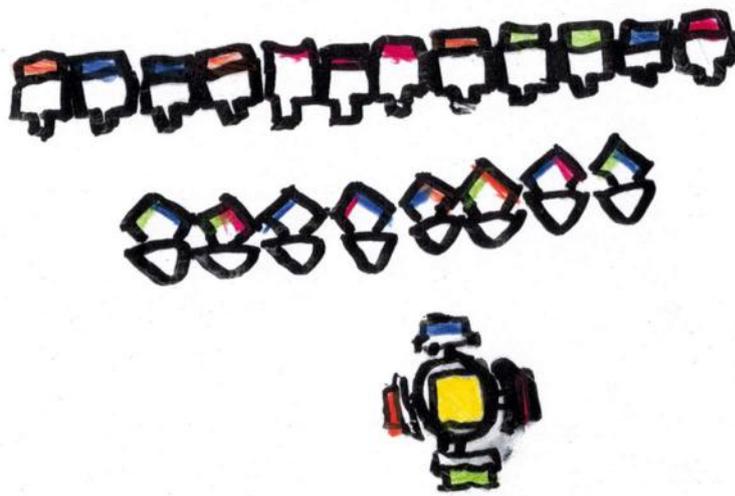

Leo worked this out in two parts. One for the corners and one for the edges. He chose to start with the edges first since there are more of them.

Since there are twelve edges, there are twelve different places for them to go. So, when Leo put the first edge in, it had twelve different spots he could choose from.
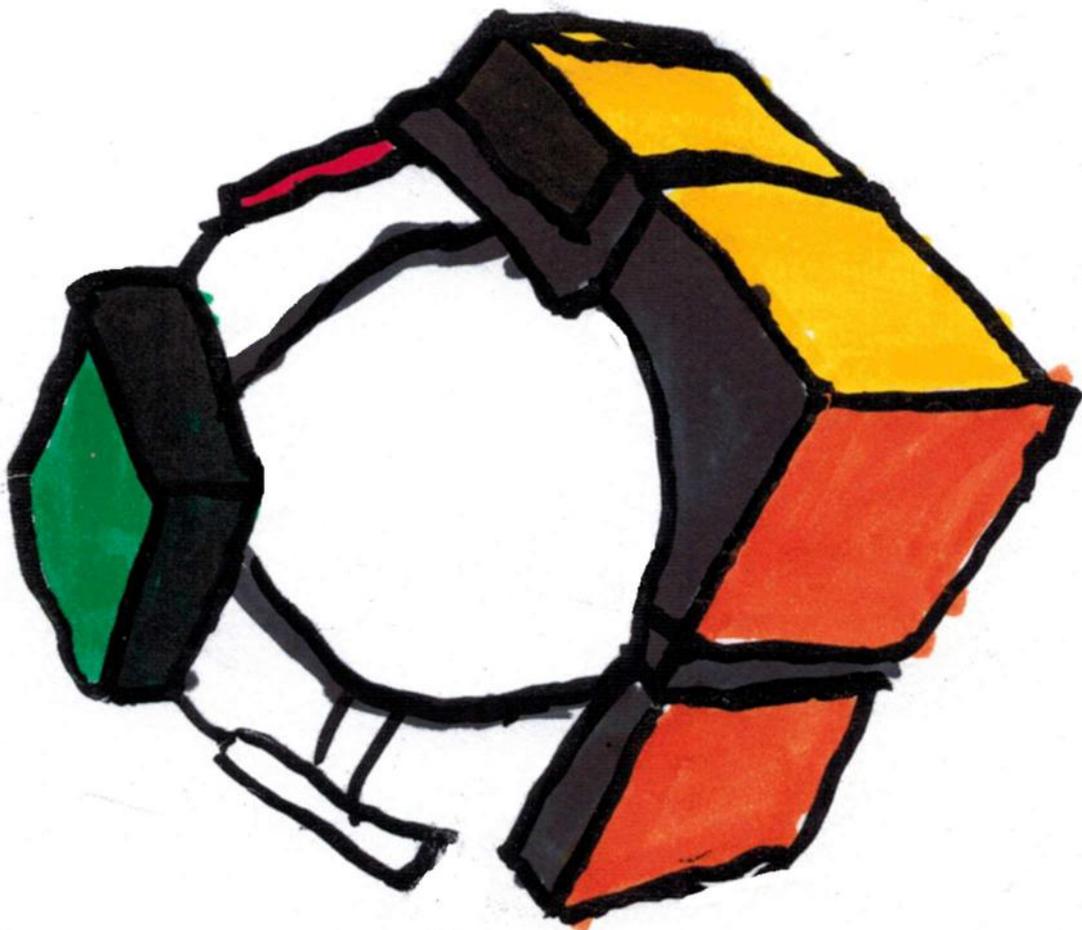
The next edge now has eleven different spots to fit into because one is taken. The next, ten because two are taken. The number of free spots is lessened by one for every edge put in.

Leo worked this out by multiplying 12 by 11 by 10 all the way down to 1. He wrote this simply as 12! In maths, the exclamation mark is used to show factorial.
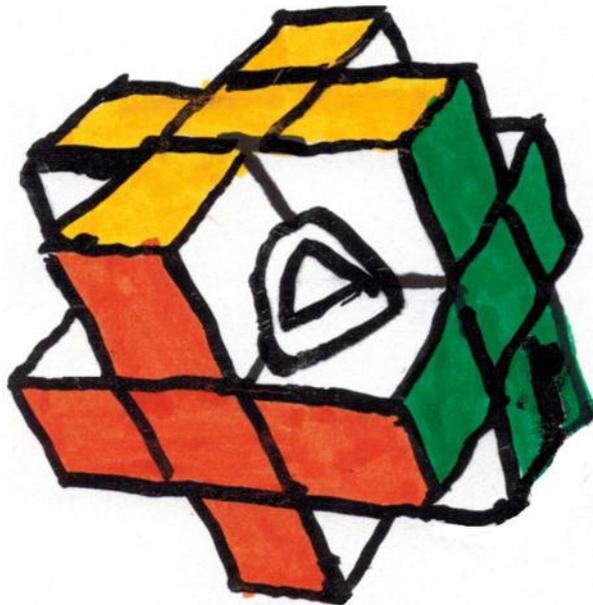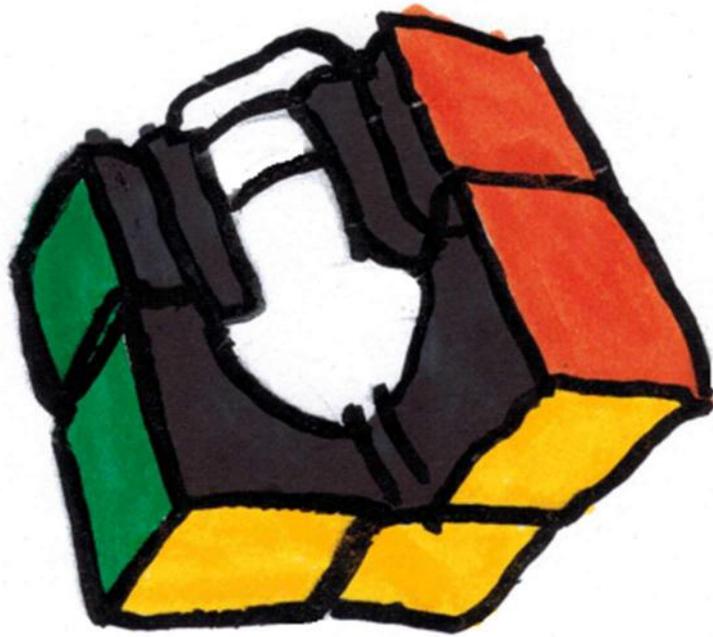
Although he covered most of the combinations, he still did not cover all of them for the edges. There are two colours on each edge and twelve edges. Since these edges could be flipped either way this equates to 2x2x2 up to 12 times. This can be written simply as 2^{12}.

Two because there are two colours on every edge, and twelve because there are 12 edges.
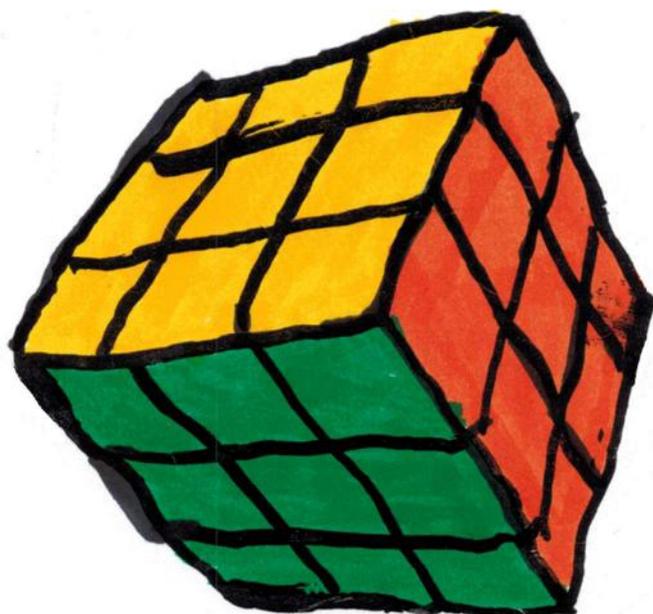
The total equation for the edges now is:

$$(12! \times 2^{12})$$

For the corners, it is the exact same idea. There are eight corners so 8! On any one corner there are three colours and there are eight corners, 3^8. The **total** equation now is:

$$(12! \times 2^{12})$$
$$\times$$
$$(8! \times 3^8)$$

Leo put the equation into his calculator, and it gave him the answer of 519 quintillion.

$(12! \times 2^{12}) \times (8! \times 3^8)$

5.1902

404 E+20

Leo was so proud of his findings he took it to school to show his maths teacher, Ms Mary. She was so amazed with Leo's findings that she gave him a gold award at the weekly school assembly.

The bullies were watching on with a jealous look on their faces. They realised that bullying behaviour does not get awards and is not cool. They stopped bullying Leo and other students.

BLURB

Leo brings his Rubik's cube to school to show his friends, but his friend throws it, and it breaks.

While, putting it back together Leo realises how many different states a Rubik's Cube can be in and comes up with an equation. He brings it to show his teacher and the bullies learn a lesson.

A story of resilience, courage, and mathematics.

ABOUT THE AUTHOR

My name is Samuel Curnow, and I am 10 years old (Year 5).

I live in Victoria, Australia and attend Warrandyte Primary School. I was inspired to write this story because of my interest in solving Rubik's cubes and I really enjoy challenging myself with maths. Therefore, I combined the two and came up with this story.

This story was originally a video but I decided it would also work well as a picture story book by illustrating the pieces of the cube. I also chose to explore the use of factorials and indices and how they relate to Rubik's cube combinations. I find this application of maths very interesting.