King Edward VI Camp Hill School for Girls

Maths Department Newsletter

31st October 2020

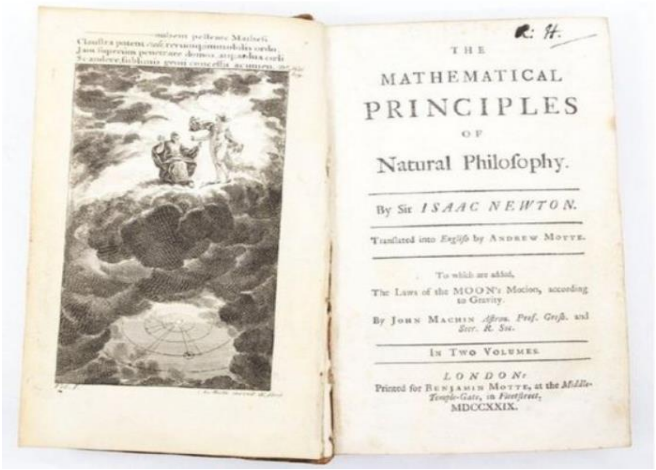
There are 75 ways to rank 4 numbers, if you allow tied ranks

Ghosts

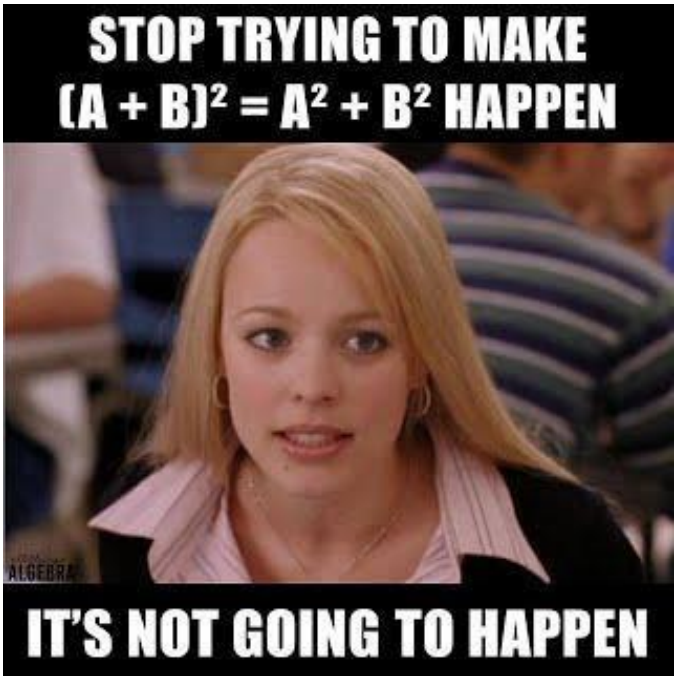
Do you believe in ghosts? If the answer is no, then do you believe in mathematics? If you do believe in mathematics, then maybe that means you believe in ghosts too. Maybe the laws of logic and physics are just ghosts, but we are just so used to them that we don't notice this, and they actually seem real. If you think that ghosts don't really exist because they only exist in your mind, then think about what this really means. Did the laws of gravity exist before Isaac Newton discovered them in the 17th century? It would seem sensible to say they did because things still fell when you dropped them before Newton was born. So when did these laws start existing? Have they always existed? But if they did, they had no mass, no energy of their own, and they were not inside anyone's mind. And yet we say they still existed. So what does it actually mean then to say that something doesn't exist? It would seem that before Newton, the laws of gravity would pass every test of *non*-existence, and yet it seems like common sense to say they existed. Maybe they didn't exist before Newton, until they arrived one day in his head and then got passed around to other heads, including ours. Either way, how exactly are the laws of maths and physics any different from ghosts? Maybe it's fair to say that all mathematicians believe in ghosts and work with them every day.[1]

News

Talking of Isaac Newton, a very rare first edition copy of his book *The Mathematical Principles of Natural Philosophy* (a.k.a. Newton's *Principia*) has recently sold at auction for £22,000. It was discovered by a family in Wales who were having a clear out during lockdown.[2]



Joke



1. These ideas are taken from chapter 3 of a very famous book called *Zen and the Art of Motorcycle Maintenance*.
2. https://www.bbc.co.uk/news/uk-england-gloucestershire-54452971

Is zero more than one?

Have you noticed that, at least in English, zero is plural? You can have three books, two books, one book, or no books. Why is 'nothing' plural? Is zero more than one? If you think about it though, it's not quite that straightforward. Whether zero is plural or not seems to depend on what the alternative would be. If the expectation is that you had two pens, you would say "I have two pens" or maybe "I have one pen" or "I have no pens". In other words, if the expectation is plural, then zero seems to be plural. On the other hand, if the expectation is that your dog has one nose, you could say "my dog has one nose" or maybe "my dog has no nose"[3]. In other words, if the expectation is singular, then zero seems to be singular. This is quite strange. Why should zero care whether people or dogs usually have one or more of something? If you speak a language other than English, please let us know how this works in your language. When you say you have 'no' or 'zero' of something, do you say 'something' or do you say 'somethings'? What do the rules seem to be?

A dog with one nose.

Puzzle

Here is a fiendish little puzzle for you.

$$\frac{1}{4}+\frac{1}{8}+\frac{1}{9}+\frac{1}{x}+\frac{1}{30}+\frac{1}{y}+\frac{1}{45}=\frac{2}{3}$$

What are the values of x and y, if x is between 9 and 30, and y is between 30 and 45?

Did You Know?

'eleven plus two' is an anagram of 'twelve plus one'.

Perron's Paradox

Hopefully, when I asked you if zero is more than one, you immediately knew it wasn't. Obviously, zero can't be bigger than one, because the German mathematician Oskar Perron proved that 1 is the largest positive integer. The proof goes like this:

Let N be the largest positive integer.
Then, clearly, either N = 1 or N > 1.
If N > 1, then multiplying both sides by N tells us that $N^2 > N$.
But this cannot be the case, since N is the largest positive integer.
Therefore N = 1.

This is called a **proof by contradiction**, but clearly something has gone wrong here because we know that, for example, 2 is bigger than 1. This **counterexample** proves that 1 cannot be the largest positive integer, although the proof seems to show that it is. Can you work out what is wrong with the proof?

Eight Eighth Powers

Did you know that an eighth power used to be called a **zenzizenzizenzic**?[4] Talking of eighth powers, it just so happens that

$8^8+8^8+5^8+9^8+3^8+4^8+7^8+7^8 = 88593477$

One Last Puzzle

This is a tricky one from John Conway![5]
What is the next number in the sequence
0, 0, 0, 0, 4, 9, 5, 1, 1, 0, 55, 55, 1, 0, 1, …?
A clue is that it has something to do with Roman numerals. Let us know if you work it out! Bye for now 😊

3. Although, if my dog had no nose, how would he smell?
4. We mentioned this back in maths newsletter #1.
5. For more about John Conway, see newsletter #61.