



# King Edward VI Camp Hill School for Girls

## Maths Department Newsletter

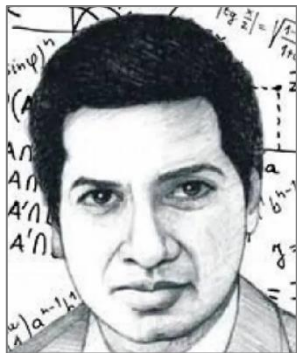


1st December 2022

95 is the lowest integer for which the Mertens function is greater than 1

### News

The famous mathematician Srinivasa Ramanujan once said that an equation meant nothing to him unless it expressed a thought of God. Now you might think that this means he was only bothered with the very best possible equations, if they had



to be good enough for God to be bothered with them. Or you may think that it meant that he was interested in every equation, because if God knows everything, then surely he<sup>1</sup> has thought about every equation there is.<sup>2</sup> I have no idea what he meant, but if you have ever looked at any of Ramanujan's mathematics you will know that having no idea what on earth he means should not really come as a surprise to us. I think that, if he actually meant anything at all, he just meant that not all mathematics is interesting.<sup>3</sup> But hopefully, since you're reading the maths newsletter, you are of the opinion that at least some mathematics is interesting. If not, why are you reading this? But the concept of 'interestingness' is a tricky one, as you will soon realise.

### Maths Quote

"To preserve my brains I want food, and this is now my first consideration."<sup>4</sup>

*Srinivasa Ramanujan*

### Puzzle

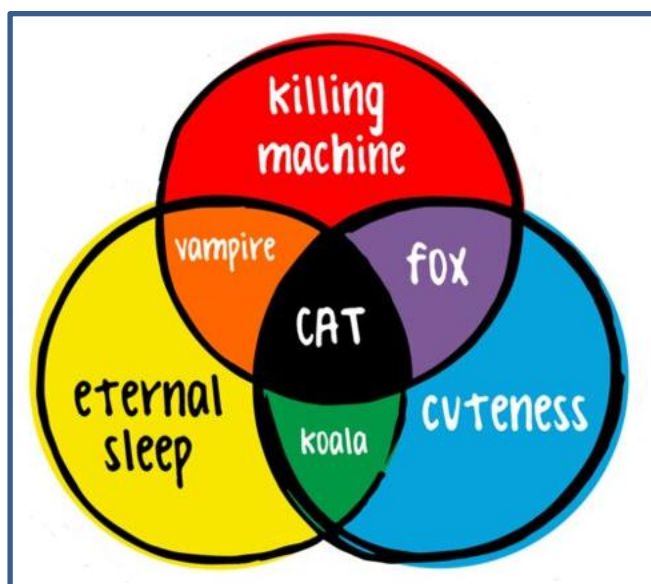
Here's a puzzle from Ramanujan. What famous number is  $p$  equal to?

$$p = \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 \dots}}}}}$$

A clue to working this out is to notice that the whole of the expression on the right-hand side of the equation is contained within itself.

### Venn Diagram Game

Here's something you could do if you are ever bored. Think of something that has three characteristics and put it in the middle of a three-set Venn diagram. Then fill in all of the other regions with things that have those characteristics. Here is an example of one that someone made about cats. Let us know if you make any good ones.



1. Or she – this isn't the RS newsletter – my points are really not meant to be theological.
2. Can you know something without having ever thought it?
3. The GCSE syllabus does quite a good job of teaching you this, I think.
4. I think I understand that one.



## Maths Word

In mathematics, a **function** from a set X to a set Y assigns to each element of X exactly one element of Y. The set X is called the **domain** of the function and the set Y is called the **range** of the function.

$$f(x) = 2x + 95$$

If that definition sounded confusing, that's because it's a proper mathematical definition and they usually do sound confusing. That's not to say that the idea is confusing though. A function is just something that you pass a number to, it does something to that number, then it gives you a number back. The function  $f(x) = 2x + 95$  just takes the number you gave it, multiplies it by 2, adds 95, then gives you the result back. Don't assume in maths that because something sounds complicated that it really is complicated. It may well not be.

## Interesting Numbers

As you know, I always put a fact at the start of the maths newsletter about the number of the newsletter.<sup>5</sup> I also do my best to make the fact interesting, although this is more difficult with some numbers than with others. So what is the smallest natural number<sup>6</sup> that is not interesting at all? Well, it turns out that every natural number is interesting. If some numbers were not interesting, there would be a set of numbers that are uninteresting, and this set must have a smallest number in it. But this number would then be interesting because it would be the smallest uninteresting number, therefore such a set cannot exist. This is called the 'interesting number paradox'.<sup>7</sup>

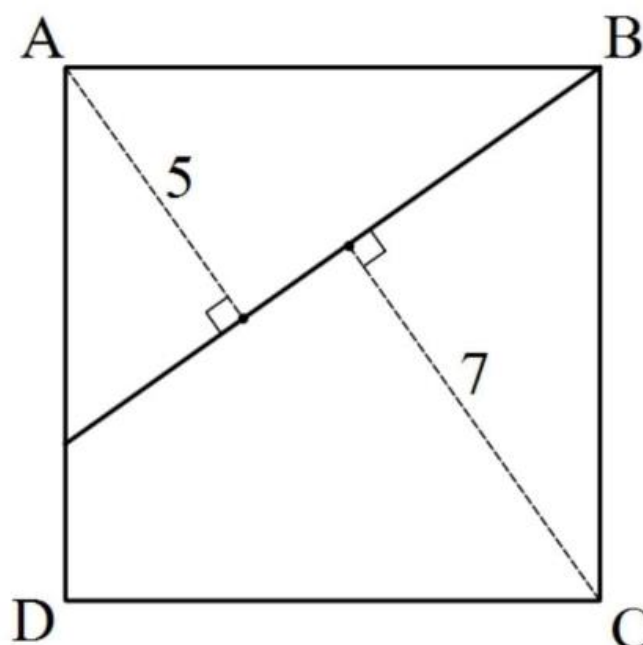
5. Some of you may not have noticed this. This newsletter is number 95.

6. Natural numbers are the positive integers: 1, 2, 3, 4, 5, etc.

7. [https://en.wikipedia.org/wiki/Interesting\\_number\\_paradox](https://en.wikipedia.org/wiki/Interesting_number_paradox)

## Geometry Puzzle

In the diagram ABCD is a square. What is its area?



## Another Puzzle

This is a puzzle called 'Hudsons Tangled' from a book called *Sherlock Holmes' Fiendish Puzzles*.

"I've mentioned my niece Katie to you, I believe," said Mrs Hudson to Sherlock Holmes one morning.

"Indeed," said Holmes. "She works for the family with the eccentric twins."

"That's her. She has a younger sister, Alison. Their ages can be a bit of a tangle."

"How so?" I asked.

Mrs Hudson smiled, and took a deep breath. "Counted together, they are forty-four years of age. Katie is twice as old as Alison was when Katie was half as old as Alison will be when Alison is three times as old as Katie was when Katie was three times as old as Alison."

Can you tell how old Katie is?

Let us know if you work it out!