



There are **83** 5-digit numbers whose squares contain 9 of the 10 different digits

News

It was in the news this week that a 32 year old man, with no underlying health issues, was offered the Covid-19 vaccine for no apparent reason. When he asked why he had been offered it, he was told that it was because of his weight.¹ Apparently, he had a BMI of 28,000, whereas the average BMI is about 20.² The BMI (which, as you know, stands for Body Mass Index) was invented by Adolphe Quetelet, a mathematician who lived during the 19th century. The formula for BMI is



$$B.M.I. = \frac{\text{mass}}{\text{height}^2}$$

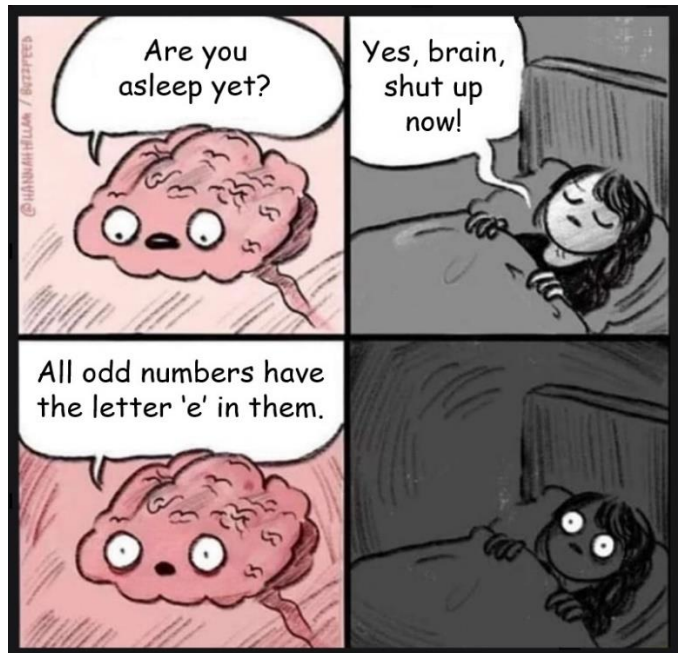
The reason for this misunderstanding was because the patient’s height, which was 6 feet and 2 inches had been entered into the computer as 6.2 cm. The person in charge of the NHS in Liverpool, where this happened, said, “I can see the funny side of this story but also recognise there is an important issue for us to address. There are millions³ of GP appointments taking place every day and while we take care to make sure records are accurate, occasional data errors do occur.” But could a man actually be 6.2 cm tall?⁴

Maths Word

In maths, an **area** is the space taken up by a flat shape or the surface of an object. The word comes from the Latin word **area**⁵, which means ‘level ground’ or ‘open space’. Experts aren’t sure, but it may be related to the Latin verb **arere**, which means ‘to become dry’ and is where we get the word **arid** from, meaning ‘dry’, as in a desert. The link would be that the piece of level ground or open space would have been made clear and open by burning down what was there before, and therefore it would be arid. But we’re not sure. So what famous area is related to flying saucers? And what does this have to do with Area 33H in Flatland?



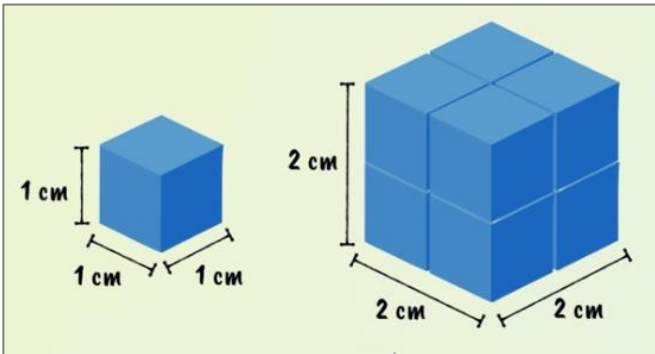
Joke



1. Well, technically, it was actually his weight relative to his height, which is what BMI measures.
 2. General mathematical principle #1 – Always check your answer to see if it’s reasonable!
 3. Well, they think it’s millions. It could be tens, or hundreds... Who knows? This could be another mistake.
 4. You know, like Ant-Man. Look on the back of this newsletter for the answer.
 5. Yes, it’s exactly the same word, I know.

The Ant-Man Thing

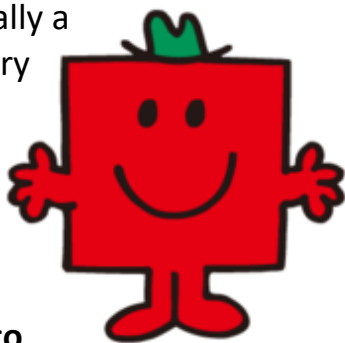
Thinking about the Ant-Man question, if you enlarge something like a cube⁶ by multiplying its side length by 2, does this also double its surface area and volume?



Well, no, it doesn't. If you double the side length of a cube, the surface area gets multiplied by 4 and the volume is multiplied by 8. This is because $4 = 2^2$ and $8 = 2^3$.

Similarly, if you halved the height of a person, their surface area would be divided by 4, and their volume would be divided by 8.

Imagine if a person were cube-shaped – I know, let's imagine Mr Strong from the Mr Men. He's basically a cube – let's not worry about his arms and legs. If he had a length, width and height of 2 m,⁷ look what happens to his **surface area to volume ratio** if you halve his dimensions.



Length (m)	2	1
Surface Area (m^2)	24	6
Volume (m^3)	8	1
SA:Vol	3:1	6:1

So why does any of this matter?

6. We talked about cubes in the last newsletter.

7. He's bigger than he looks. Like a wombat. Have we talked about wombats? Google 'wombats'.

8. I was always taught that elephants have big ears because Noddy wouldn't pay the ransom.

9. <https://www.syfy.com/syfywire/science-behind-the-fiction-could-anyone-get-as-small-as-ant-man-and-if-so-what-would-it-do>

The greater the surface area to volume ratio of an animal is, the more heat it loses relative to its volume.

This is because heat is lost through the animal's surface, so if two animals had the same volume, but one had a greater surface area, that one would lose heat more quickly. Sometimes this is beneficial. For example, the reason elephants have big ears is because it increases their surface area and helps them cool down.⁸

In biology, there is a rule called **Bergmann's rule** which says that, very generally speaking, bigger animals are found in colder places, and smaller animals are found in warmer places. This is because larger animals have a lower surface area to volume ratio than smaller animals, so they radiate less body heat per unit of mass, and therefore stay warmer in cold climates.

Ant-Man would not be possible because, as he got smaller and smaller, his surface area to volume ratio would get so big that he would have to be eating constantly to make up for the energy he was losing through his relatively huge surface area. It's actually really complicated though. Why not ask the people who write the biology newsletter to do an article about this? Alternatively, you could read one of the many articles online, such as this one.⁹ Like most things though, it basically comes down to maths.

Chess Club

Our new Camp Hill Chess Club is up and running. We are now using the website chesskid.com, as well as the Google classroom. If you haven't yet joined, and you would like to, the Google classroom code is **mdwgxrn** and the instructions are on there!