King Edward VI Camp Hill School for Girls

Maths Department Newsletter

20th May 2021

5! - 4! - 3! - 2! - 1! = 87

News

I was talking to one of my classes the other day about something called the **Potato Paradox**. Lucy brings home 100 kg of potatoes, which (being mathematical potatoes) consist of 99% water.

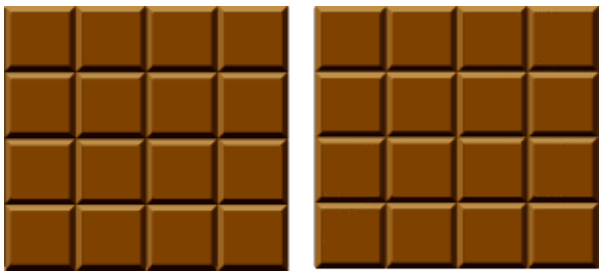
She then leaves them outside overnight, and in the morning they consist of only 98% water. What is their new weight? The surprising answer to this question is 50 kg. Can you work out why this is?

This week's maths newsletter is going to be mostly about food, so here we go…

Chocolate Bar Puzzle

The solution to this very famous puzzle is actually extremely easy, but only if you look at the situation in the right way.[1]

How many steps are required to break an *m* x *n* bar of chocolate into 1 x 1 pieces? You may break an existing piece of chocolate horizontally or vertically, but stacking two or more pieces on top of each other is not allowed.

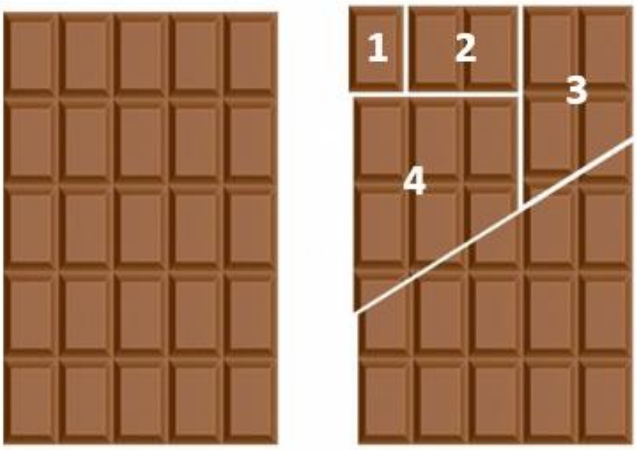


If you struggle to solve this, just google the answer. You will find it easily.

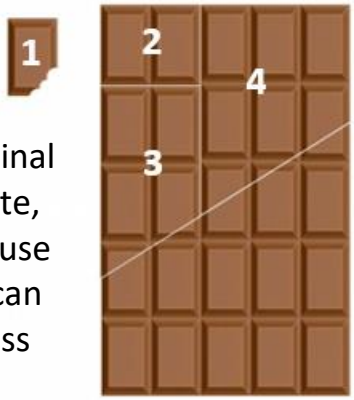
Maths Word

A **paradox** is a statement that, despite apparently valid reasoning, leads to a seemingly self-contradictory or a logically unacceptable conclusion.[2]

Here is a paradox sometimes called the **Infinite Chocolate Bar**. You take a 5 by 5 square of chocolate[3] and cut off four pieces as shown in the diagram.



These pieces can then be rearranged to reconstruct the original big piece of chocolate, without needing to use piece 1, which you can then eat. This process can be repeated an infinite number of times and you will never run out of chocolate!



Can you work out how this trick is done? There are some good animated versions of this online. I recommend this one https://www.youtube.com/watch?v=kf6-DQuo0Po but there are lots of others.

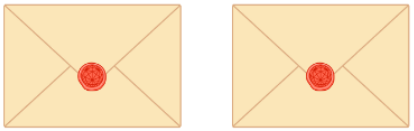
1. When you think about it, that's pretty much a description of maths generally, isn't it?
2. We have already looked at several paradoxes in the maths newsletter: The Pinocchio Paradox (issue 8), The Paradox of your non-existence (issue 42), and the Raven's Paradox (issue 57).
3. OK, so they're really rectangles – but nobody says, "Can I have a rectangle of chocolate?", do they?

Another Paradox

This is called the **Two Envelopes Paradox**.

One envelope has X dollars,
the other has 2X.

You open one of the envelopes and are offered the chance to switch…



Given that all you know is how much money is in the envelope that you opened, should you switch? The surprising answer is that you should definitely switch. Can you work out why? [4]

Culinary Ratios

As you probably know, when you are cooking food the amount of each ingredient you need is often better explained using a ratio rather than an actual amount. Here are some of them.

Vinaigrette 3:1 (oil : vinegar)
Brine 20:1 (water : salt)
Pie Crust 3:2:1 (flour : fat : water)
Bread 5:3 (flour : liquid)
Pasta 3:2 (flour : egg)
Custard 2:1 (dairy : egg)
Pancakes 2 : 2 : 1 : 0.5
(flour : liquid : egg : fat)
Sponge Cake 1:1:1:1
(flour : egg : fat : sugar)
Biscuits 3:2:1 (flour : liquid : fat)
Muffins 2:2:1:1
(flour : liquid : eggs : fat)

If you know of any others, please send them to me, as I collect them. [5]

Joke

The recipe said "Set the oven to 180 degrees", so I did, but now I can't open it because the door faces the wall.

Riddle

I am a food with 5 letters. If you remove the first letter I am a form of energy. Remove two letters and I'm needed to live. Scramble the last 3 and you can drink me. What am I?

Did You Know?

Students from Sheffield University Maths Society came up with a formula for the perfect pancake, taking into account the number of pancakes required, their thickness and the pan size. The total amount of pancake mixture required is

$$\frac{D^2 \times T \times \pi \times P}{4} \text{ ml}$$

where D is the diameter of the frying pan in cm, T is the required thickness of the pancakes in cm, and P is the number of pancakes you want to make. Let me know if you try this formula!

Also please let us know if you find out about any other bits of food-related maths, or any other food-related paradoxes.

4. Unfortunately you need a bit of A-level maths to solve this one. The fact that it is true though should be enough to convince you never to trust your common sense in any situation ever. Maths is always the better option.
5. Maths teachers collect strange things. Do you collect anything strange? Please let us know if you do.