

Cells

G'Day!

This is your math friend James. Today I am answering a question from Macy.

Can you do something with math and red blood cells?

Umm. Hmm.

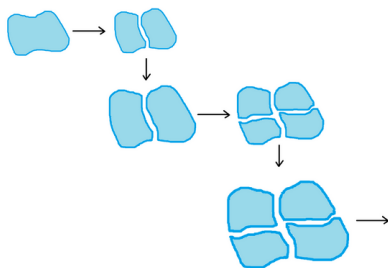
The truth is, I don't know very much about these cells, except that they contain something called hemoglobin, which they use to carry oxygen from our lungs to all the other cells in the body. They are very important cells!

And I bet biologists have figured out how much oxygen they carry, how quickly they transport it, and so on. There is a lot of science and math involved in figuring that out, I am sure.

[Can you look on the internet to learn just how effective red blood cells are in transporting oxygen?](#)

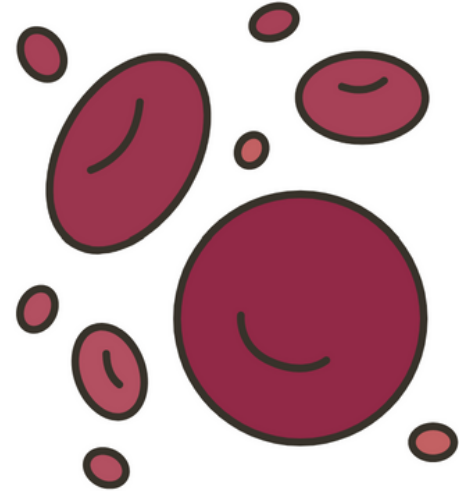
But now I am thinking of a question. Do red blood cells grow? I don't think they do. ([Again, what can you learn from the internet?](#))

When I was a kid, my body grew because my cells grew--the cells of my muscles and organs and so forth. And I remember learning they not only grow but also keep splitting into two to make even more cells.



From 1 cell I would get 2 cells, and then 4 cells, and then 8 cells, and then 16 cells, and so on. The count of cells keeps doubling and I see I am getting the list of counts: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048,

These are the **doubling numbers** and there is mathematics in those. for sure!



These doubling numbers get very big, very fast!

One only has to double twenty times to get over a million cells (1,048,576 of them, in fact), and only thirty times to get over a billion cells (1,073,741,824 of them.)

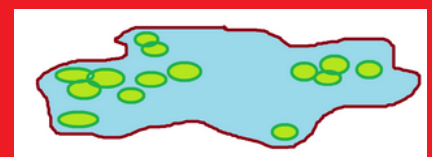
[\(Ooh! Surely biology puts a stop to all this growing-and-splitting at some point. Do cells have a life span? Do they stop growing?\)](#)

puzzle #1

Water lilies are growing in a lake, covering the surface area of the lake.

And these lilies are growing so fast that, by the end of each day, they cover double the amount of surface area they did the day before. Luckily, it is a big lake.

It has taken 60 days for the lilies to cover half of the surface area. How many more days will it be before the entire surface is covered?



If you take a strip of paper, 1 layer thick, and fold it in half, you get a strip 2 layers thick. Fold it in half again, you get 4 layers, and then 8 layers. This is another way to get the doubling numbers.

BY THE WAY: It is really hard to keep folding a strip of paper in half over-and-over again. For a every long time, people thought you could do so only seven or eight times. But, back in 2002, then high-school student Brittney Gallivan proved the world wrong by folding a very long, thin strip of paper (4000 feet long) in half 12 times.

In 2011, high-school students in Boston used a mile of paper to create a strip that is equivalent to 13 folds. (The strip of paper was so long that they had to use tape to make the folding pattern, alas.)



Check out [MATHICAL](#) for award-winning math books for middle-schoolers and teens, the YouTube channel [NUMBERPHILE](#) for math videos galore, and [MORE MATH!](#) for even more resources. Wowza!

On a related note, here's a [NUMBERPHILE video on The Shape of DNA](#).

Do you have a math question for me to answer, or try to answer?

**Write to me [at the website](#).
Each week I'll pick a new question and give my thoughts on it!**

puzzle #2

Look at the doubling numbers.

1 2 4 8 16 32 64 128 256 512 1024 ...

There's one that begins with a 3.

There's one that begins with a 5.

There's one that begins with a 6.

Is there one that begins with a 7?

If there is: What's the second one that begins with a 7? What's the third one and the fourth one?

If there isn't: What's wrong with "7" as a starting digit?

I am worried! I've just talked about cells that split, and water-lilies, and folded paper, and the digits of the doubling numbers. And I've asked a lot of questions about cell biology that I don't know the answers to.

But I haven't really answered any questions! And I certainly have side-skipped Macy's question entirely. (Sorry Macy!)

Maybe learning goes that way? You ask a question, and find lots of more unanswered questions to explore and ideas to play with, and off you go on a journey.

I certainly have some discovery learning I want to now do, and for that I say: Thank you, Macy!

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The NMF Weekly is written by mathematician Dr. James Tanton as a resource for friends and fans of the 2021 National Math Festival.

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