the nmf weekly

Ask your math friend, James

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Math and Outer Space

G'Day!

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

Can you do something with Math and Outer Space?

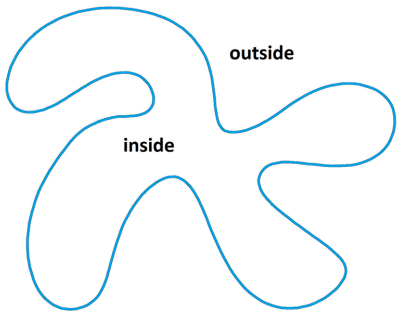
Of course I need to answer YES to this question, but I am nervous doing so! Why? Because this question should go to my wife and not me. She is a NASA space scientist and is leading a space mission to send a probe to the asteroid Psyche! Launch will be in 2022.

You can learn about the mission here. You'll see lots of frequently-asked-questions answered, and lots of photos, and lots of student art projects about the mission, too.

Moreover, NASA has a whole website devoted to math problems about space and planets and space travel. So, actually, there is really nothing for me to add. NASA has this question well and truly covered!

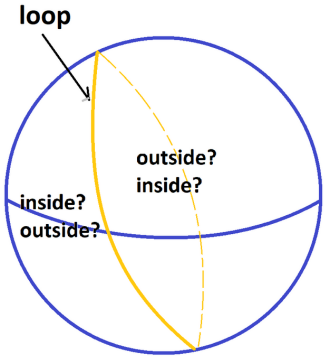
What additional mathy things can I possibly offer?

Well, I am intrigued by the phrase "outer space" in Arthur's super question. Is it always easy to tell when space is "inside" versus "outside"?

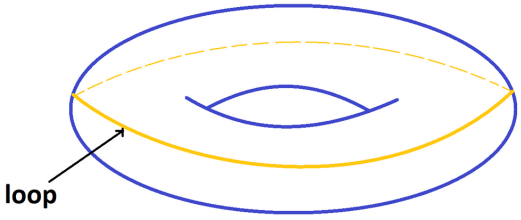


Every closed loop we draw on the page seems to divide the page into an inside and an outside.
(I guess the loop shouldn't cross itself. Or maybe it's okay if it does? Maybe that just makes several "insides" and one outside. What do you think?)

A loop drawn on the surface of the Earth divides the surface into two regions. But it is not always clear which piece should be called "inside" and which "outside."

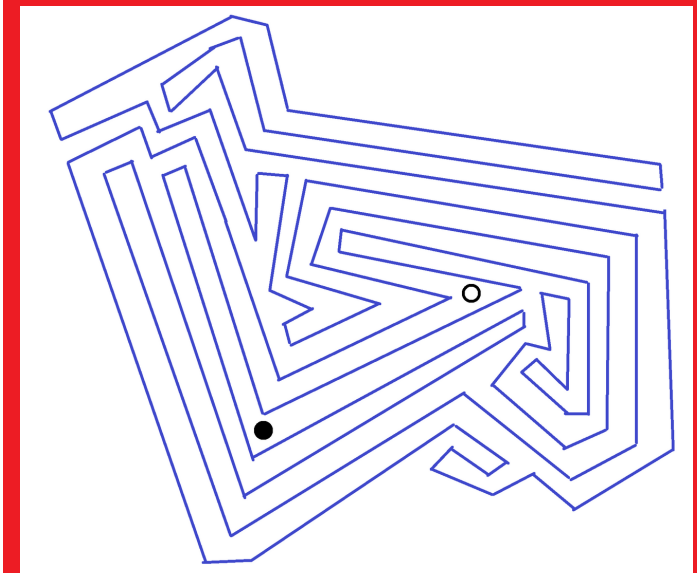


And a loop drawn on a bagel might not divide the surface into two separate regions at all: no inside and no outside. (Does my picture below make sense?)



Maybe the universe is shaped like a bagel and there is no inside or "outer space"? Whoa!

puzzle #1



Is the solid dot inside or outside?
Is the hollow dot inside or outside?

Is there a quick way to tell?

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!

Check out John Rocco's Mathical prize-winning book:
HOW WE GOT TO THE MOON!

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

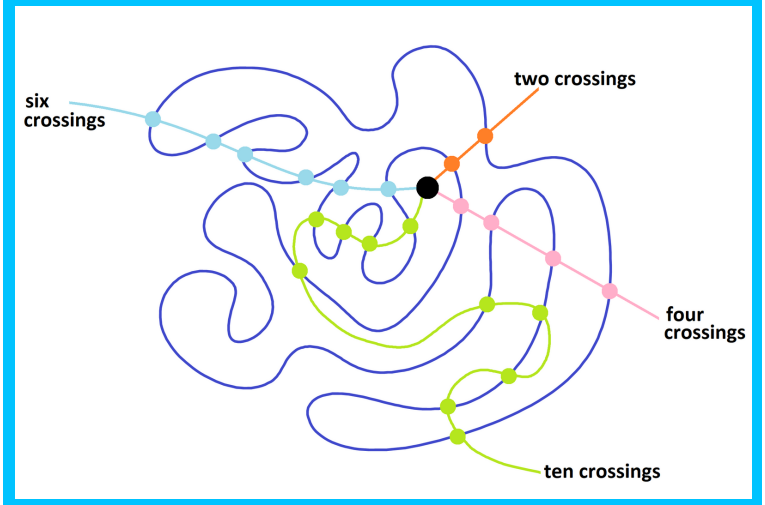
Write to me at the website.
Each week I'll pick a new question and give my thoughts on it!

puzzle #2

Here's a messy complicated picture.

There is one big, dark blue loop.
There is one solid black dot.

And there are some paths from that dot each going to the "outer space" of the loop. And on each path, we've counted the number of times that path crosses the dark blue loop.



The count of crossings each time is an even number.

Is that a coincidence? Or is there a path from the black dot to "outer space" that crosses the blue curve an odd number of times?

About the Author: Dr. James Tanton

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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