

Do straight lines exist?

G'Day! This is your math friend James. Today I am answering a question from Ann.

DO STRAIGHT LINES EXIST?

I am not sure what Ann was doing or watching or thinking about when she thought to ask this question. But it is a really good question! My answer is:

I think we like to think that straight lines exist.

Is that a helpful answer? Probably not.

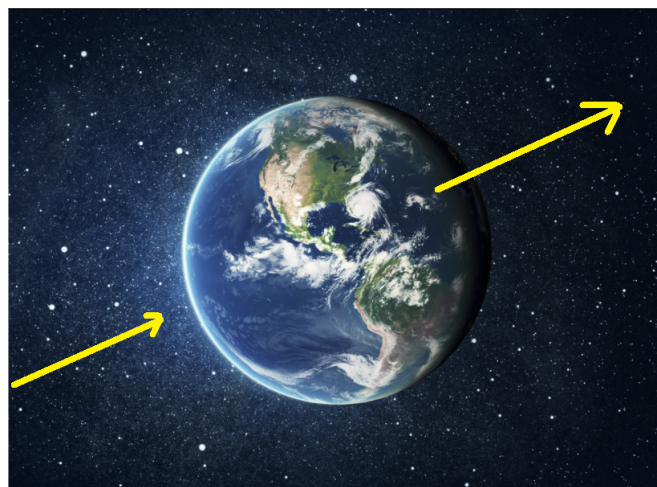
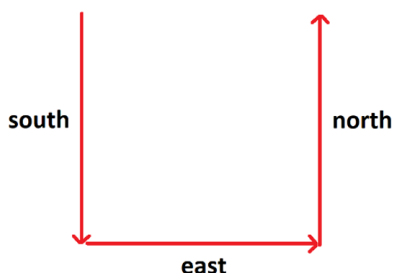
There's a very famous puzzle that shows that Ann's question is deep and worth asking. The puzzle is this:

One day a woman decides to take a three-mile walk.

She starts by heading directly south for one mile, trotting along at a happy pace, admiring the sunshine and the wildlife. Then she turns left and heads directly east for one mile, all the while enjoying the smell of the sweet air and the glorious sights of nature around her. Next, she turns left one more time and heads directly north just for one more mile. Surprisingly, after this third one-mile stretch she finds herself back to where she started!

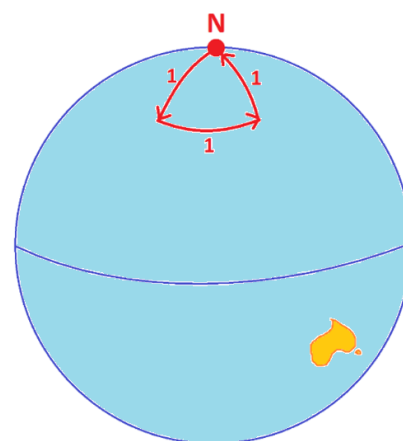
What color was the bear she saw on her walk?

This seems like a crazy question! First, how I am meant to know what color bear she saw? There was no mention of a bear in the puzzle! And second, if you draw out the path of her walk, what is described is impossible. If you walk a mile south, and then a mile east, and then a mile north you DO NOT end up back at start. The set-up of this question is wrong!



But, actually, there is a starting place on Earth where one could walk such a journey and return to start. It's the North pole!

Every direction from the North pole is south and you can see that if you walk away from the pole for a mile and then turn east for a mile, heading back north will indeed bring you back to start!



Since this is happening in the Arctic region, if the woman saw a bear, it must have been a polar bear, and hence white. She saw a white bear!

But this is why Ann's question is so fascinating. When we look at the woman's journey from above, we can see that she wasn't really walking along segments of straight lines. Since the Earth is curved, all three sections of her journey were bent lines.

But the woman would say: "It felt like I was walking a perfectly straight line segment each time."

If I were to ask you to go outside and walk directly east, would it feel to you that you are walking a perfectly straight line? How are you meant to know that the line you are walking is not actually straight?

I wonder if Ann was wondering about this sort of thing when she asked me her question.

When did humankind first figure out that the Earth is round? What made people realize this?

If I am not restricted to the surface of the Earth, where all lines I draw will be curved, I might ask: Do straight lines exist in space?

I don't know the answer to that question. But imagine a brave astronaut decided to run an experiment for us. She launches from Earth and heads in a straight line away from our planet. She promises only to go straight. And then suppose, some 300 years later, she returns - from the opposite direction!

Hmm. This will make us wonder if the entire universe is actually curved. Heavens!

So, my answer to Ann, really is "I don't know."

But I can say, when we draw drawings on paper and build bridges and buildings and such, all the edges we draw do operate as though they are "straight" and all the geometry we understand and use works perfectly well — thank goodness!

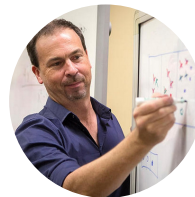
Do you have a math question for me to answer, or try to answer?

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

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.

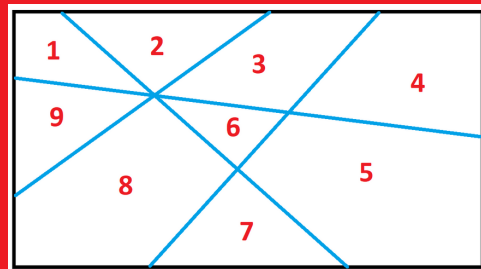
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puzzle #1

Draw **FOUR** straight lines across a blank sheet of paper. Have each line start and end on an edge of the paper. Count how many regions you get.

In my picture here I count **9** regions.



What is the **biggest** count of regions you can get? What is the **smallest** number of regions possible?

puzzle #2

Believe it or not, there is another place on Earth where the women could have started her curious walk. (She won't see a bear on this journey, though.) Where?

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For straight line (and circle) geometry fun check out [Euclidean!](#)

