

Map Coloring

Although Map Coloring is a topic of Graph Theory, the basic idea is simple and can demonstrate how mathematicians think.

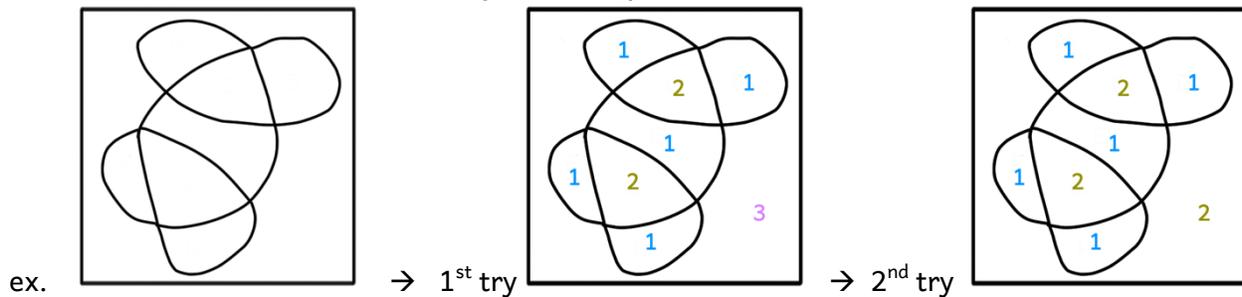
1. Start with a question:

“Have you ever colored in a pattern and wondered what is the smallest number of different colors needed so that no two sections that share a common edge are the same color? “

For example: What is the smallest number of colors you can use to color this drawing?

Hints: Using numbers to represent each color lets you change you mind.

Also, remember that having a corner (point) in common is ok.



2. It is ok to make mistakes. The processes you use matter.

While trying to find out how many colors are needed and then proving their conjectures (educated guesses), mathematicians went down many wrong paths, but what they learned along the way led to other advancements in mathematics.

3a. Draw it out:

There are many examples of “maps” below. Color in at least 4 with the smallest number of colors you can use. When you are finished, try creating a design of your own and see how few colors you can use to color it in.

3b. Clothesline Activity:

Start by putting up two clotheslines in the front of the room.

On the top line have the numbers 2 through 6.

After coloring a design, put it on the bottom clothesline under the number representing how many colors were needed. (Clip the same images together – if they use the same number of colors.)

3c. On your own or in small groups:

Compare your work. Could you have used fewer colors? Try redoing the design that required the most colors and see if you can color it using fewer colors.



4. Talk to Others

If possible, discuss different strategies people used to minimize the number of colors used.

Ask if anyone had to redo a design.

When in discussions remember the way we talk about mathematics with others:

- I agree/disagree with you because ...
- Can you explain your steps to me?
- What strategy did you use?
- Is there another way to solve this problem?
- My first step was ...
- I still have a question about ...

Notice: There can be more than one way to color the same design

Sometimes a design has an error and has to be redone

5. **Make a conjecture** of how many colors one needs to color any pattern.

I think all “maps” can be colored using _____ colors.

6. **Prove the conjecture: Speed is not the most important thing.**

In 1852 Frederic Guthrie (a map maker and mathematician) noticed he only needed 4 colors to color any map and wondered if this was true for all maps. It seemed like a simple idea, but sometimes simple ideas can be very hard to prove. The Four Color Map Theorem, was not proven until 1976, 124 year later. (This was the first time a computer was used to prove a major mathematical theorem.)

7. **Challenge yourself**

Redo a graph that took more than four colors, or try and create a graph that requires 5 colors.



Map Coloring Game

Here is a two-person game that may give you insights into map coloring.

Playing the game:

The first player draws a region.

The second player colors it and draws a new region.

The first player colors it and adds a third region.

This goes on until somebody gets stuck and has to use a fifth color.

When the game is over:

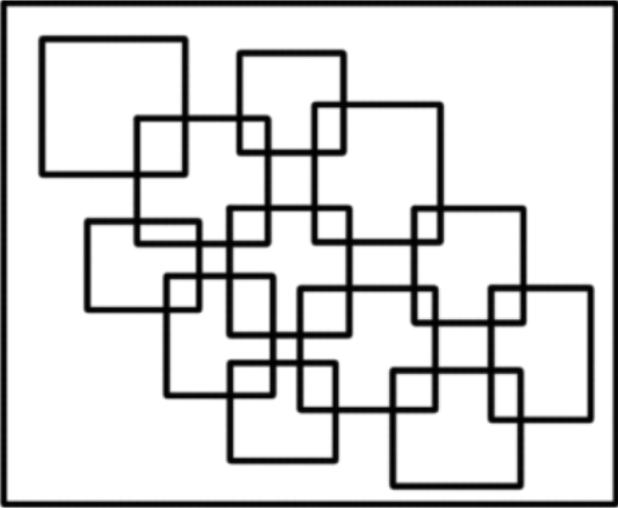
Redraw the regions (without the colors) and show that it can be colored in only four colors.

For more information go to:

<https://www.frontporchmath.com/topics/algebra/language-of-algebra/what-is-algebra-video/>

<https://www.frontporchmath.com/topics/numbers-patterns/discrete-math/four-color-theorem-map-coloring/>

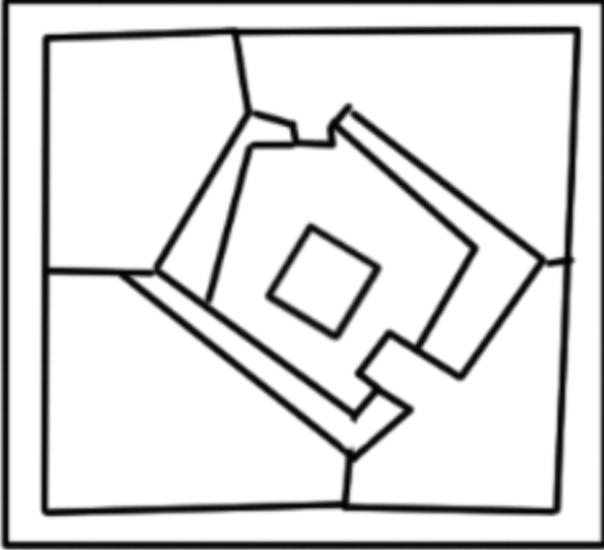




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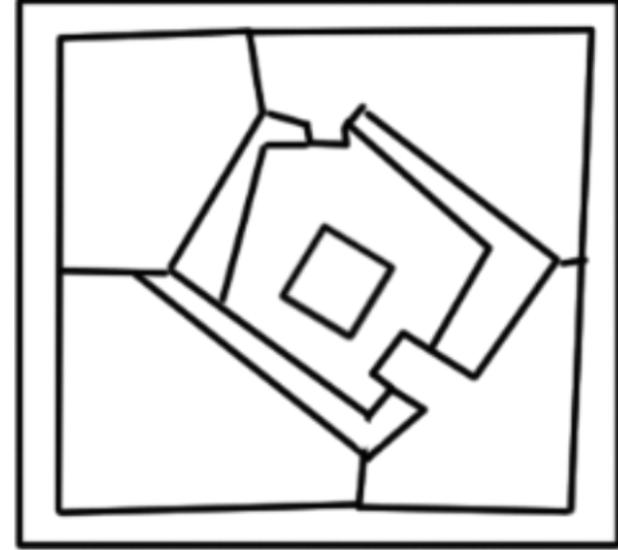
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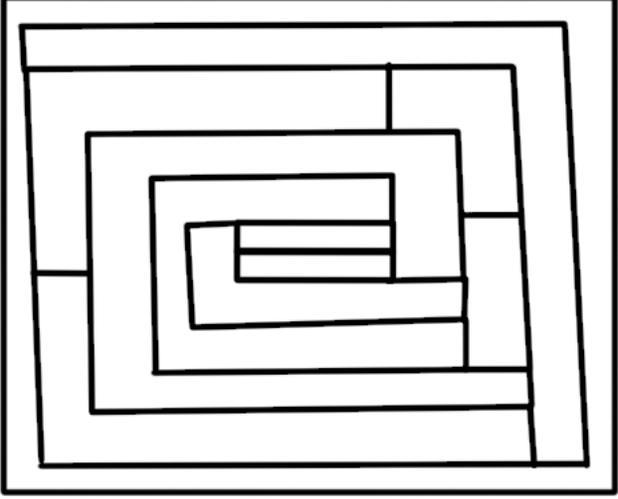
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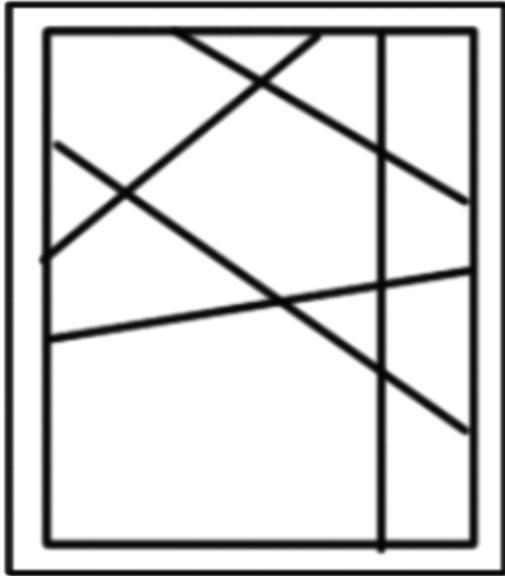


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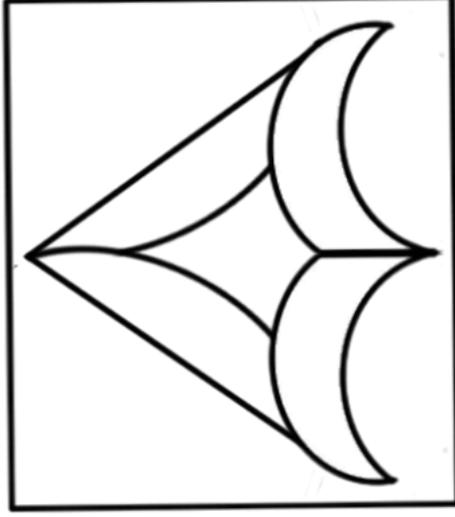
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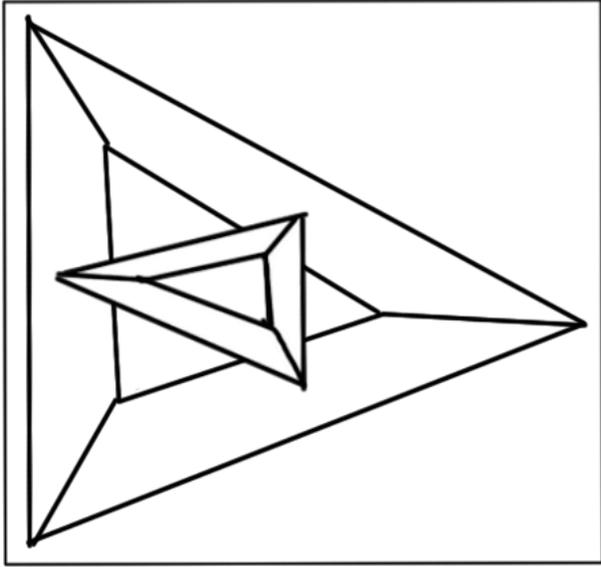
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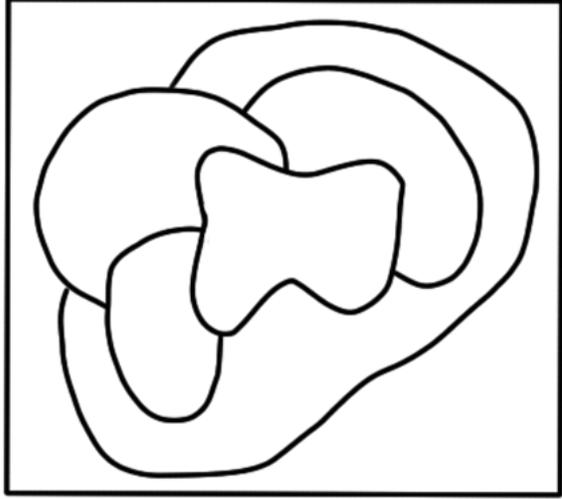
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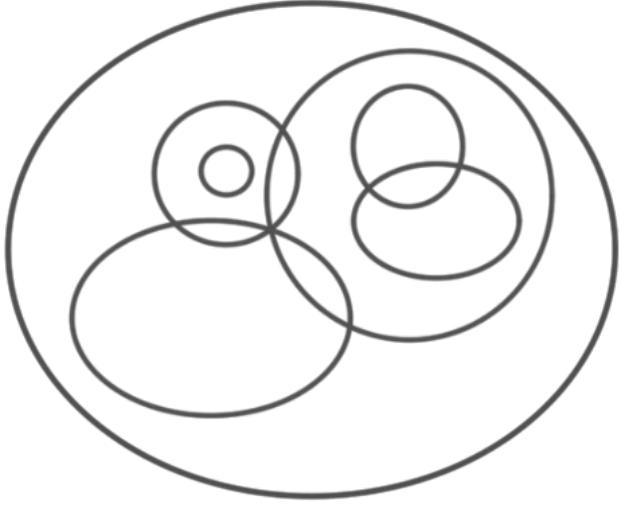
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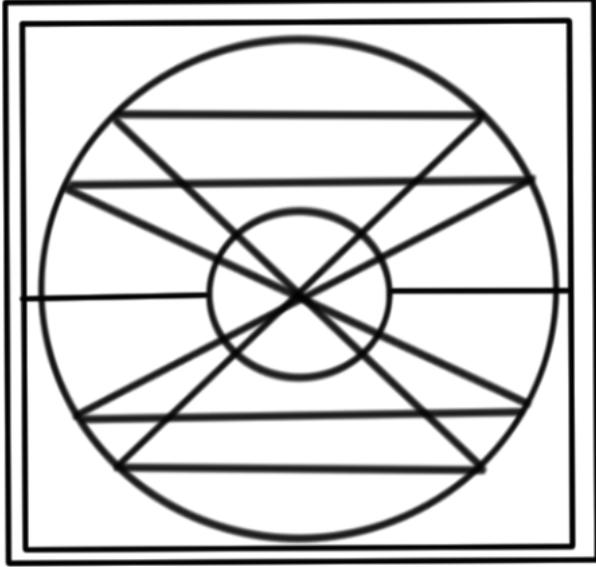
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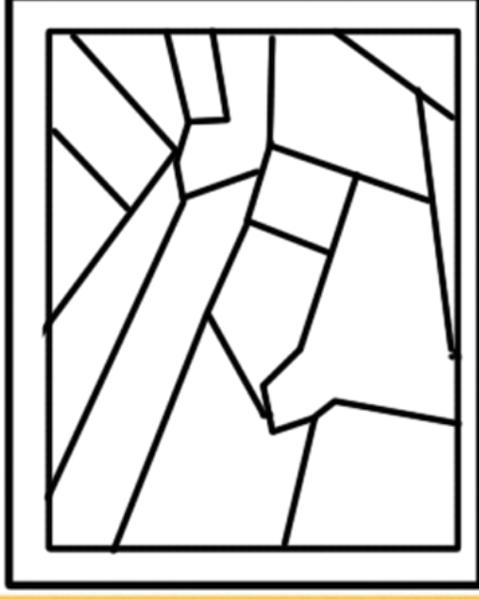


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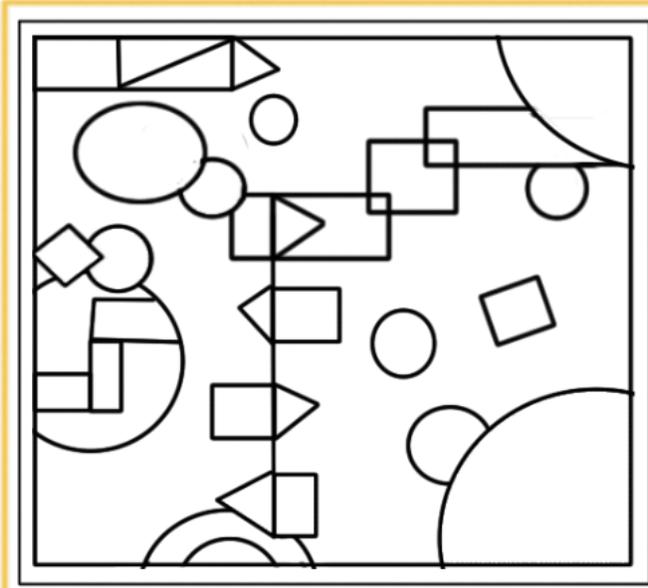


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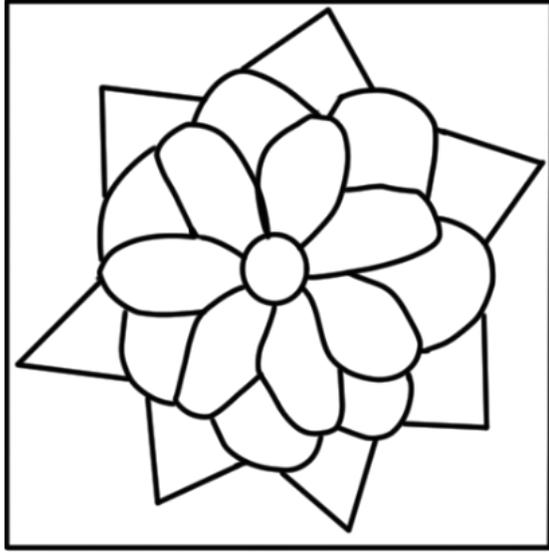
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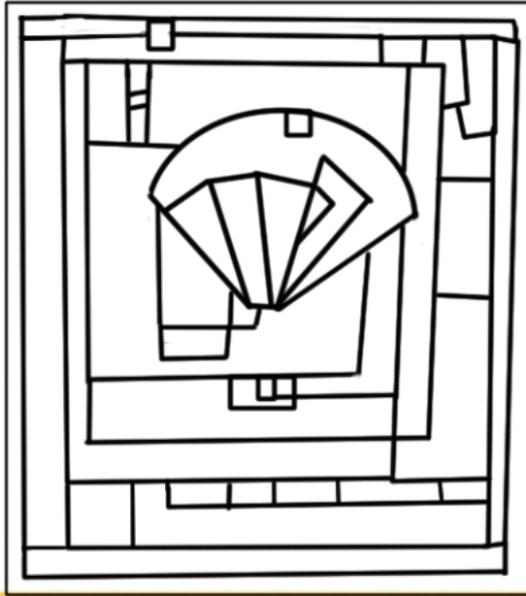
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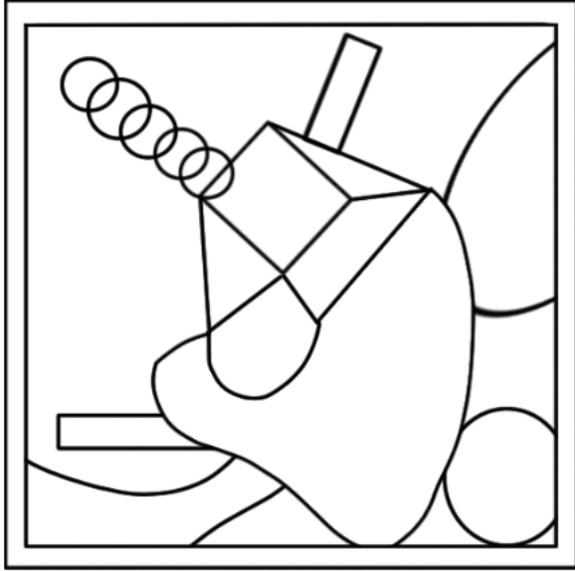
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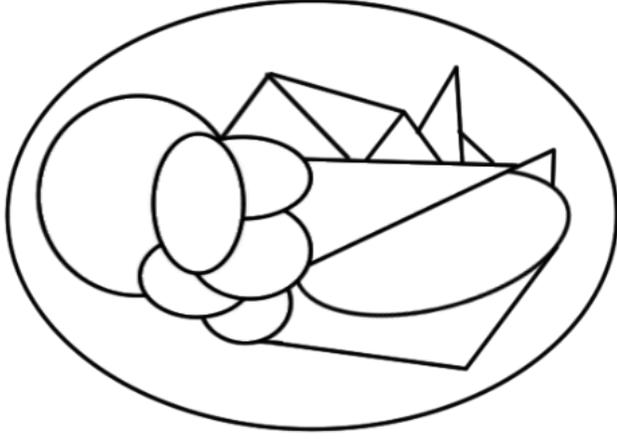
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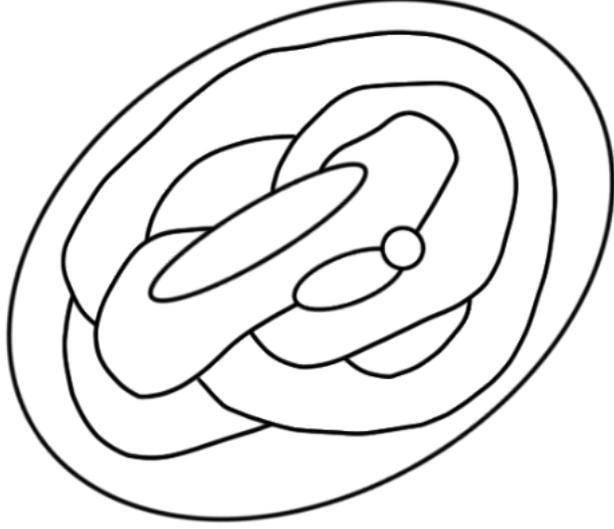
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