

Map Challenges

Thank you for downloading the science and mathematics activity packet! Below you will find a list of contents with a brief description of each of the items. This activity packet contains all the information (including any handouts) you will need to run this activity in your own classroom or at a science festival.

Please note: some activities might require the need for a facilitator to be present to oversee the activity. Activities that require a facilitator will be clearly noted.

-Community Resources for Science



Map Challenges

ACTIVITY PACKET CONTENTS

1. Organizer Instructions for the person running the activity
 - Print suggestion: 1 for the facilitator
 - Includes information for setup prior to the event (e.g., materials prep)
2. Participant Instructions (tabletop sign/printout)
 - Print suggestion: 1-2 to put in a plastic sign holder
3. Activity Printout(s) for participants
 - Print suggestion: number of expected participants
 - Printouts needed for participants to do the activity (e.g., cutout templates)



Map Challenges

ORGANIZER INSTRUCTIONS

Grade(s): 1-5

Standard connections:

- **CCSS.Math.Practice.MP1:** Make sense of problems and persevere in solving them.
- **CCSS.Math.Practice.MP2:** Reason abstractly and quantitatively.
- **CCSS.Math.Practice.MP7:** Look for and make use of structure.

Next Generation Science Standards: Science and Engineering Practices

- **Developing and Using Models** Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).
- **Crosscutting Concepts**
 - **Patterns** Children recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Objective: Identify how many colors are needed to color different maps so that adjacent regions have different colors

Activity overview and background: Student-directed or adult-directed activity
Adults can read the first story aloud and each subsequent step, monitoring students.
The activity explores a real mathematics problem that has both theoretical and practical applications

Materials:

- Coloring pencils, crayons, or markers
- Pencils or pens
- Printouts of Maps #1, #2, #3 (one set for each student)
- String or yarn, cut about 1-yard lengths (activity 2: “Making Your Own Map”)
- Scissors

Setup:

1. Set out coloring markers on table, the Map Story, and Instructions
2. Give each student one set of maps



A Map Story

Many years ago, there lived a poor map-colorer whose job it was to color the maps of the provinces of the kingdom. In order for the maps to appear pleasing to the eye, and be easy to use, provinces sharing a common border were required to have different colors. This requirement is sensible because it makes different provinces easy to see at a glance; it is still the practice today for coloring maps.

Long ago, crayons were rare and quite expensive. The poor map-colorer was often obliged to do her job with just a very few crayons. She spent many hours figuring out the fewest number of crayons that a map would need.

She tried to work out a way to color each map with only three or four crayons. Sometimes this was a very hard problem. *Can you help her?*



Instructions

1. Work with a partner to discover the fewest number of colors needed to color map #1
 - Use crayons, marking pens, and/or colored markers
2. Discuss with your group how you went about solving this problem
 - Was there any point when you knew you would need more than 2 colors? More than 3 colors?
 - Do you think you have learned anything from map #1 that will help you on another map?
3. Now try map #2
 - Discuss your strategies and insights with your table group
4. Now try maps #3 and #4, using what you've learned!

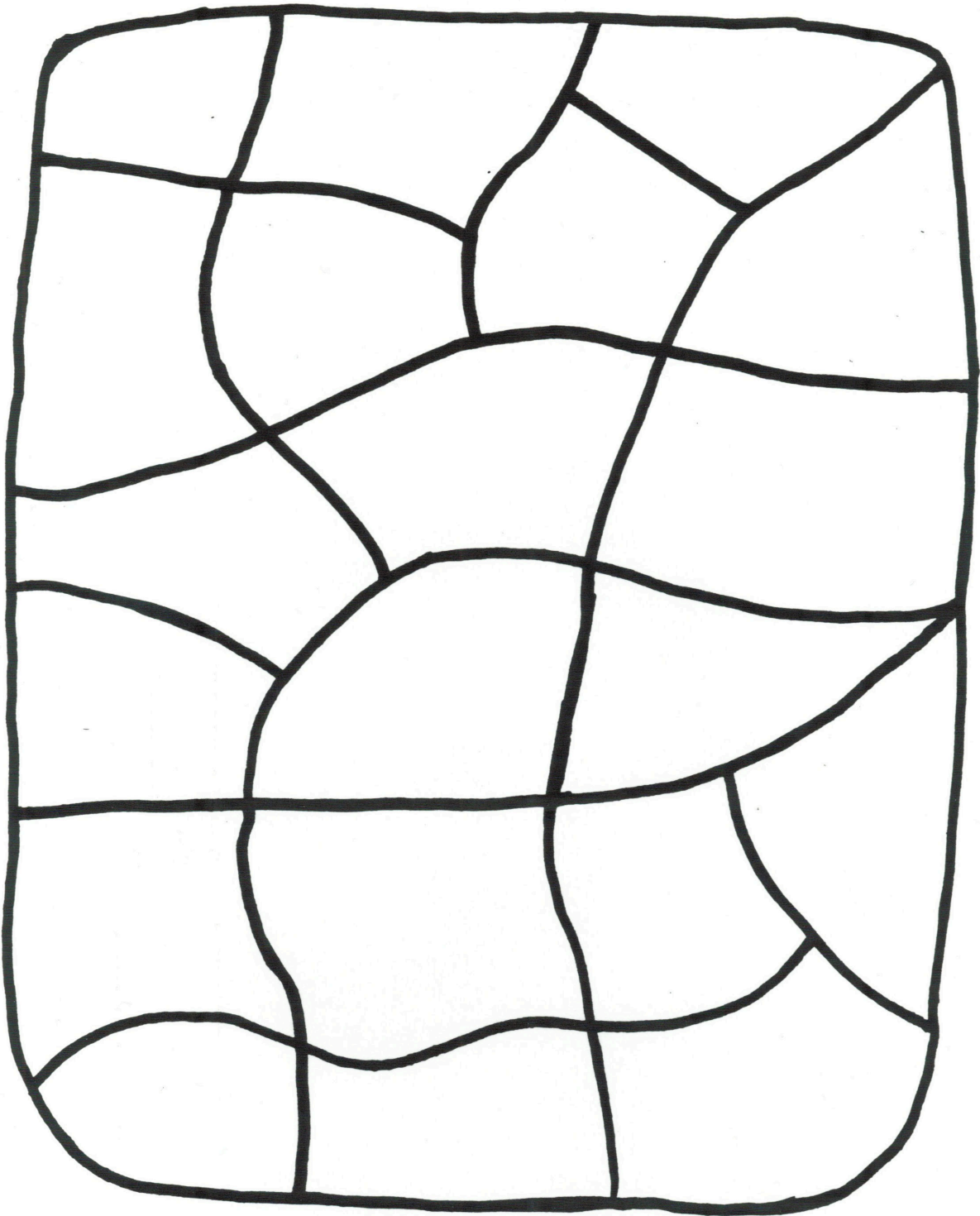


Making Your Own Maps

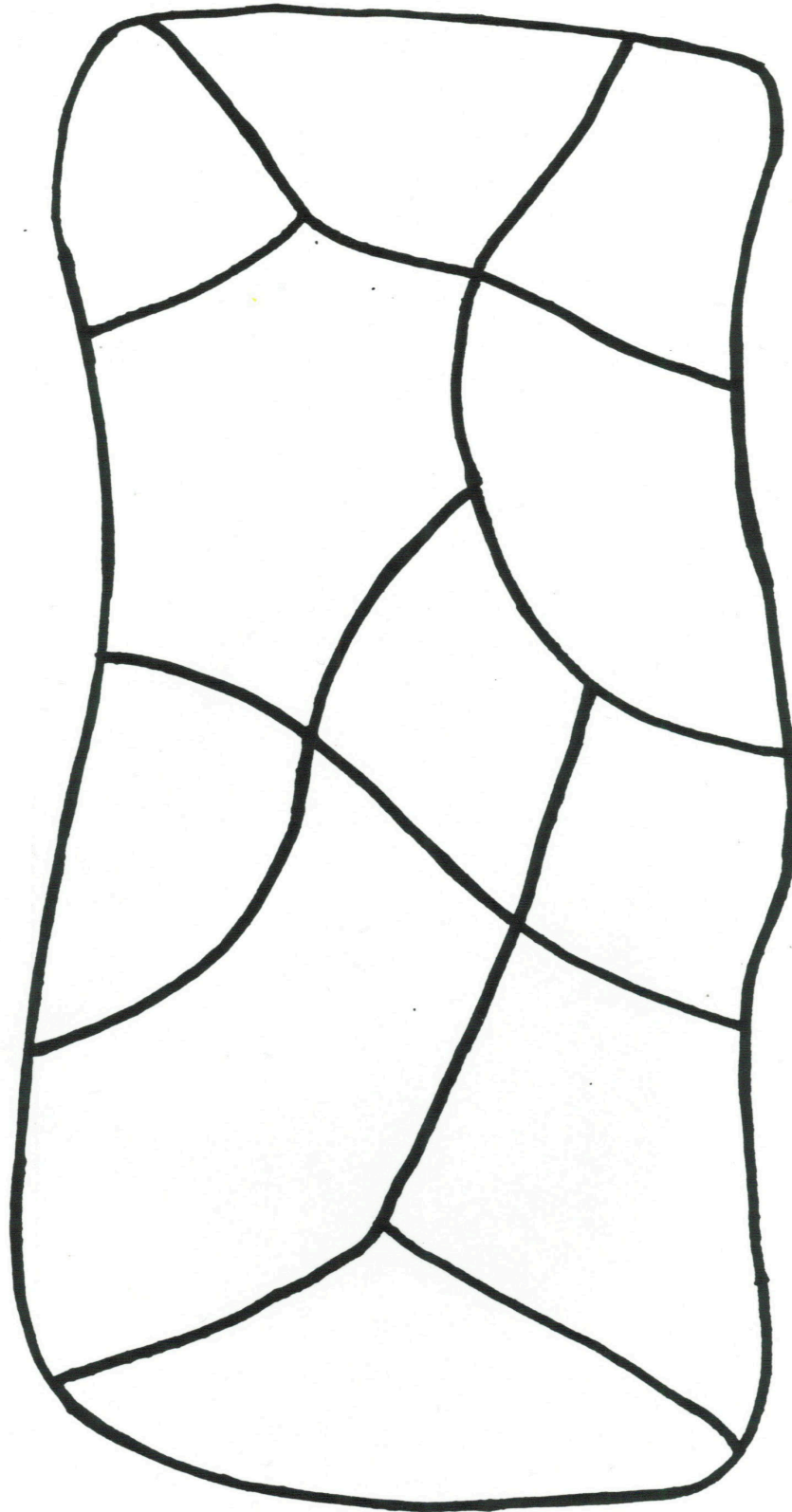
1. A friend said she could make a map that she knows a solution for. She said all she does is spread out colored markers on a blank paper and draw borders around them. Then she gives her parents or partner a blank copy of the map and keeps a solution copy with the colors she used to create it.
 - Try her method to make some new maps for your partner or family to color. Do you think that there is only one way to color maps created this way?
2. Mike Fellows (the computer scientist who made this activity) said that if you make a map by placing your pen or pencil on a paper and drawing a continuous loop that returns to the starting place, your map will only need two colors—no matter how many times the loop crosses itself!
 - Try this method of creating a map and see what you think
 - Tie two ends of string (or yarn) together to make a loop. Think of the string or yarn as making the borders of countries. Experiment with the loop to see how making different folds (or crosses) in it affects the coloring of the map your string outlines. Do these experiments help explain why Mike's method of two-color map making works?
3. You can draw as many closed loops—crossing themselves and each other as often as you wish—and you will still have a two-color map. Try this new method of creating maps and see if you agree.

Map Challenges

Map 1

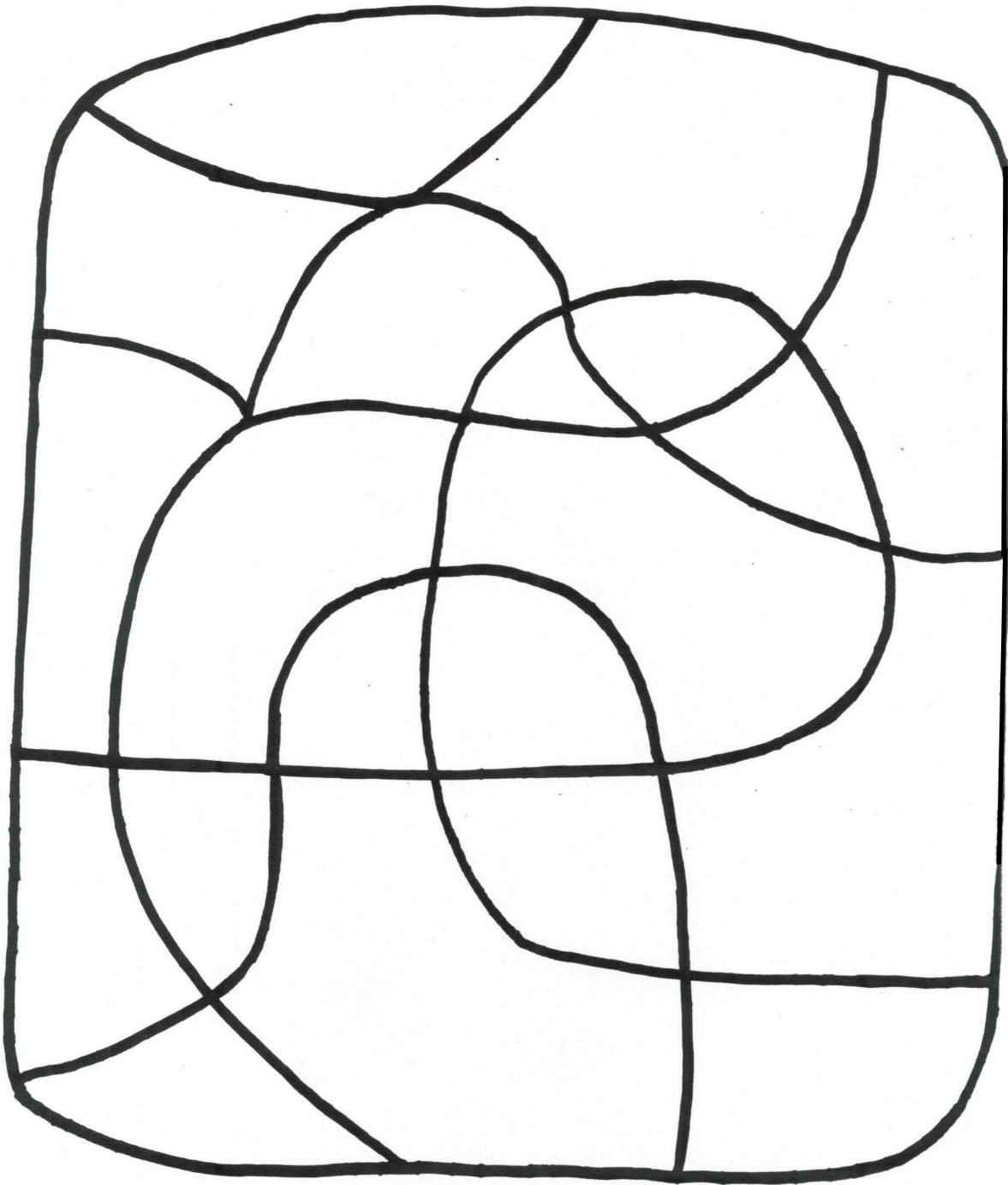


Map 2



Map Challenges

Map 3



Map Challenges

Map 4

