

Google

Classroom Activity: Map Projections - Shape, Distance, Area



Recommended level: Middle School

Subject Areas: Geography, Social Studies, Science

Google Tools used:

- Google Earth
- My Maps
- Tour Builder
- Google Maps
- Street View
- Google Earth Engine
- Expeditions
- Earth VR
- Other YouTube

Skills gained:

- ▶ How to create a new layer in My Maps
- ▶ How to load a KML/KMZ in Google Earth
- ▶ How to style your layer in My Maps
- ▶ How to share a My Map project

www.google.com/earth/education

Overview:

In his book *The Fourth Part of the World*, Toby Lester chronicles the development of one of the most extraordinary maps of all time: the Waldseemuller map of 1507. It was the first map to use the name “America,” which at the time was considered the “Fourth Part of the World.” For centuries, **people have used maps as essential tools to help them define, explain, and navigate their way through the world**. The earliest maps are of stars, and date back to 16,500 BC. We see samples of maps on cave walls, museum halls, and now digitally preserved in the [Library of Congress Map Collections](#).

Cartographers have been challenged to take a three-dimensional sphere -- Earth -- and morph it into a two-dimensional representation. This transformation is not easy. Envision drawing the continents on the surface of an orange and then peeling it and flattening it on your desk or table. The peel will tear and break apart as you press downward. This is a form of distortion. It happens because as you move the shape from 3D to 2D, the shape, distance, and/or area change.

This is the same challenge cartographers face when creating maps of the world. Cartographers use projections to alleviate some of the distortion.

Instructional Goals:

- Students will explore the history of cartography and how it applies to current mapping practices
- Students will use Google My Maps to determine the actual shape, distance, and area of certain landforms
- Students will create layers of information to make informed decisions

Learning Objectives:

- Use vocabulary associated with cartography
- Describe how a “flat” map changes the shape, distance, and area of a three-dimensional landform
- Create a project highlighting several landforms, as well as the comparable shapes of these landforms

Length:

- Two to three 45-minute class periods.

Introduction:

As a renowned expert cartographer, you have been called upon to solve a dispute between two exploration companies. The disagreement involves the comparative size of Greenland and the United States. A solution is critical: it will help each company determine the costs of exploring the continent for precious metals.

Learning Experience:

Start with a new **My Maps** project. Create a map, and name it with your first and last name followed by Greenland. Zoom out on the map (using the tool at the bottom right of the screen), or by scrolling down with your mouse. Locate Greenland on the map. If you have trouble finding it, use the search bar at the top of the My Maps window.

From the toolbar, located just below the search bar, click "Measure distances and area." (If you hold your cursor over the tools, a popup will identify the selected item.) Begin outlining the continent of Greenland by dragging your mouse around the coastline. Each time you click your mouse, a point will be added to your shape. Continue to outline Greenland, staying as close to the coast line as possible. Once you have outlined the entire coast, connect the last point to the first point, closing the shape. You should now have two numbers displayed on your map. The top number is the distance around Greenland; the second shows the area in square miles.

- Record your numbers in the student worksheet.
- Do a search online to find the distance around Greenland and the area. Did you get close to the actual distances with your results?
- Repeat the same process for the United States. Draw your line around the lower 48 states and compare the distance and area to Greenland.
- Which has the greatest distance and area? What is the difference between the two?
- There is another way to compare landform size: Select "Draw a line" from the top menu. Select "Add a line or shape" from the drop-down menu and start placing points around the boundary of Greenland. Complete the shape by connecting the first dot to the last.

A window will pop up, asking you to name the shape. Name your layer "Greenland" and click "save." Hold your left mouse button down as you hover over the shape and notice that you can now drag the shape around. Drag Greenland down to cover the United States: What happens to the size of Greenland?

- Create another shape around your country, state, or province. Drag it over the Greenland shape. How does the size of your country compare to Greenland?

- Choose other countries and or states, and compare them with other regions around the world. (Be sure to explore the northern and southern hemispheres.) What happens to the size of the country as it gets closer to the equator? What happens when it gets further away?
- Select five countries and compare their sizes—first by using the measure tool, and then by using the “draw a line” tool. Which countries did you choose? Rank your countries from smallest to largest.

Extensions:

- Give the “Orange World” a try: Take an orange and draw the continents on it. Then peel it, being careful to keep it as a single peel, and see how well you do transforming it into a two-dimensional shape.
- Research the different projections used by cartographers, and determine which projections are used for worldviews versus regional or local views.
- After looking at the different countries in My Maps, [export to KMZ](#), and open that file in Google Earth to view on the 3D globe.

Additional Resources:

- The Map that Named America - <https://www.loc.gov/loc/lcib/0309/maps.html>
- Smithsonian Map History - <http://www.smithsonianmag.com/ist/?next=/history/the-waldseemuller-map-charting-the-new-world-148815355/>
- The Map Makers Video - https://www.youtube.com/watch?v=QsGHL_cJcWg
- History of Cartography - https://en.wikipedia.org/wiki/History_of_cartography
- List of Map Projections - https://en.wikipedia.org/wiki/List_of_map_projections
- Library of Congress Map Collection - <https://www.loc.gov/maps/>