

Compass & Quadrant

Overview:

Before GPS, Ships used compasses and quadrants to determine their direction and location at sea. In this lesson, participants will learn about these navigation tools by constructing their own compass and/or quadrant.

Goals:

- Build a Compass
- Learn about Latitude and Longitude
- Build a Quadrant

Time Required: 30 minutes each or 60 minutes total

Materials:

- For Compass:
 - Sewing Needle
 - Neodymium Magnet
 - Styrofoam square
 - Bowl
 - Water
- For Quadrant:
 - Quadrant template – printed on cardstock
 - Straw
 - Weight (wood bead, fishing weight, or washer works well)
 - String
 - Tape
 - Hole punch
 - Scissors

Vocab: Latitude, Longitude, Equator, Prime Meridian

Procedure:

1. Introduction: “Since the first explorers set sail, navigation – or how to determine their location – has been a challenge. In this activity, we will explore one/some of the tools used by sailors to navigate the seas.”
2. Ask students “What direction is that?”, once several have answered ask “how do you know?” Tell students “We are going to build our own model compass. Compasses are used to determine direction: North, South, East, West. Today’s compasses point North, but the earliest compasses built by the Chinese pointed south!”
3. Introduce students to the concept of Latitude and Longitude. The Singing History Teachers have a fun video parody: <https://www.youtube.com/watch?v=5Ab-gE8ov4o>



Compass & Quadrant

- a. One way to remember the difference between latitude and longitude is to look at the shape your mouth makes when you say the word.
- b. Latitude are the lines that run East-West. The Equator is 0° Latitude. Another way to remember latitude is thinking Lat = Fat.
- c. Longitude lines are the lines that run North-South. 0° Longitude is known as the Prime Meridian. Longitude lines also serve to mark time zones. Another way to remember Longitude is by thinking Long = Long.
- d. Sailors used a quadrant to determine their latitude. A sextant is a more advanced and accurate version of the quadrant.
- e. Longitude was harder to measure and is usually done by calculating the difference between the times at your location, and the time at another known location.

If building a compass:

4. To build a compass:
 - a. Carefully poke a hole through the center of your Styrofoam square with the needle. Remove the needle and set the Styrofoam aside.
 - b. Next, we need to magnetize the needle. Do this by moving the magnet down the length of the needle from hole to tip about 50 times. Only move the magnet in ONE DIRECTION down the needle!
Use caution with magnets! Powerful magnets can hurt your fingers!
 - c. Insert the needle into the hole you made in your Styrofoam square. Use a marker to draw an arrow on the Styrofoam pointed in the same direction as the point of the needle.
 - d. Place the Styrofoam/needle into the bowl of water. The needle should begin to rotate, it should stop when the point of the needle is facing North.

If building a Quadrant:

5. To build a quadrant:
 - a. Cut out the Quadrant Template from Kiwi Co: www.kiwico.com/diy/nature-adventure/space-exploration/make-your-own-quadrant
 - b. Tape a straw along the darker stripe at the top edge of the Quadrant.
 - c. Use a hole punch to punch a hole in the corner of the Quadrant, marked with a circle.
 - d. Put one end of the string through the hole and tape it to the back side of the Quadrant.
 - e. Tie your weight to the other end of the string.
 - f. To use the Quadrant:
 - i. Close one eye and look through the straw at the North Star. When you have it in sight, have another person write down the number the string is hanging over. If you are by yourself, once you have the North Star in position, hold the string in place, then lower the quadrant to get the reading.



Compass & Quadrant

- ii. Take the reading two more times, add the numbers together and divide by three to get an average – this number is your latitude!
6. With GPS technology – finding compass directions, latitude and longitude is as easy as reaching for your smart device. For example, on an iPhone just go to the Compass App!

Reflection:

1. What are some other ways you can use a compass/quadrant?
2. If we can just “use an app”, why should we learn how to make/use compasses and quadrants?

Extension / Adaptations:

1. Research other ways to determine North when you don't have a compass.
2. Find locations on a map based on the Latitude and Longitude.

Adapted from the following lesson:

“Floating Magnetic Compass: DIY for Beginners.” *KiwiCo*, 2023, www.kiwico.com/diy/stem/engineering-building/floating-magnetic-compass.

“Make Your Own Quadrant: DIY for Beginners.” *KiwiCo*, 2023, www.kiwico.com/diy/nature-adventure/space-exploration/make-your-own-quadrant.

“Navigation: The Mariner’s Quadrant.” *Ponce Inlet Lighthouse*, 2023, <https://missionsanluis.org/media/1749/nautical-quadrant.pdf>.

Additional Resources:

“Latitude and Longitude Coordinates.” *YouTube*, YouTube, 2 Feb. 2022, www.youtube.com/watch?v=G5T9VIGQYic.

Tyson, Peter. “Secrets of Ancient Navigators.” *PBS*, Public Broadcasting Service, 6 Oct. 1998, www.pbs.org/wgbh/nova/article/secrets-of-ancient-navigators/.

The Singing History Teachers. “Latitude and Longitude Is Useful One Direction Remix HD.” *YouTube*, YouTube, 6 Aug. 2014, www.youtube.com/watch?v=5Ab-gE8ov4o.

Payne, David. “Look to the Horizon: Why Latitude Was Easier to Find than Longitude.” *Australian National Maritime Museum*, 22 June 2016, www.sea.museum/2016/06/22/look-to-the-horizon-why-latitude-was-easier-to-find-than-longitude.

Lynch, Matthew. “How to Calculate Latitude and Longitude.” *The Tech Advocate*, 15 Sept. 2023, www.thetechadvocate.org/how-to-calculate-latitude-and-longitude/.

