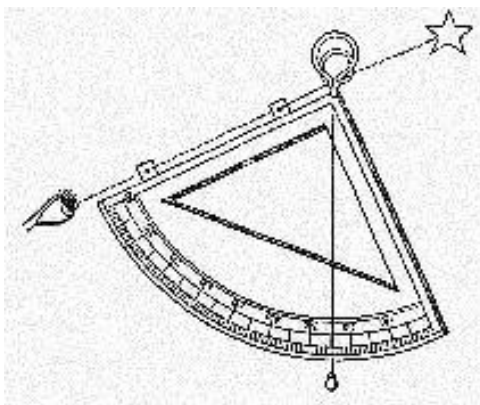


Navigation: The Mariner's Quadrant

The quadrant is a very simple tool that allows the user to determine his or her latitude by measuring the altitude of a heavenly body. When used in celestial navigation or astronomy, altitude means the angle of elevation between the horizon and celestial bodies like the sun, planets, moon, or stars. The quadrant takes its name from its shape, which is a quarter of a circle.

Invented by the Greeks around 240 B.C., several different types of quadrants have been used over the past 2500 years.

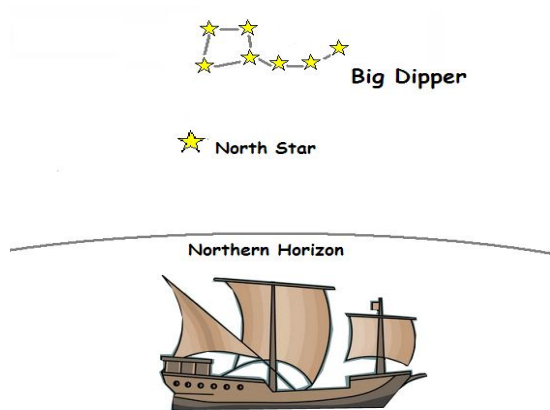
Early quadrants used a 90 degree arc and a string bob to determine the angle of elevation to the sun, Polaris, and other celestial bodies.



Quadrants were often designed for a specific use. Artillery officers used a simplified quadrant known as a gunner's quadrant for aiming their guns and measuring distance. Astronomers used a far more complicated version of the quadrant that was engraved with geometrical and square lines showing the sun's path through the signs of the zodiac.

Although average seamen would not have had much use for the complicated quadrants used by astronomers, they found that a simplified version was very useful for determining their latitude at sea. Cut from a piece of metal plate or wood, the mariner's quadrant had a radius of about 6-8 inches. It had a pair of rectangular plates with pinhole sights on one of the straight edges for sighting. The only scale needed was the degree marks on the curved edge. It was light and easy to handle.

Mariners would line the sights of the quadrant up with Polaris (the North Star) located directly over the North Pole. Because of its location, Polaris never sets like the other stars in the night sky. Lining the star up in the quadrant's sights, navigators could determine their latitude by measuring the angle (or elevation) between the horizon and Polaris.



South of the equator, where the North Star is not visible, mariners would use the constellation known as the Southern Cross to determine their southern latitude. Located almost directly above the South Pole, the Southern Cross also never sets. Following the same steps used with the North Star, navigators would measure the angle of elevation between the horizon and the Southern Cross to determine their latitude. Although the sun could have been used to measure latitude as well, doing so would have blinded the navigator over time.

The quadrant remained one of the most common navigational tools used by mariners until the invention of the far more accurate sextant in 1731. For more information and activities related to early navigation and celestial constellations please visit these sites:

The Mariners Museum @ www.mariner.org/exploration.

The Columbus Navigation Homepage @ www.columbusnavigation.com

Star Date Online @ www.stardate.com

NASA Navigation Site @ <http://www1.jsc.nasa.gov/er/seh/navigate.htm>

Measuring Your Backyard Latitude Using a Quadrant

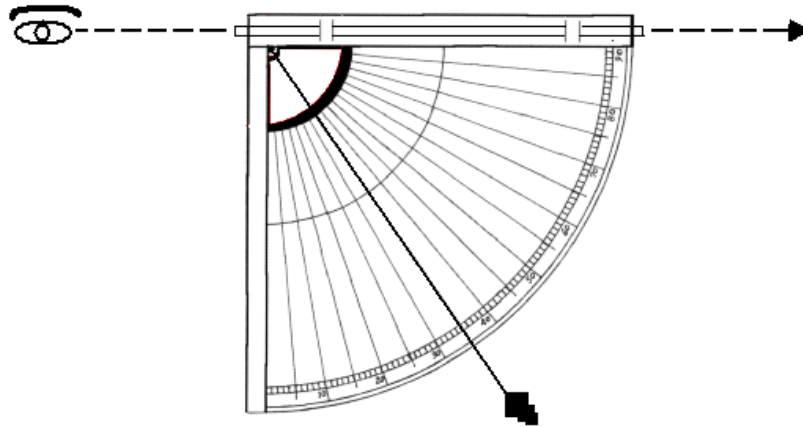
Provided by the Ponce de Leon Inlet Light Station

Materials Needed:

1. Cardboard (approximately 8"x11")
2. Quadrant Template
3. Scissors
4. Glue
5. 1 Drinking Straw
6. 12" long piece of String
7. Heavy Bead or Fishing Weight
8. Sharp Instrument for Making a Hole (Nail, Large Needle)

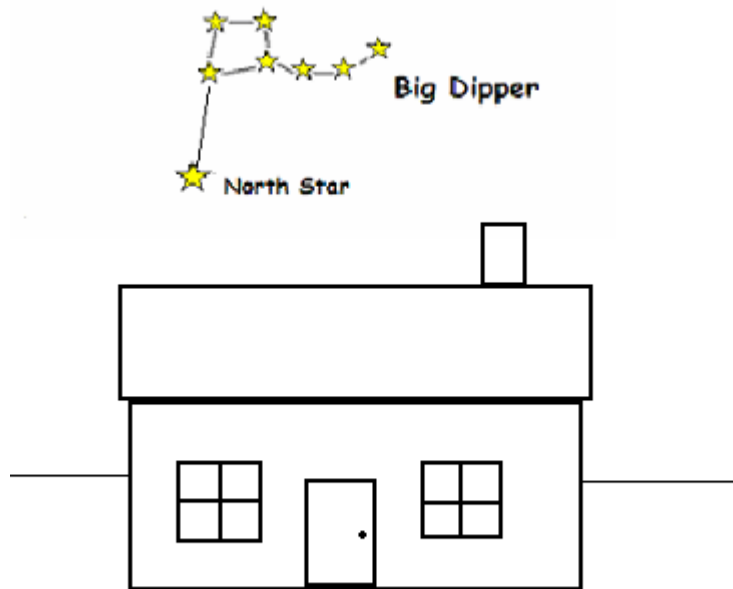
Procedures: (Making the Quadrant)

1. Carefully cut out quadrant from template provided.
2. Cut 4 small slits where straw sight will be placed, being careful not to cut all the way to the edge of the quadrant.
3. Insert straw through the slits so that it is held in place along edge of quadrant.
4. Glue quadrant onto a piece of stiff cardboard and allow to dry.
5. Cut cardboard along the edge of the freshly glued quadrant.
6. Using a sharp nail or large needle, poke a hole through the quadrant where the two sides of the quadrant form a ninety degree corner. (The template will show where this hole is to be located.)
7. Insert the string through the hole. Tie a knot in the string on the blank side of the quadrant and pull tight. This is the quadrant's plumb line.
8. Tie a heavy bead or fishing weight on the other end of the plumb line. (The string should hang down past the scale on the radius of the quadrant)



Procedures for Finding Your Backyard Latitude:

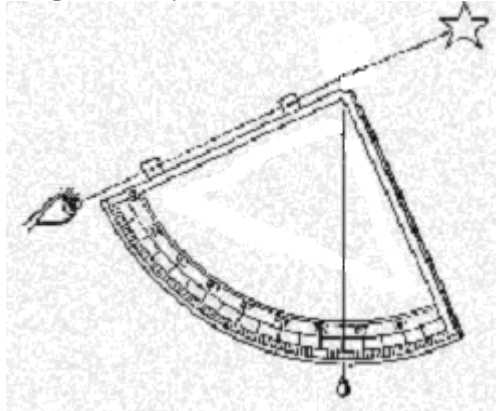
1. On a clear night, go outside and face north.
2. Locate the North Star by finding the Big Dipper and trace a line from the two stars that form the outside edge of the dipper cup down to the first star below the constellation. This is the North Star.



Face North and locate the Big Dipper

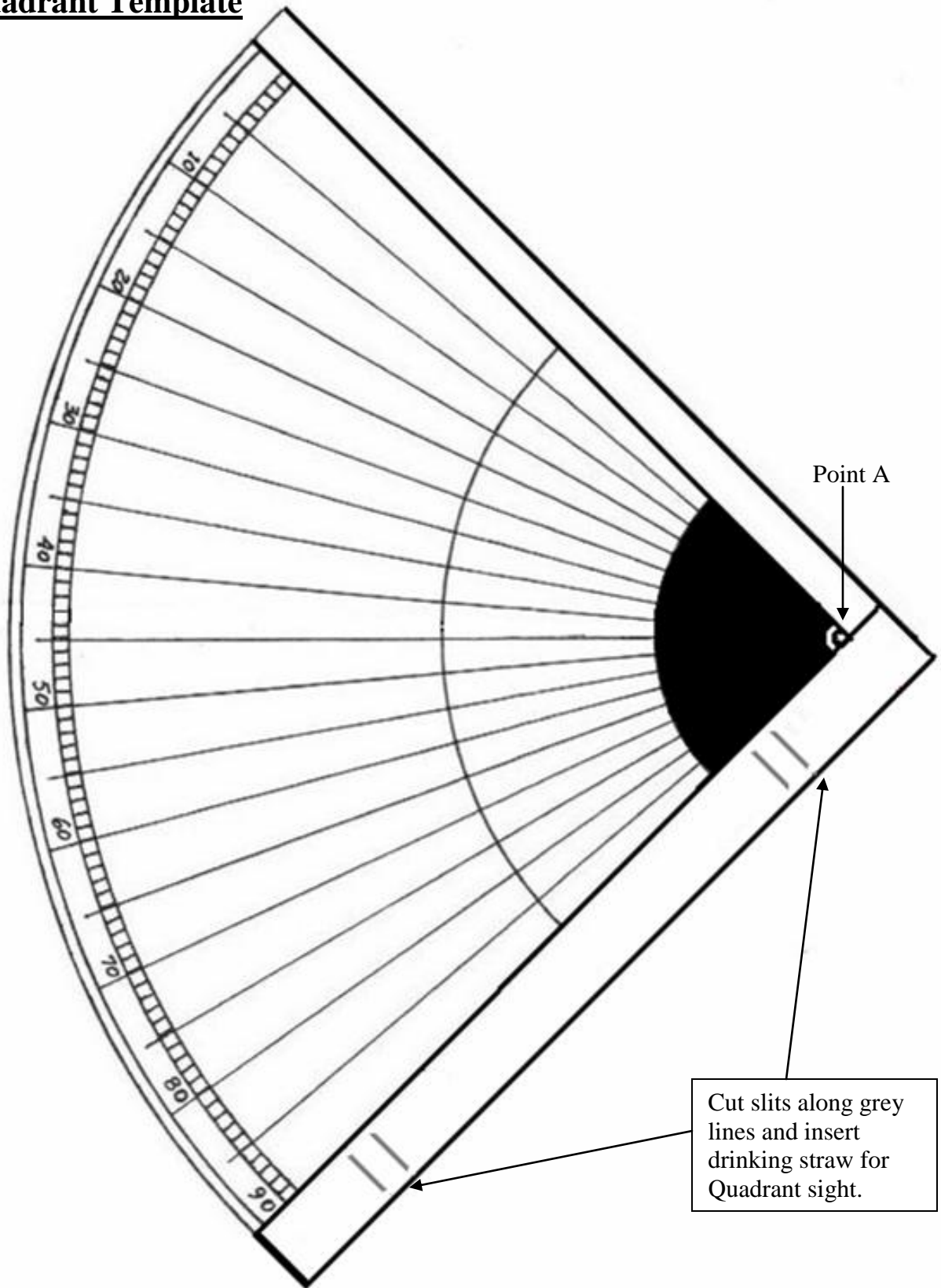
3. Hold your quadrant up to your eye with the radius facing towards you and the illustrated side facing to your left.

4. Looking through the straw, locate the North Star by tilting the quadrant up. Allow the plumb line to hang down the side of the quadrant and swing freely.



5. Once you have located the North Star, hold the quadrant steady until the string stops moving and carefully pinch the plumb line against the side of the quadrant without moving it.
6. Continuing to hold the plumb line between your thumb and forefinger, tilt the quadrant over and read the angle where the line crosses the scale at the edge of the quadrant radius. This is your latitude.
7. Record your measurement and repeat the process three times to ensure accuracy.
8. Find the sum of the three measurements and divide by three. This is the latitude of your backyard.
9. Go to the United States Geologic Society to find out if your findings were correct. Their website is:
<http://geonames.usgs.gov/redirect.html>
10. Enter the name of your city and state in the space provided and click on "Query". Your city's latitude and longitude will be listed in the text box.

Quadrant Template



Point A

Cut slits along grey lines and insert drinking straw for Quadrant sight.