

MEET YOUR SHIPMATES



Become a Navigator

Part of the Midshipmen's education on board was navigation, or learning to determine *Constitution's* location and direction at sea. How was this done with no land in sight? Well, each day Midshipmen measured the movement of celestial bodies – the sun, moon, or stars – using instruments like sextants or quadrants. They calculated the Ship's position using these measurements and mathematical tables.

Make your own navigation tool called a quadrant to measure the height of an object above the horizon.

You will need:

- Protractor
- Straw
- String
- Metal washer or three paper clips
- Tape



Midshipman



Instructions:

Tie a washer or three paperclips to one end of the string. Tie or tape the other end of the string to the middle of the straight edge of the protractor, so that the string hangs down the center (at the 90 degree mark).

Tape the straw to the straight edge of the protractor, leaving a little space on either side. When you use the protractor, the straw edge will be on top.

Hold the protractor in your right hand (the numbers should be facing to your left). Look through the straw at the top of an object (like the moon, a star, a tall building, a tree, a telephone pole, or a mountain).

Have a partner look at the string and read the angle from the inner set of numbers on the protractor (0-90 degrees). Which angle degree does the string fall on? This will tell you the **zenith angle** (the angle between the highest point over your head [the zenith] and the object you're looking at). Subtract this number from 90 degrees to find the **altitude angle** (the height in degrees of the object above the horizon).

Try another object (it can be taller or shorter). Is this altitude angle larger or smaller?

Challenge! Try tracking the movement of a celestial body (like the moon or a star) over the course of a week. Each night at the same time, take a measurement of your object and calculate the altitude angle. How does it change over time? Why do you think it changes?

