

ED 5661 Mathematics & Navigation Teacher Institute

Lesson: Finding locations on a chart with Polar Coordinates

Target Grade: 11th grade Trigonometry

Lesson Overview: The overall goal of this lesson is for students to gain an understanding of polar coordinates through use of navigational charts. Students should be able to convert rectangular coordinates to polar coordinates.

Sources Consulted:

Roblee, R. Stephen, Captain R/V Agassiz. Navigation Activities on Agassiz and in classroom, Teaching Mathematics through Navigation Teacher Institute, June 27 - Jul- 1, 2011.

Terms (<http://www.marineinstitute.org/nautical%20terms.htm#B>)

Materials: Dividers, Map of School, Laptop with internet access, calculator

Vocabulary: Heading, Bearing, Vector, Polar Coordinates, Latitude, Longitude, Nautical mile

Focus Question: Can we take the latitude, longitude coordinates and convert them to polar coordinates?

Learning Objective

At the end of this unit students will be able to take rectangular coordinates and convert them to polar coordinates.

State Objectives:

Michigan Merit Curriculum:

P9.1 Convert between polar and rectangular coordinates. Graph functions given in polar coordinates.

A3.7.2 Use the relationship between degree and radian measures to solve problems.

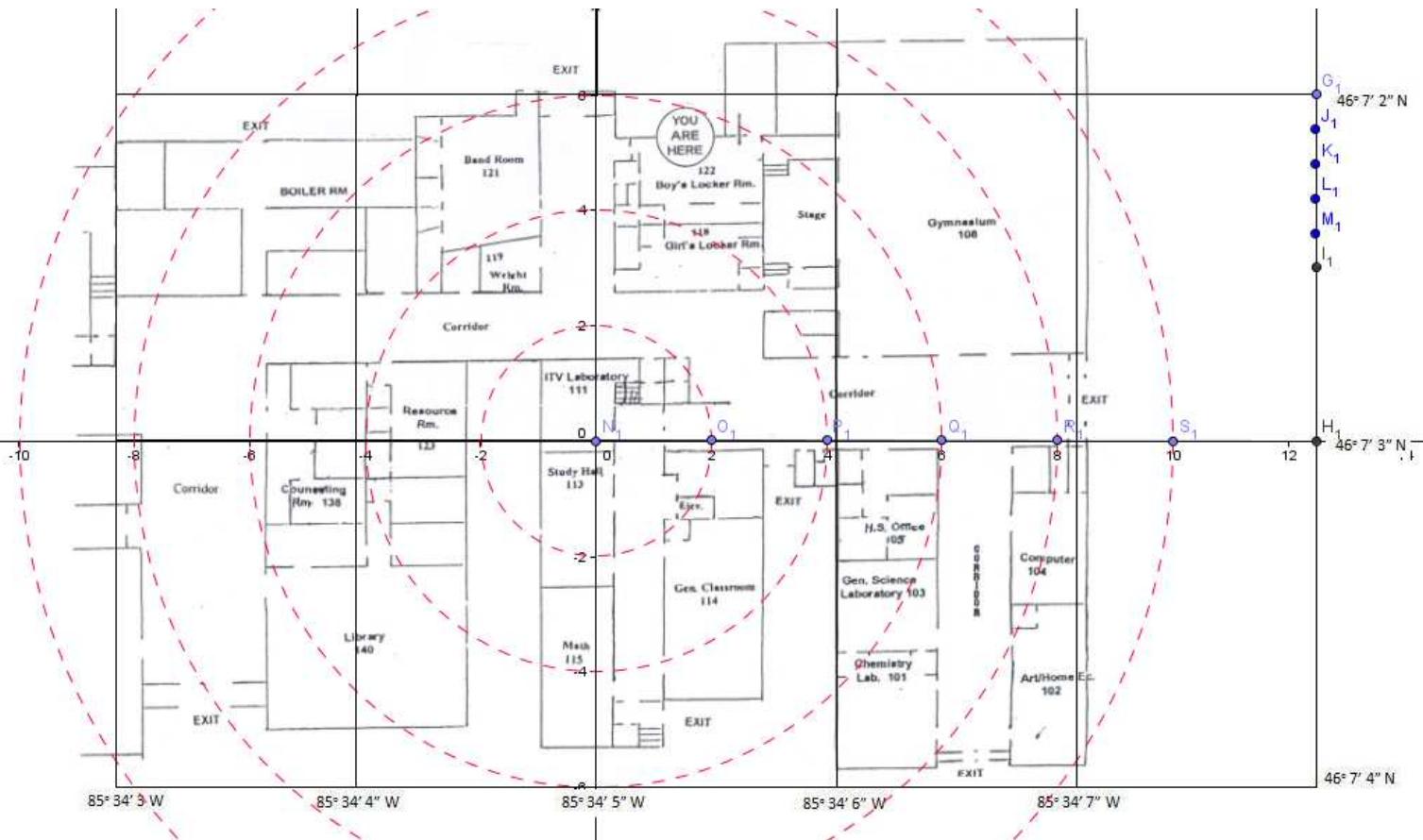
Lesson Procedure

1. Have the students take their coordinates from the previous day.
2. Introduce the process of converting rectangular coordinates. Give students time to try to come up with the method for converting using previously learned trig ratios and the Pythagorean theorem.

$$\text{Theta} = \tan^{-1}(\text{latitude} / \text{longitude})$$
$$\text{Radius} = (\text{latitude}^2 + \text{longitude}^2)^{1/2}$$

3. Have students convert the coordinates of their endpoints of legs into polar coordinates. Use the coordinate 46° 7' 3" N, 85° 34' 5" W, as the polar coordinate [0 ,0].
4. For checking the polar coordinate endpoints by plotting them on the school chart with polar coordinate lines.
5. We will end the day discussing different areas where polar coordinates are useful and meaningful.
6. For Homework have the students use their laptops to access the Mackinac Straits Waterway chart and plot a course giving endpoints in polar coordinates.

School Polar Chart



Assessment on next page:

Polar Coordinates

Name: _____

Date: _____

(1) Explain the value of polar coordinates and give examples of where they might be used.

(2) How would you go backwards and convert polar coordinates to rectangular coordinates?

(3) Go to <http://www.charts.noaa.gov/OnLineViewer/14880.shtml> to get the chart for the Mackinac Straights. Plot a course from Big St Martin Island to Pointe Epoufette. Give the endpoints of each of your legs in polar coordinates. Use $45^{\circ} 50' \text{ N}$, $84^{\circ} 10' \text{ W}$, as the polar coordinate [0,0].

LEG 1:

ENDPOINT 1:

ENDPOINT 2:

LEG 2:

ENDPOINT 1:

ENDPOINT 2:

LEG 3:

ENDPOINT 1:

ENDPOINT 2:

LEG 4:

ENDPOINT 1:

ENDPOINT 2: