Target: Geometry or Algebra 2

Lesson Overview: This lesson should be presented after the students have worked with vectors in the coordinate plane. Students will research the concept “to navigate” including vocabulary words heading, bearing, direction, and distance. Student will be able to compare and contrast headings in navigation and the direction of a vector in a coordinate plane. Students will use charts to plot a course, giving the heading and distance for each leg and then convert each heading to a direction and distance for the coordinate plane.

Sources Consulted:


Web Sites:
- Nautical terms [http://www.marineinstitute.org/nautical%20terms.htm#B](http://www.marineinstitute.org/nautical%20terms.htm#B)
- Charts [http://www.charts.noaa.gov/OnLineViewer/GreatLakesViewerTable.shtml](http://www.charts.noaa.gov/OnLineViewer/GreatLakesViewerTable.shtml)

Materials:
One per group:
- Chart #14934 from Muskegon Lake (including compass roses)
- parallel rulers
- dividers
- maritime dictionary or Nautical Terms web site

New Vocabulary:
- heading- direction you are traveling in a water craft
- bearing- direction to a known fixed position
- direction of a vector- degree measure of a vector in standards position
- magnitude of a vector- length of or quantity represented by a vector

Focus Questions:
How do I plot a course for a boat from Lake Michigan through Muskegon Lake to the coal dock at the Cobb Plant?
Learning Objectives:
Students will learn to use a *rose compass* and parallel rulers to calculate headings from a chart.
Students will use a *rose compass* to change a true compass heading into a magnetic compass heading.
Students will learn how to determine distance from a chart using dividers and the scales from the chart.

Benchmarks Addressed:
HSCE L1.2.3 Use vectors to represent quantities that have magnitude and direction, interpret direction and magnitude of a vector numerically, and calculate the sum and difference of two vectors.

Represent and model with vector quantities.
CCSS N.VM.1 (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g.,

N.VM.2 (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

Reason quantitatively and use units to solve problems.
N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.®

Classrooms Activities:
Start class with a short review or quiz covering vectors in a coordinate plane. (7 min.)
Put students into groups of three or four and using the web site for charts, download and make copies of charts in your local area. (I use White Lake Harbor, Muskegon Harbor, Grand Haven Harbor, Inland Water Ways, etc.). Using one of the charts (not the one used for assessments), parallel rulers, and dividers, chart a course using headings. Show the students how to break the course into legs with a heading for each leg. (I have a *Smart Board* and I have found that using this is great for class demonstrations.) (13 min.)
Pass out the chart of Muskegon Harbor and have each group plot a course from a given point in Lake Michigan to the coal dock at the Cobb Plant in Muskegon Lake. I will put the point on each group’s chart so that they all have a different starting point. (20 min.)
Allow each group to present their courses to the rest of the class. (15 min.)

Assessment: Each group will turn in their chart of Muskegon Harbor with their course plotted and on a separate sheet of paper, each leg of the course listed with headings and directions.