Materials Required: compasses (directional), protractors, graph paper, rulers, football field or playing board
Activity Time: 3 class periods
Concepts Taught: vectors, graphing

Day 1: Pacing
Mark off a long section (100 ft or so) and have the students measure their pace by counting steps over 1000 feet and then dividing by 1000.

Day 2: Use of compass
1. Instruct students on the use of a directional compass, sighting a landmark and pacing for distance
2. Direct students on how to read compass directions written on paper
3. Divide students into groups of 3 students, give each a compass, or use one compass and a 4th person to act as "runner" to bring the compass back to the next student
4. Give the groups a set of vectors to "add", go to a football field to give them plenty of room to do this - you will need to make up your vectors before hand
5. Space your students far enough apart that they do not run into each other
6. The first student in a group reads the directions given, and moves to the first vector location (200 ft at 200 degrees for eg)
7. The second student stands next to the first student (who is at their vector location) and reads the next direction and follows the directions for the second vector
8. The third student goes to where the second student is located and sights the first student using the compass, makes a note of the direction and then measures the distance using pacing as the distance guide, and they all record the distance and the direction the last student had to travel.
Alternate plan if there is no football field or the weather rains using the lab table or the floor, use markers and have the students move markers the different locations on the floor or very big lab table

Day 2 Graphing
1. Have students graph the vectors from the previous day, making note of the direction and length of the final vector drawn

Day 3 Vector addition
If graphing calculators are available, show students how to translate between rectangular and polar coordinates, and add vectors, compare answers to the other two days work
If graphing calculators are not available, teach them some trig functions and how to translate to polar coordinates and add the (x,y) coordinates and compare the work from the previous two days.
Optional homework - map out the vectors that would describe the circumnavigation of their home, graph it, add it
Ratios and Proportions

(1) \( \frac{7}{2} \) minutes of every 30 minutes on TV are used for commercials. How many commercials are there in 24 hours?

(2) What is the sales tax you would pay on a bicycle costing $125? (Sales tax rate is 7%)
(3) Change $\frac{5}{12}$ to a fraction with 60 as the numerator.

(4) 52% of voters voted for the independent candidate. If 208 people voted for the independent candidate, how many people voted?
Answer Key

1. 30 minutes is 1/2 hour (ratio & proportion, right?)

\[ \frac{1 \text{ hr}}{60 \text{ min}} = \frac{x \text{ hr}}{30 \text{ min}} ; x = \frac{1}{2} \text{ hour} \]

so,

\[ \frac{7 \frac{1}{2}}{2} = \frac{x}{24} \]

\[ \frac{15}{1} = \frac{x}{24} \]

\[ x = (15)(24) \]

\[ x = 360 \text{ min or 6 hrs of commercials} \]

2. Every dollar is taxed 7 cents

\[ \frac{.07}{1} = \frac{x}{125} \]

\[ x = (.07)(125) \]

\[ x = 8.75 = \text{sales tax} \]
3. \[ \frac{5}{12} = \frac{60}{x} \]

\[ 5x = (12)(60) \]

\[ x = (12)(12) \]

\[ x = 144, \text{ so,} \]

\[ \frac{5}{12} = \frac{60}{144} \]

4. \[ \frac{52\%}{206} = \frac{100\%}{x} \]

\[ .52x = 206 \]

\[ 52x = 20800 \]

\[ x = \frac{20800}{52} = 400 \text{ people voted} \]