

Vector Map Lab

Key

Purpose: Add vectors using a map. This will require knowledge of maps, vectors, including using scales and simple trig to describe a vector using map notation:

Scales

Using a scale enables people to make reasonable-sized models. For example, a tiny atom can be scaled up to model it, or Europe can be scaled down so it can be modeled on a single sheet of paper. Open the vector program and load the map of the USA. Find how many horizontal pixels are equivalent to 500 miles using the scale provided on the lower left of the map. Depending on screen resolution this may vary, but by clicking on the 0 and the 500 mile hash marks on my computer I got it as 153 pixels = 500 miles. I can use this to convert between pixels and miles exactly the same way as I can use 1 foot = 12 inches to convert feet into inches.

Your conversion factor: 500 miles = 153 pixels

Sample measurement

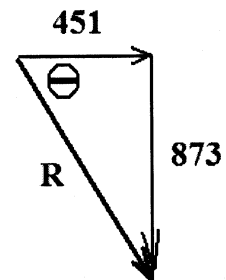
A lot of people enjoy visiting Orlando on vacation. Do you know how many miles it takes to fly there? Let's come up with the distance and the direction and describe a vector from Chicago to Orlando.

When I did this I got the following values:

Chicago: (610, 416); Orlando (748, 149)

Based on this I can see that Orlando is $748 - 610 = 138$ pixels East (451 miles East)

And it's $149 - 416 = -267$ pixels North (negative, so 873 miles South)



Using pythagorus to find the magnitude of $R = 983$, Find the angle using inverse Tangent: $\tan^{-1}(873/451) = 63^\circ$
Therefore the resultant from Chicago to Orlando is: 983 miles 63° South of East

Adding two vectors

- Bob in Chicago picks up his friend in St. Louis on the way to see a football game in Kansas City. Use vector addition to add both legs of his trip from Chicago to Kansas City

	ΔX	ΔY	Sketch/Scratch
Chicago to St. Louis $571 - 610 = -39$ $346 - 417 = -71$	-39	-71	<p style="font-size: 0.8em;"> $R = [110^2 + 64^2]^{1/2} = 127.3 \text{ pixels} \left \frac{500 \text{ mi}}{153 \text{ pix}} = 415.9 \text{ mi} \right.$ $\theta = \tan^{-1}\left(\frac{64}{110}\right) = 30.2^\circ$ </p>
St. Louis to KC $500 - 571$ $353 - 346$	-71	+7	
Total	-110	-64	

Result vector for entire trip: 416 miles 30.2° S of W