Warm Up: Unit analysis and vectors

Prof. Jordan C. Hanson

August 26, 2022

1 Chapter 1 - Unit Analysis and Estimation

1. Suppose there are 1000 meters in 1 kilometer, 0.01 meters to one centimeter, and 0.001 meters to 1 millimeter. Convert the following:

   - 2.3 kilometers to meters
   - 10 meters to centimeters
   - 33 centimeters to meters
   - 0.4 millimeters to meters

2. Suppose someone is traveling at a *speed* (ratio of distance to time duration) of 30 km/hr. Convert this to meters per second.

2 Chapter 2 - Algebra of Vectors

1. A *vector* is a quantity with a *magnitude* and a *direction*. If we travel 4 km in the x-direction, and we travel 4 km in the y-direction, our displacement from the origin is $\vec{x} = 4\hat{i} + 4\hat{j}$ km. Suppose a party of explorers is exploring an area of jungle that we assume to be flat. The trek is broken into four steps:

   - $\vec{a} = -2\hat{i} + 2\hat{j}$
   - $\vec{b} = -1\hat{i} - 1\hat{j}$
   - $\vec{c} = +1\hat{i} + 5\hat{j}$
   - $\vec{d} = -2\hat{i} + 0\hat{j}$

   To obtain the final location of the party, *sum the displacements $\vec{a}$ through $\vec{d}$*. Where are they?

2. Suppose a plane is traveling at 141 km/hr, to the North East. (a) Draw this vector in a coordinate system below. (b) How much of the velocity is in the x-direction? How much is in the y-direction? *Hint: if East means the x-direction, then the angle with respect to the x-direction is 45 degrees.*