Monday Reading Assessment: Unit 2, Two-dimensional kinematics

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1 Memory Bank

- $\vec{x} = a\hat{i} + b\hat{j}$ ... Component form of a two-dimensional vector.
- $|\vec{x}| = \sqrt{a^2 + b^2}$ ... Pythagorean theorem for obtaining vector magnitude.
- $\theta = \tan^{-1}(b/a)$ ... Obtaining the angle between vector and x-axis.
- $a = |\vec{x}| \cos(\theta)$ ... Obtaining the x-component with trigonometry.
- $b = |\vec{x}| \sin(\theta)$ ... Obtaining the y-component with trigonometry.
- $\Delta x = \vec{x}_f - \vec{x}_i$ ... Definition of displacement.

2 Chapter 3 - Two-Dimensional Kinematics

1. Suppose Los Angeles is located at the origin of a 2D coordinate system with North in the positive y-direction and East in the positive x-direction. A certain ship needs to sail from Los Angeles, California to Honolulu, Hawaii. The ship heads almost directly West, but about 10 degrees South of West. *Draw a two-dimensional coordinate system below, indicating Los Angeles at the origin and Honolulu in the correct quadrant of the graph.*

2. (a) The distance between Los Angeles and Honolulu is 4100 kilometers. Write the displacement the ship makes from Los Angeles to Honolulu in $\hat{i}$ $\hat{j}$ notation. This will give the amount of distance *West* (x-direction) and the amount of distance *South* (y-direction) the ship must sail. What should the *sign* of each number be? (b) Suppose the trip takes 5 days. Divide the displacement by this time to obtain the velocity vector.

3. Imagine that the ship secretly has a launcher capable of launching a capsule into space for a short time. The ship is traveling with the velocity vector derived in the prior exercise, and shoots a space capsule straight up with no wind resistance. Will the capsule land back on the ship if the ship keeps moving? Why or why not?