Homework #3

1) Is it possible to have $\left|\vec{A} + \vec{B}\right| = \left|\vec{A} - \vec{B}\right| =$? If so, illustrate with a diagram.

2) Four vectors, each of magnitude 2.50 m, are shown in the figure. (a) Express each in unit vector notation. (b) Express their sum in unit vector notation. (c) What is the magnitude and direction of their sum?
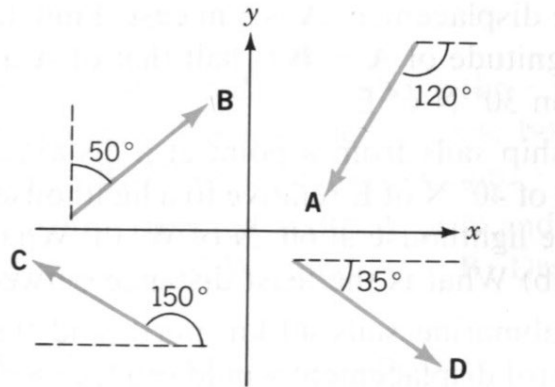
3) An object follows as shown below. What is the displacement from the last point to the starting point? Express your answer (a) in unit vector notation, and (b) as a magnitude and direction.
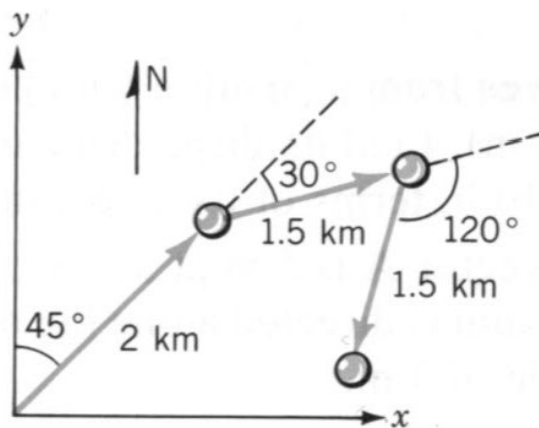
4) Given two vectors, $\vec{A} = 5.00\,\hat{\imath} + 2.00\,\hat{\jmath}$, and $\vec{B} = -2.00\,\hat{\imath} - 3.00\,\hat{\jmath}$, find (a) $\vec{A} + \vec{B}$; (b) $\left|\vec{A} + \vec{B}\right|$; (c) $\left|\vec{A} - \vec{B}\right|$ (d) $A - B$.

5) Find the components of the following vectors: (a) $\vec{P}$ of length 5.50 m directed at 160^0 counterclockwise from the +x axis; (b) $\vec{Q}$ of length 3.50 m directed at 120^0 clockwise from the +y axis.

6) Two vectors have equal magnitudes of 2.0 m. Find graphically the angle between them if the magnitude of their resultant is (a) 3.0 m; (b) 1.0 m. In each case use the law of cosines to confirm your answer.

7) An airplane is flown in the direction $30°$ W of N. If the magnitude of the westerly component of the displacement is 100. km, how far north does it travel?

8) A rectangular coordinate system with axes x' and y' is rotated by angle θ from axes x and y as shown in the figure. (a) What are the components of the position vector r in the two coordinate systems? (b) Use the results of part (a) to shown that the coordinates of a point P in the two systems are related by

$$x' = x\cos(\theta) + y\sin(\theta)$$
$$y' = -x\sin(\theta) + y\cos(\theta)$$

Hint, it might help to expand $\cos(\phi - \theta)$ *and* $\sin(\phi - \theta)$.