Vector Test Review Name:
15 January 2020

1. Find the vector going from point a to point b and write it in column-vector form and unit-vector form:

$$a = (-1, 1, 2) \qquad b = (3, 5, 8)$$

$$\vec{a} = \begin{pmatrix} 3-(-1) \\ 5-1 \\ 8-2 \end{pmatrix}$$

$$\vec{a} = \begin{pmatrix} 4 \\ 4 \\ 6 \end{pmatrix}$$

$$\vec{a} = 4i + 4j + 6k$$

2. Find a value for n that will make the magnitude of vector $\vec{a}$ 5:

$$\vec{a} = \begin{pmatrix} 1 \\ 2 \\ n \end{pmatrix}$$

$$|\vec{a}| = 5$$

$$|\vec{a}| = \sqrt{1^2 + 2^2 + n^2}$$

$$5^2 = 1^2 + 2^2 + n^2$$

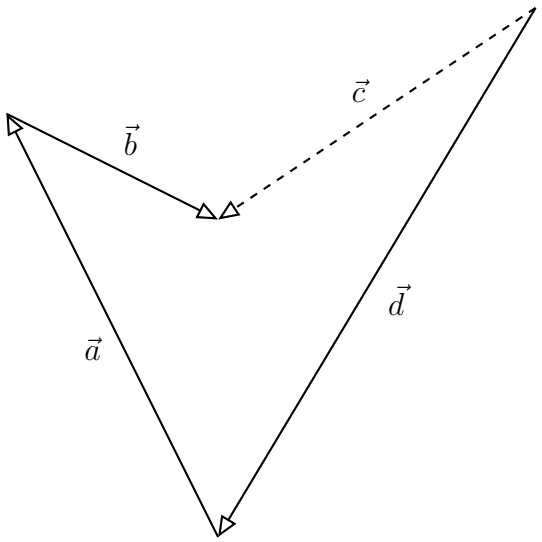
$$n^2 = 19$$

$$n = \sqrt{19}$$

For the same vector $\vec{a}$ as above, is it possible to find a value for n that will make $\vec{a}$ have a magnitude of 1? Find such a value n or explain why no such value exists:

Not possible. $|\vec{a}| = \sqrt{1^2 + 2^2 + n^2}$, so in order to have $|\vec{a}| = 1$, we must have $1 = 1^2 + 2^2 + n^2$. The right hand side of the equation will be larger than 1 regardless of what value we choose for n, so no value of n works.

3. Consider the path formed by the 4 vectors in the diagram below:



(a) Fill in + or − signs in between the vectors on the left hand side of the equation below to make the equation true:

$$\vec{a} + \vec{b} - \vec{c} + \vec{d} \quad = \quad \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

Starting with $\vec{a}$ and walking around the path, we follow $\vec{a}$, $\vec{b}$, $\vec{c}$, and $\vec{d}$. We negate $\vec{c}$ because we follow it in the reverse direction.

(b) Let the following be the values for the vectors in the diagram:

$$\begin{pmatrix} -2 \\ 4 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} c_x \\ c_y \end{pmatrix} + \begin{pmatrix} -3 \\ -5 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

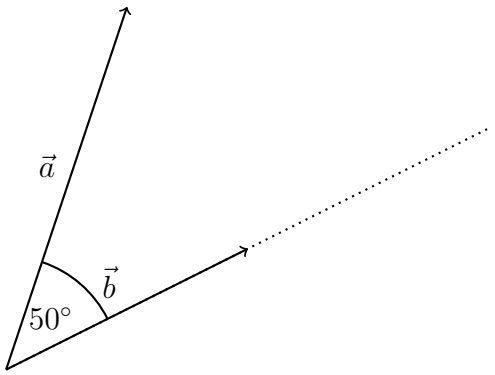
Find the value of c_x and c_y:

$$c_x = 0 + 2 - 2 + 3 = 3$$

$$c_y = 0 - 4 - 3 + 5 = -3$$

But, we need to negate these values to account for the fact that c is reversed. Thus, $\vec{c} = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$.

4. In the diagram below, the magnitude of $\vec{a}$ is 10 and the angle between $\vec{a}$ and $\vec{b}$ is 50°. Find the magnitude of $\vec{b}$ that will make the dot product $\vec{a} \cdot \vec{b} = 10$



$$\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos\theta$$

$$10 = |\vec{a}||\vec{b}| \cos\theta$$

$$10 = 10|\vec{b}| \cos 50$$

$$|\vec{b}| = \frac{1}{\cos 50} = 1.56$$