Question 1.8.16

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Question:

Find a vector in the direction of vector $\mathbf{a} = \begin{pmatrix} 1 \\ -2 \end{pmatrix}$ that has magnitude 7 units.

Solution:

To find a vector in the direction of a vector $\mathbf{q}$ with a magnitude of m, we first have to find a unit vector in the direction of $\mathbf{q}$, called $\hat{\mathbf{q}}$.

$$\hat{\mathbf{q}} = \frac{\mathbf{q}}{\|\mathbf{q}\|} \tag{1}$$

A vector in the direction of $\mathbf{q}$ ($\hat{\mathbf{q}}$) having a magnitude of m is then $m\hat{\mathbf{q}} = m\frac{\mathbf{q}}{\|\mathbf{q}\|}$

$$\therefore \text{Required vector } = 7\frac{\begin{pmatrix} 1 \\ -2 \end{pmatrix}}{\left\|\begin{pmatrix} 1 \\ -2 \end{pmatrix}\right\|} \tag{2}$$

$$= \begin{pmatrix} \frac{7}{\sqrt{5}} \\ -\frac{14}{\sqrt{5}} \end{pmatrix} \tag{3}$$