You have 20 minutes to complete the quiz.

1. (2 points) Are the following two vectors orthogonal?

$$\begin{bmatrix} 1 \\ 4 \\ 10 \end{bmatrix} \qquad \begin{bmatrix} 2 \\ -6 \\ 2 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 4 \\ 10 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ -6 \\ 2 \end{bmatrix} = 2 + (-24) + 20 = -2$$

2. (4 points) Find the two unit vectors u_1 and u_2 such that $\text{Span}\{u_1\} = \text{Span}\{u_2\} = \text{Span}\{v\}$. Which of these is the normalization of v?

$$v = \begin{bmatrix} 1 \\ -2 \\ 2 \end{bmatrix}$$

$$u_1 = \frac{v}{\|v\|} = \frac{v}{\sqrt{9}} = \frac{1}{3}v = \begin{bmatrix} 1/3 \\ -2/3 \\ 2/3 \end{bmatrix} \quad \text{is the } \underline{\text{normalization}}$$

$$u_2 = -u_1 = \begin{bmatrix} -1/3 \\ 2/3 \\ -2/3 \end{bmatrix}$$

3. (4 points) Compute the orthogonal projection of y onto u. Compute the component of y orthogonal to u. Write y as a sum of these two vectors.

$$y = \begin{bmatrix} 7 \\ 6 \end{bmatrix} \qquad u = \begin{bmatrix} -4 \\ -2 \end{bmatrix}$$

$$y = \frac{y \cdot u}{u \cdot u} u + z$$

$$\begin{bmatrix} 7 \\ 6 \end{bmatrix} = \frac{-40}{20}\begin{bmatrix} -4 \\ -2 \end{bmatrix} + z$$

$$\begin{bmatrix} 7 \\ 6 \end{bmatrix} + \begin{bmatrix} -8 \\ -4 \end{bmatrix} = z$$

$$\begin{bmatrix} -1 \\ 2 \end{bmatrix} = z$$

orthogonal
proj. of
y onto u

$$\begin{bmatrix} 7 \\ 6 \end{bmatrix} = (-2)\begin{bmatrix} -4 \\ -2 \end{bmatrix} + \begin{bmatrix} -1 \\ 2 \end{bmatrix}$$

component of y orthogonal to u