Problem 1. **(1 point)**

Consider the basis $\vec{v}_1 = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$, $\vec{v}_2 = \begin{bmatrix} 4 \\ 4 \end{bmatrix}$ of $\mathbb{R}^2$. Apply the algorithm in the text (the Gram-Schmidt process) to this basis to find an orthonormal pair of basis vectors $\vec{u}_1$ and $\vec{u}_2$. *(Be sure to enter your answers to at least four decimal places of accuracy.)*

$\vec{u}_1 = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$

$\vec{u}_2 = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$

Answer(s) submitted:

- $\begin{bmatrix} 0.8944 \\ -0.4472 \end{bmatrix}$
- $\begin{bmatrix} 0.4472 \\ 0.8944 \end{bmatrix}$

submitted: (correct)
recorded: (correct)

Problem 2. **(1 point)**

Consider the basis $\vec{v}_1 = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$, $\vec{v}_2 = \begin{bmatrix} 4 \\ 4 \end{bmatrix}$ of $\mathbb{R}^2$. Consider the QR factorization of the matrix $M = \begin{bmatrix} \vec{v}_1 & \vec{v}_2 \end{bmatrix}$:

$$\begin{bmatrix} \vec{v}_1 & \vec{v}_2 \end{bmatrix} = QR.$$

What is the first column of Q?

first column of $Q = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$

What is the first column of R?

first column of $R = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$

Answer(s) submitted:

- $\begin{bmatrix} 0.8944 \\ -0.4472 \end{bmatrix}$
- $\begin{bmatrix} 2.2361 \\ 0 \end{bmatrix}$

submitted: (correct)
recorded: (correct)

Problem 3. **(1 point)**

Consider the basis vectors $\vec{v}_1 = \begin{bmatrix} -4 \\ 3 \end{bmatrix}$ and $\vec{v}_2 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ of $\mathbb{R}^2$. The QR factorization of $M = \begin{bmatrix} \vec{v}_1 & \vec{v}_2 \end{bmatrix}$ is

$$M = \begin{bmatrix} -4/5 & 3/5 \\ 3/5 & 4/5 \end{bmatrix} R,$$

where $R = \begin{bmatrix} r_{11} & r_{12} \\ r_{21} & 3/5 \end{bmatrix}$. What are the remaining components of R?

$r_{11} =$ _____
$r_{12} =$ _____
$r_{21} =$ _____

Answer(s) submitted:

- 5
- $-\frac{4}{5}$
- 0

submitted: (correct)
recorded: (correct)