1. (1 pt) Let 
\[ x = \begin{bmatrix} -1 \\ -3 \\ 3 \end{bmatrix} \text{ and } y = \begin{bmatrix} 0 \\ -5 \\ 5 \end{bmatrix}, \]
find the dot product of \( x \) and \( y \):
\[ x \cdot y = \]

2. (1 pt) Find the value of \( k \) for which the vectors
\[ x = \begin{bmatrix} 0 \\ -4 \\ 5 \\ 3 \end{bmatrix} \text{ and } y = \begin{bmatrix} -4 \\ 4 \\ 4 \\ k \end{bmatrix} \]
are orthogonal:
\[ k = \]

3. (1 pt) You’ll need to use the formatted text mode in order to do this problem: click on the “formatted text” button on the bottom of the page and then click “submit answer”.
Let
\[ x = \begin{bmatrix} 2 \\ -4 \\ 3 \\ 1 \end{bmatrix}. \]
Find the norm of \( x \):
\[ ||x|| = \]
Find the unit vector in the direction of \( x \):
\[ u = \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix} \]

4. (1 pt) Let
\[ x = \begin{bmatrix} 5 \\ 3 \\ -1 \end{bmatrix} \text{ and } y = \begin{bmatrix} 4 \\ -2 \\ -4 \end{bmatrix}, \]
find the angle between \( x \) and \( y \):
\[ \alpha = \]

5. (1 pt) If
\[ A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \text{ and } B = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \]
are arbitrary vectors in \( M_2(\mathbb{R}) \), then the mapping
\[ <A, B> = a_{11}b_{11} + a_{12}b_{12} + a_{21}b_{21} + a_{22}b_{22} \]
defines an inner product in \( M_2(\mathbb{R}) \).
Use this inner product to determine \( <A, B> \), \( ||A|| \), \( ||B|| \), and the angle \( \alpha_{A,B} \) between \( A \) and \( B \) for
\[ A = \begin{bmatrix} -1 & 1 \\ 2 & -2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2 & -3 \\ 2 & 1 \end{bmatrix} \]
\[ ||A|| = \]
\[ ||B|| = \]
\[ \alpha_{A,B} = \]

6. (1 pt) You’ll need to use the formatted text mode in order to do this problem: click on the ”formatted text” button on the bottom of the page, and then click ”submit answer”.
Let
\[ x = \begin{bmatrix} 1 \\ 1 \\ 4 \\ 0 \end{bmatrix}, \quad y = \begin{bmatrix} 2 \\ -2 \\ -9 \\ 0 \end{bmatrix}, \quad \text{and } z = \begin{bmatrix} 4 \\ 12 \\ -15.5 \end{bmatrix}, \]
Use the Gram-Schmidt process to determine an orthonormal basis for the subspace of \( \mathbb{R}^n \) spanned by \( x, y, \) and \( z \):
\[ \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix} \]

7. (1 pt) Use the inner product \( <f, g> = \int_0^1 f(x)g(x)dx \) in the vector space \( C^0[0, 1] \) to find \( <f, g> \), \( ||f|| \), \( ||g|| \), and the angle \( \alpha_{f,g} \) between \( f(x) \) and \( g(x) \) for \( f(x) = -10x^2 - 9 \) and \( g(x) = 9x + 2 \).
\[ <f, g> = \]
\[ ||f|| = \]
\[ ||g|| = \]
\[ \alpha_{f,g} = \]