1. two vectors $V = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$ and $w = \begin{bmatrix} \alpha \\ 3 \\ 1 \end{bmatrix}$

are known to be orthogonal. What is α?

2. Are the following vectors linearly independent?

$$x_1 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad x_2 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \quad x_3 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$$

3. a) Is the following set of vectors a Basis?

$$x_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \quad x_2 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \quad x_3 = \begin{bmatrix} -1 \\ 1 \\ 3 \\ 1 \end{bmatrix} \quad x_4 = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

b) What is the dimension of this set of vectors?

c) Is the vector $\begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$ representable?

4. The linear operator A maps $\begin{pmatrix} 5 \\ 6 \end{pmatrix}$ onto $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$ onto $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$

What is the mapping of $\begin{pmatrix} 11 \\ 4 \end{pmatrix}$?

5. Use the Gram-Schmidt process to construct a set of orthonormal vectors from

$$x_1 = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad x_2 = \begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix} \quad x_3 = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$$

Make sure and show this set is linearly independent first.

6. Express $z = \begin{bmatrix} 6 \\ 4 \\ -3 \end{bmatrix}$ using the orthonormal basis from 5.

7. The linear transformation A maps the vectors v to the vectors u.
The basis vectors

$$v_1 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \quad v_2 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} \quad v_3 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

have images

$$u_1 = \begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix} \quad u_2 = \begin{bmatrix} -1 \\ -1 \\ 2 \end{bmatrix} \quad u_3 = \begin{bmatrix} 1 \\ 1 \\ 5 \end{bmatrix}$$

What is the matrix representation for A?