1.1.11 Apply elementary equation operations to the given linear system to find an equivalent linear system in echelon form. If the system is consistent then use back substitution to find the general solution.

$$\begin{array}{ccccccc} x & - & 2y & - & 3z & = & 1 \\ x & - & 3y & - & 8z & = & 2 \\ 2x & - & 2y & + & 3z & = & 4 \end{array}$$

1.2.19 Apply Gaussian elimination to the given matrix in order to obtain its reduced row echelon form.

$$\begin{pmatrix} 0 & 0 & 0 & 1 & -1 \\ 1 & 2 & -1 & 2 & 1 \\ 2 & 4 & -2 & 6 & 0 \\ 3 & 6 & -6 & 0 & 0 \end{pmatrix}$$

2.2.12 Let $u_1 = \begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}$ **and** $u_2 = \begin{pmatrix} 3 \\ 8 \\ 7 \end{pmatrix}$**. Determine if** $u = \begin{pmatrix} 1 \\ 4 \\ 1 \end{pmatrix}$ **is a linear combination of** u_1 **and** u_2**. If it is, give scalars** a_1 **and** a_2 **such that** $u = a_1 u_1 + a_2 u_2$**.**

2.3.7 Let

$$u_1 = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}, \quad u_2 = \begin{pmatrix} 2 \\ 1 \\ 2 \\ 3 \end{pmatrix}, \quad u_3 = \begin{pmatrix} 1 \\ 1 \\ -1 \\ -2 \end{pmatrix}$$

Determine if $\begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} \in \operatorname{span}(u_1, u_2, u_3)$**.**

2.4.15 Verify that the following collection of vectors are linearly dependent and find a non-trivial dependence relation.

$$\left(\begin{pmatrix} 1 \\ -1 \\ 2 \\ 1 \end{pmatrix}, \begin{pmatrix} -2 \\ 3 \\ 1 \\ -1 \end{pmatrix}, \begin{pmatrix} 1 \\ -1 \\ -3 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 2 \\ 2 \end{pmatrix} \right)$$

2.5.9 Determine if the collection $\mathcal{B}$ **is a bsis for** V**.**

$$V = \operatorname{span}\left(\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} \right), \quad \mathcal{B} = \left(\begin{pmatrix} 1 \\ -1 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix} \right)$$

2.6.24 Find all vectors in $\mathbb{R}^4$ **which are orthogonal to** $\operatorname{span}(u_1, u_2, u_3)$ **where**

$$u_1 = \begin{pmatrix} 2 \\ 3 \\ 1 \\ -2 \end{pmatrix}, \; u_2 = \begin{pmatrix} 3 \\ 4 \\ 2 \\ 0 \end{pmatrix}, \; u_3 = \begin{pmatrix} 3 \\ 5 \\ 1 \\ -6 \end{pmatrix}$$

3.1.13 Compute the standard matrix of the linear transformation T **given by**

$$T \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} x_2 + x_3 \\ x_3 + x_4 \\ x_1 + x_4 \\ x_1 + x_2 \end{pmatrix}$$

3.2.5 Find the null space of the matrix A; express $\operatorname{null}(A)$ as a span of linearly independent vectors.

$$A = \begin{pmatrix} 2 & 3 & 1 & 0 \\ 3 & 4 & 2 & 1 \\ 1 & 1 & 1 & 1 \end{pmatrix}$$

3.3.16 Compute.

$$\begin{pmatrix} 1 & 2 & 3 & 1 \\ 2 & 5 & 7 & 4 \\ 1 & 1 & 2 & -1 \end{pmatrix} \begin{pmatrix} 1 & 3 & 1 & 7 \\ 1 & -2 & -4 & -3 \\ -1 & 0 & 2 & -1 \\ 0 & 1 & 1 & 2 \end{pmatrix}$$

3.4.8 Determine if the following matrix has an inverse. If it does, compute the inverse.

$$\begin{pmatrix} 4 & 5 & 2 \\ 1 & 1 & 1 \\ 2 & 3 & 1 \end{pmatrix}$$

3.5.13 Express the following matrix and its inverse as products of elementary matrices.

$$\begin{pmatrix} 3 & 5 \\ 5 & 9 \end{pmatrix}$$