

## Answer on Question #63621 – Math – Linear Algebra

### Question

$$X_1 = [ 2 \ 1 \ 2 ], X_2 = [ 1 \ -1 \ -2 ], X_3 = [ 1 \ 1 \ 1 ]$$

find the dimension and a set of basis vector of  $V$

### Solution

$$\begin{array}{ccc} 2 & 1 & 1 \\ 1 & -1 & 1 \\ 2 & -2 & 1 \end{array}$$

Use the Gaussian Elimination

Divide 1<sup>st</sup> row by 2

$$\begin{array}{ccc} 1 & 0.5 & 0.5 \\ 1 & -1 & 1 \\ 2 & -2 & 1 \end{array}$$

Subtract the 1<sup>st</sup> row from the 2<sup>nd</sup> row and subtract the 1<sup>st</sup> row multiplied by 2 from the 3<sup>rd</sup> row

$$\begin{array}{ccc} 1 & 0.5 & 0.5 \\ 0 & -1.5 & 0.5 \\ 0 & -3 & 0 \end{array}$$

Divide the 2<sup>nd</sup> row by -1.5

$$\begin{array}{ccc} 1 & 0.5 & 0.5 \\ 0 & 1 & -\frac{1}{3} \\ 0 & -3 & 0 \end{array}$$

Subtract the 2<sup>nd</sup> row multiplied by 0.5 from the 1<sup>st</sup> row; add the 2<sup>nd</sup> row multiplied by 3 to the 3<sup>rd</sup> row

$$\begin{array}{ccc} 1 & 0 & \frac{1}{3} \\ 0 & 1 & -\frac{1}{3} \\ 0 & 0 & -1 \end{array}$$

Multiply the 3<sup>rd</sup> row by (-1):

$$\begin{array}{ccc} 1 & 0 & \frac{1}{3} \\ 0 & 1 & -\frac{1}{3} \\ 0 & 0 & 1 \end{array}$$

Subtract the 3<sup>rd</sup> row multiplied by  $\frac{1}{3}$  from the 1<sup>st</sup> row, add the 3<sup>rd</sup> row multiplied by  $\frac{1}{3}$  to the 2<sup>nd</sup> row

$$\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{array}$$

The set of basis vectors is  $\{E_1 = [1\ 0\ 0], X_2 = [0\ 1\ 0], X_3 = [0\ 0\ 1]\}$ .

The dimension is  $\dim = 3$ .

**Answer:**  $\{E_1 = [1\ 0\ 0], X_2 = [0\ 1\ 0], X_3 = [0\ 0\ 1]\}; \dim = 3$ .