**EXAMPLE 5'** Let 
$$\mathbf{a}_1 = \begin{bmatrix} 1 \\ 0 \\ -3 \end{bmatrix}$$
,  $\mathbf{a}_2 = \begin{bmatrix} -1 \\ 2 \\ 7 \end{bmatrix}$ ,  $\mathbf{b} = \begin{bmatrix} -3 \\ 4 \\ 1 \end{bmatrix}$ .

Determine whether **b** is a linear combination of  $\mathbf{a}_1$  and  $\mathbf{a}_2$ . Do weights  $x_1$  and  $x_2$  exist such that

$$x_1 \mathbf{a}_1 + x_2 \mathbf{a}_2 = \mathbf{b} \tag{1}$$

Solution

$$x_{1}\begin{bmatrix}1\\0\\-3\end{bmatrix}+x_{2}\begin{bmatrix}-1\\-2\\7\end{bmatrix}=\begin{bmatrix}-3\\4\\1\end{bmatrix}$$

$$\uparrow \qquad \uparrow \qquad \uparrow$$

$$\mathbf{a}_{1} \qquad \mathbf{a}_{2} \qquad \mathbf{b}$$

Rewrite this vector equation:

$$\begin{bmatrix} x_1 \\ 0 \\ -3x_1 \end{bmatrix} + \begin{bmatrix} -x_2 \\ -2x_2 \\ 7x_2 \end{bmatrix} = \begin{bmatrix} -3 \\ 4 \\ 1 \end{bmatrix}$$

and

$$\begin{bmatrix} x_1 - x_2 \\ 0 - 2x_2 \\ -3x_1 + 7x_2 \end{bmatrix} = \begin{bmatrix} -3 \\ 4 \\ 1 \end{bmatrix}$$

(2)

## 1.3.04

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