Section 1.4 Exercises

Q5. *Write the matrix equation as a vector equation using definition of Ax.*

$$\begin{bmatrix} 1 & 2 & -3 & 1 \\ -2 & -3 & 1 & -1 \end{bmatrix}\begin{bmatrix} 2 \\ -1 \\ 1 \\ -1 \end{bmatrix} = \begin{bmatrix} -4 \\ 1 \end{bmatrix}$$

By the definition of Ax

$$2\begin{bmatrix} 1 \\ -2 \end{bmatrix} + (-1)\cdot\begin{bmatrix} 2 \\ -3 \end{bmatrix} + 1\cdot\begin{bmatrix} -3 \\ 1 \end{bmatrix} + (-1)\cdot\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} -4 \\ 1 \end{bmatrix}$$

Therefore

$$2\begin{bmatrix} 1 \\ -2 \end{bmatrix} -1\cdot\begin{bmatrix} 2 \\ -3 \end{bmatrix} + 1\cdot\begin{bmatrix} -3 \\ 1 \end{bmatrix} -1\cdot\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} -4 \\ 1 \end{bmatrix}$$

Q7.

$$X_1\begin{bmatrix} 4 \\ -1 \\ 7 \\ -4 \end{bmatrix} + X_2\begin{bmatrix} -5 \\ 3 \\ -5 \\ 1 \end{bmatrix} + X_3\begin{bmatrix} 7 \\ -8 \\ 0 \\ 2 \end{bmatrix} = \begin{bmatrix} 6 \\ -8 \\ 0 \\ -7 \end{bmatrix}$$

The left side of the equation is linear combination of three vectors. Given system of equations is equivalent to an angle matrix equation AX = B

Where $A=\begin{bmatrix} 4 & -5 & 7 \\ -1 & 3 & -8 \\ 7 & -5 & 0 \\ -4 & 1 & 2 \end{bmatrix}, X = \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix}, B=\begin{bmatrix} 6 \\ -8 \\ 0 \\ -7 \end{bmatrix}$

Thus

$AX=B$

$$\begin{bmatrix} 4 & -5 & 7 \\ -1 & 3 & -8 \\ 7 & -5 & 0 \\ -4 & 1 & 2 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} = \begin{bmatrix} 6 \\ -8 \\ 0 \\ -7 \end{bmatrix}$$

Q9.

$$5x_1 + x_2 - 3x_3 = 8$$

$$2x_2 + 4x_3 = 0$$

$$x_1\begin{bmatrix} 5 \\ 0 \end{bmatrix} + x_2\begin{bmatrix} 1 \\ 2 \end{bmatrix} + x_3\begin{bmatrix} -3 \\ 4 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 5 & 1 & -3 \\ 0 & 2 & 4 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ x3 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \end{bmatrix}$$