

# 5.2.65

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## Question

Solve

$$\mathbf{X} + \mathbf{Y} = \begin{pmatrix} 5 & 2 \\ 0 & 9 \end{pmatrix} \text{ and } \mathbf{X} - \mathbf{Y} = \begin{pmatrix} 3 & 6 \\ 0 & -1 \end{pmatrix}$$

**Solution:**

Given,

$$\mathbf{X} + \mathbf{Y} = \begin{pmatrix} 5 & 2 \\ 0 & 9 \end{pmatrix} \quad (1)$$

$$\mathbf{X} - \mathbf{Y} = \begin{pmatrix} 3 & 6 \\ 0 & -1 \end{pmatrix} \quad (2)$$

$$\Rightarrow \begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} \mathbf{X} \\ \mathbf{Y} \end{pmatrix} = \begin{pmatrix} \mathbf{A} \\ \mathbf{B} \end{pmatrix} \quad (3)$$

$$\mathbf{A} = \begin{pmatrix} 5 & 2 \\ 0 & 9 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} 3 & 6 \\ 0 & -1 \end{pmatrix} \quad (4)$$

Forming the Augmented matrix

$$\left( \begin{array}{cc|c} 1 & 1 & \mathbf{A} \\ 1 & -1 & \mathbf{B} \end{array} \right) \xrightarrow{R_2 \rightarrow R_2 - R_1} \left( \begin{array}{cc|c} 1 & 1 & \mathbf{A} \\ 0 & -2 & \mathbf{B} - \mathbf{A} \end{array} \right) \quad (5)$$

$$\Rightarrow -2\mathbf{Y} = \mathbf{B} - \mathbf{A} \quad (6)$$

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} -2 & 4 \\ 0 & -10 \end{pmatrix} \quad (7)$$

$$\Rightarrow \mathbf{Y} = \begin{pmatrix} 1 & -2 \\ 0 & 5 \end{pmatrix} \quad (8)$$

$$\Rightarrow \mathbf{X} + \mathbf{Y} = \begin{pmatrix} 5 & 2 \\ 0 & 9 \end{pmatrix} \quad (9)$$

$$\Rightarrow \mathbf{X} = \begin{pmatrix} 4 & 4 \\ 0 & 4 \end{pmatrix} \quad (10)$$

on back substitution we get

$$\Rightarrow \mathbf{X} = \begin{pmatrix} 4 & 4 \\ 0 & 4 \end{pmatrix} \text{ and } \mathbf{Y} = \begin{pmatrix} 1 & -2 \\ 0 & 5 \end{pmatrix} \quad (11)$$