5.4.13

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Question:
Using elementary transformations, find the inverse of the following matrix.

$$\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$$

Solution: Given

$$\mathbf{M} = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix} \tag{1}$$

Let $\mathbf{M}^{-1}$ be the inverse of $\mathbf{M}$.Then

$$\mathbf{M}\mathbf{M}^{-1} = \mathbf{I} \tag{2}$$

Augmented matrix of $\begin{pmatrix} \mathbf{M} & | & \mathbf{I} \end{pmatrix}$ is given by

$$\left(\begin{array}{cc|cc} 1 & 3 & 1 & 0 \\ 2 & 7 & 0 & 1 \end{array}\right) \xrightarrow{R_2 \to R_2 - 2R_1} \left(\begin{array}{cc|cc} 1 & 3 & 1 & 0 \\ 0 & 1 & -2 & 1 \end{array}\right) \xrightarrow{R_1 \to R_1 - 3R_2} \left(\begin{array}{cc|cc} 1 & 0 & 7 & -3 \\ 0 & 1 & -2 & 1 \end{array}\right) \tag{3}$$

Hence the inverse of the matrix $\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ is $\begin{pmatrix} 7 & -3 \\ -2 & 1 \end{pmatrix}$