

Matrices in Geometry 5.4.32

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Question: Find inverse of the matrix

$$\mathbf{A} = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{pmatrix}$$

Solution:

Let \mathbf{B} be the inverse of \mathbf{A} , then

$$\mathbf{AB} = \mathbf{I} \quad (1)$$

forming the augmented matrix,

$$\left(\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 2 & 0 & 1 & 0 \\ 0 & 0 & 4 & 0 & 0 & 1 \end{array} \right) \xrightarrow{R_3 \rightarrow R_3/4} \left(\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 2 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array} \right) \xrightarrow{R_2 \rightarrow R_2 - 2R_3} \quad (2)$$

$$\left(\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & \frac{-1}{2} \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array} \right) \xrightarrow{R_1 \rightarrow R_1 - R_3} \left(\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & 0 & \frac{-1}{4} \\ 0 & 1 & 0 & 0 & 1 & \frac{-1}{2} \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array} \right) \quad (3)$$

Thus,

$$\mathbf{B} = \mathbf{A}^{-1} = \begin{pmatrix} 1 & 0 & \frac{-1}{4} \\ 0 & 1 & \frac{-1}{2} \\ 0 & 0 & \frac{1}{4} \end{pmatrix} \quad (4)$$