# Matrices in Geometry - 5.4.32

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# Problem Statement

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

$$\mathbf{AB} = \mathbf{I} \tag{1}$$

forming the augmented matrix,

$$\left(\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 2 & 0 & 1 & 0 \\ 0 & 0 & 4 & 0 & 0 & 1 \end{array}\right) \overset{R_3 \to R_3/4}{\longleftrightarrow} \left(\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 2 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array}\right) \overset{R_2 \to R_2 - 2R_3}{\longleftrightarrow} \tag{2}$$

$$\left(\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & \frac{-1}{2} \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array}\right) \overset{R_1 \to R_1 - R_3}{\longleftrightarrow} \left(\begin{array}{ccc|ccc} 1 & 0 & 0 & 1 & 0 & \frac{-1}{4} \\ 0 & 1 & 0 & 0 & 1 & \frac{-1}{2} \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{4} \end{array}\right) \tag{3}$$

# Solution

Thus,

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