Step-1

Given that $[A\ I]=\begin{bmatrix} \mathbf{2} & \mathbf{1} & \mathbf{0} & 1 & 0 & 0 \\ \mathbf{1} & \mathbf{2} & \mathbf{1} & 0 & 1 & 0 \\ \mathbf{0} & \mathbf{1} & \mathbf{2} & 0 & 0 & 1 \end{bmatrix}$

We have to eliminate above and below the pivots to reduce $[A\quad I]$ to $[I\quad A^{-1}]$.

Step-2

Exchanging row 1 and row 2 gives

$$\begin{bmatrix} \mathbf{1} & \mathbf{2} & \mathbf{1} & 0 & 1 & 0 \\ \mathbf{2} & \mathbf{1} & \mathbf{0} & 1 & 0 & 0 \\ \mathbf{0} & \mathbf{1} & \mathbf{2} & 0 & 0 & 1 \end{bmatrix}$$

Subtracting 2 times row 1 from row 2

$$\begin{bmatrix} \mathbf{1} & \mathbf{2} & \mathbf{1} & 0 & 1 & 0 \\ \mathbf{0} & \mathbf{-3} & \mathbf{-2} & 1 & -2 & 0 \\ \mathbf{0} & \mathbf{1} & \mathbf{2} & 0 & 0 & 1 \end{bmatrix}$$

Step-3

Subtracting 2 times row 3 from row 1 and adding 3 times row 3 to row 2

$$\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{-3} & 0 & 1 & -2 \\ \mathbf{0} & \mathbf{0} & 4 & 1 & -2 & 3 \\ \mathbf{0} & \mathbf{1} & \mathbf{2} & 0 & 0 & 1 \end{bmatrix}$$

Dividing row 2 by 4 gives

$$\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{-3} & 0 & 1 & -2 \\ \mathbf{0} & \mathbf{0} & \mathbf{1} & \frac{1}{4} & -\frac{1}{2} & \frac{3}{4} \\ \mathbf{0} & \mathbf{1} & \mathbf{2} & 0 & 0 & 1 \end{bmatrix}$$

Step-4

Adding 3 times row 2 to row 3, subtracting 2 times row 2 from row 3

$$\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \frac{3}{4} & -\frac{1}{2} & \frac{1}{4} \\ \mathbf{0} & \mathbf{0} & \mathbf{1} & \frac{1}{4} & -\frac{1}{2} & \frac{3}{4} \\ \mathbf{0} & \mathbf{1} & \mathbf{2} & -\frac{1}{2} & 1 & -\frac{1}{2} \end{bmatrix}$$

Exchanging row 2 and row 3

$$\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \frac{3}{4} & -\frac{1}{2} & \frac{1}{4} \\ \mathbf{0} & \mathbf{1} & \mathbf{0} & -\frac{1}{2} & 1 & -\frac{1}{2} \\ \mathbf{0} & \mathbf{0} & \mathbf{1} & \frac{1}{4} & -\frac{1}{2} & \frac{3}{4} \end{bmatrix} = \begin{bmatrix} I & A^{-1} \end{bmatrix}$$

Hence $\boxed{\begin{bmatrix} I & A^{-1} \end{bmatrix} = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \frac{3}{4} & -\frac{1}{2} & \frac{1}{4} \\ \mathbf{0} & \mathbf{1} & \mathbf{0} & -\frac{1}{2} & 1 & -\frac{1}{2} \\ \mathbf{0} & \mathbf{0} & \mathbf{1} & \frac{1}{4} & -\frac{1}{2} & \frac{3}{4} \end{bmatrix}}$