Step-1

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ times } \begin{pmatrix} d & -b \\ -c & a \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \cdot \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$

$$= \begin{pmatrix} ad - bc & -ab + ab \\ cd - cd & -bc + ad \end{pmatrix}$$

$$= \begin{pmatrix} ad - bc & 0 \\ 0 & ad - bc \end{pmatrix}$$

$$= (ad - bc) \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (\because ad - bc \neq 0)$$

Step-2

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}^{-1} = \boxed{\frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}} \quad (\text{given that } ad - bc \neq 0)$$

$$\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}^{-1} = \boxed{\frac{1}{ad - bc} \begin{pmatrix} a & b \\ c & d \end{pmatrix}} \quad (\text{given that } ad - bc \neq 0)$$