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ETIVITY 4 Worked Examples of determinant, inverse + cross product.

Determinant

$$\det\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right) = ad - bc$$

$$\det\left(\begin{bmatrix} 1 & 4 \\ 5 & -2 \end{bmatrix}\right) = (1 \times -2) - (4 \times 5)$$
$$= -2 - 20$$
$$= -22$$

Inverse

$$\text{Inverse}\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right) = \frac{1}{\det\left(\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right)} \times \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$\text{Inverse}\left(\begin{bmatrix} 1 & 4 \\ 5 & -2 \end{bmatrix}\right) = \frac{1}{-22} \times \begin{bmatrix} -2 & -4 \\ -5 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{-2}{-22} & \frac{-4}{-22} \\ \frac{-5}{-22} & \frac{1}{-22} \end{bmatrix} = \begin{bmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{5}{22} & \frac{1}{-22} \end{bmatrix}$$

$$\text{Inverse}(A) \times (A) = I$$

$$\begin{bmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{5}{22} & \frac{-1}{22} \end{bmatrix} \times \begin{bmatrix} 1 & 4 \\ 5 & -2 \end{bmatrix} = \begin{bmatrix} 1 \times \frac{1}{11} + \frac{2}{11} \times 5 & 4 \times \frac{1}{11} + \frac{2}{11} \times -2 \\ 1 \times \frac{5}{22} + 5 \times \frac{-1}{22} & 4 \times \frac{5}{22} + -2 \times \frac{-1}{22} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{11} + \frac{10}{11} & \frac{4}{11} - \frac{4}{11} \\ \frac{5}{22} - \frac{5}{22} & \frac{20}{22} + \frac{2}{22} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$