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Using Inverses to Solve Matrix Equations

SOLVING EQUATIONS Solve the matrix equation.

$A \cdot X = B$

$$\begin{bmatrix} 3 & -2 \\ -7 & 5 \end{bmatrix} X = \begin{bmatrix} -2 & 4 \\ 3 & -1 \end{bmatrix}$$

$AX = B$

$A^{-1} \cdot A \cdot X = A^{-1} \cdot B$

$A^{-1} \cdot A \cdot X = A^{-1} \cdot B$

$\boxed{X = A^{-1} \cdot B}$

$$A^{-1} = \frac{1}{|A|} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$|A| = ad - bc = 15 - 14 = 1$

$$A^{-1} = \frac{1}{1} \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix} = A^{-1}$$

$$X = A^{-1} \cdot B = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix} \cdot \begin{bmatrix} -2 & 4 \\ 3 & -1 \end{bmatrix} = \begin{bmatrix} -4 & 18 \\ -5 & 25 \end{bmatrix}$$

SYSTEMS OF TWO EQUATIONS Use an inverse matrix to solve the linear system.

$$4x + 7y = -16$$
$$2x + 3y = -4$$

$(10, -8)$

Coefficient Matrix | Variable matrix | Answer Matrix

$$\begin{bmatrix} 4 & 7 \\ 2 & 3 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -16 \\ -4 \end{bmatrix}$$

$A \cdot X = B$

$A^{-1} \cdot A \cdot X = A^{-1} \cdot B$

$$X = \begin{bmatrix} 10 \\ -8 \end{bmatrix}$$

SYSTEMS OF THREE EQUATIONS Use an inverse matrix and a graphing calculator to solve the linear system.

$$x - y - 3z = 2$$
$$5x + 2y + z = -17$$
$$-3x - y = 8$$

$$\begin{bmatrix} 1 & -1 & -3 \\ 5 & 2 & 1 \\ -3 & -1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ -17 \\ 8 \end{bmatrix}$$

$(-9, 19, -10)$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -9 \\ 19 \\ -10 \end{bmatrix}$$