

# Chapter 7

## Learning Target 3

I can solve a 2-variable system  
using inverse matrices

How to use **inverse** matrices to solve systems of equations

$$\underline{ax} + \underline{by} = c$$

$$\underline{dx} + \underline{ey} = f$$

matrix equation

$$\begin{bmatrix} a & b \\ d & e \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} c \\ f \end{bmatrix}$$

work to solve

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a & b \\ d & e \end{bmatrix}^{-1} \cdot \begin{bmatrix} c \\ f \end{bmatrix}$$

inverse

$2 \times 2$     $2 \times 1$

Write a matrix equation for the following system of equations then solve the system of equations using inverse matrices.

$$\begin{array}{l}
 1.) \quad \underline{7}x + \underline{5}y = \boxed{3} \\
 \quad \quad \underline{3}x - \underline{2}y = \boxed{22}
 \end{array}
 \rightarrow
 \begin{bmatrix} 7 & 5 \\ 3 & -2 \end{bmatrix}^{-1}
 \begin{bmatrix} 3 \\ 22 \end{bmatrix} = \begin{bmatrix} 4 \\ -5 \end{bmatrix}$$

$(4, -5)$

Write a matrix equation for the following system of equations then solve the system of equations using inverse matrices.

$$\begin{array}{l}
 2.) \quad 4x = 3y \\
 \quad \quad 2x - y = -1
 \end{array}
 \longrightarrow
 \begin{array}{l}
 4x = 3y \\
 \quad \quad -3y \quad -3y \\
 \underline{4}x - \underline{3}y = 0 \\
 \underline{2}x - \underline{1}y = -1
 \end{array}$$

$$\begin{bmatrix} 4 & -3 \\ 2 & -1 \end{bmatrix}^{-1}
 \begin{bmatrix} 0 \\ -1 \end{bmatrix} = \begin{bmatrix} -1.5 \\ -2 \end{bmatrix}$$

$(-1.5, -2)$

Get out your homework from last night.

1.) Avery and Mead went to an office supplies store to buy paper clips and pencils. Avery bought 15 boxes of paper clips and 7 packages of pencils, while Mead bought 12 boxes of paper clips and 10 packages of pencils. If Avery spent \$55.40 and Mead spent \$61.70, how much does a box of paper clips and a package of pencils cost?

$$\begin{array}{l} x = \text{pencils (\$)} \\ y = \text{paper clips (\$)} \end{array} \quad \left\{ \begin{array}{l} 7x + 15y = 55.40 \\ 10x + 12y = 61.70 \end{array} \right.$$

$$\left[ \begin{array}{cc} 7 & 15 \\ 10 & 12 \end{array} \right]^{-1} \left[ \begin{array}{c} 55.40 \\ 61.70 \end{array} \right]$$

$$3.75 = x$$

$$1.85 = y$$

- 2.) Two angles are complementary. One angle is  $81^\circ$  less than twice the other angle. Find the measure of each angle.

$$x: \angle 1$$

$$y: \angle 2$$

$$\left. \begin{array}{l} x: \angle 1 \\ y: \angle 2 \end{array} \right\} \begin{array}{l} x + y = 90 \\ \underline{x = 2y - 81} \\ x - 2y = -81 \end{array}$$

$$\boxed{\begin{array}{l} 33^\circ \\ 57^\circ \end{array}}$$

$$\begin{bmatrix} 1 & 1 \\ 1 & -2 \end{bmatrix} \xrightarrow{-1} \begin{bmatrix} 90 \\ -81 \end{bmatrix}$$