

7.3 SOLVING LINEAR SYSTEMS WITH MATRICES**Learning Targets**

1. Write a system of equations in matrix form.
2. Use a calculator to solve a system of equations with matrices.

A fourth way to solve systems of equations is using matrices. A matrix is simply a way to organize the information.

A matrix is organized into rows and columns. The rows are horizontal and the columns are vertical. We describe matrices by their rows and columns. For example, a matrix with 3 rows and 2 columns would be a “3 x 2” matrix.

We are going to let the calculator do the math with the matrices, so we will focus solely on how to write a system of equations in matrix form.

Example 1: Describe this matrix.
$$\begin{bmatrix} 5 & 2 & 1 & 0 \\ 7 & -5 & 8 & 9 \\ -3 & 6 & 7 & 11 \end{bmatrix}$$

Example 2: Write the system of equations in matrix form $x + 2y = 5$
 $3x + 5y = 14$

Solving a Matrix equation is a little different from solving a normal equation because division of matrices is not allowed. Instead of Division, we can multiply both sides of a matrix equation by the Inverse of the matrix. However, once again, the rules of matrices restrict the order in which multiplication can be done. We could spend days talking about the rules of matrices and what you can and can't do, but again, we are going to let the calculator do that work.

Example 3: Show how to solve the matrix equation $AX = B$, where A is the coefficient matrix, X is the variable matrix, and B is the constants matrix.

Example 4: Use matrices to solve the system of equations in example 1.

Example 5: Use matrices to solve the system of equations. Show your setup! $5a + 3b = 7$
 $3a + 2b = 5$

Example 6: Use matrices to solve the system of equations. Show your setup!

$$\begin{aligned}2x + y + 3z &= 1 \\5x + y - 2z &= 8 \\x - y - 9z &= 5\end{aligned}$$

Example 7: Suppose you want to fill nine 1-lb tins with a holiday snack mix. You plan to buy almonds for \$2.45/lb, peanuts for \$1.85/lb, and raisins for \$0.80/lb. You have \$15 and want the mix to contain twice as much of the nuts as of the raisins by weight. How much of each ingredient should you buy?

- a) Explain how each equation in the system at the right relates to the problem.

$$\begin{aligned}x + y + z &= 9 \\2.45x + 1.85y + 0.8z &= 15 \\x + y &= 2z\end{aligned}$$

What does each variable represent?

- b) Solve the system. Show your setup!