Name:______________________________ Date:__________

PCH: Using Matrices to Solve Systems of Linear Equations Ms. Loughran

We can use matrices as a streamlined technique for solving systems of linear equations.

Model:

1. Given:
$$\begin{aligned} x - 2y + 3z &= 9 \\ -x + 3y \quad\quad &= -4 \\ 2x - 5y + 5z &= 17 \end{aligned}$$

Coefficient Matrix **Augmented Matrix**

***constant terms are not included** ***constant terms are included**

To solve a linear system of equations we will use an augmented matrix.

To solve a matrix we use the elementary row operations that we discussed. Remember the 3 elementary row operations are the same three operations that we used to solve the linear systems of equations by elimination.

Let's get back to solving the system.

This last matrix is said to be in row-echelon form. The term echelon refers to the stair step pattern formed by the nonzero elements of the matrix. To be in row echelon form, a matrix must have these properties:

1. **All rows consisting entirely of zeros occur at the bottom of the matrix.**

2. **For each row that does not consist entirely of zeros, the first nonzero entry is 1 (called a leading 1).**

3. **For two successive (nonzero) rows, the leading 1 in the higher row is father to the left than the leading 1 in the lower row.**

A matrix in row-echelon form is in *reduced row-echelon form* if every column that has a leading 1 has zeros in every position above and below its leading one.

2. Solve the following system using matrices:

$$\begin{aligned} x + y - 5z &= 3 \\ x \qquad - 2z &= 1 \\ 2x - y - z &= 0 \end{aligned}$$

3. Solve the following system using matrices:

$$\begin{aligned} x - 2y + z &= 7 \\ 3x + y - z &= 2 \\ 2x + 3y + 2z &= 7 \end{aligned}$$

Steps:

1.

2.

3.

Practice

Solve each of the following using matrices.

1. $$\begin{aligned} x+y+z&=-2 \\ 2x-3y+z&=-11 \\ -x+2y-z&=8 \end{aligned}$$

2. $$\begin{aligned} x+y+z-6&=0 \\ 2x-3y+4z-3&=0 \\ 4x-8y+4z-12&=0 \end{aligned}$$

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

4. $$\begin{aligned} x-2y-3z&=2 \\ x-4y+3z&=14 \\ -3x+5y+4z&=0 \end{aligned}$$

5. $$\begin{aligned} x \qquad -3z&=-2 \\ 3x+y-2z&=5 \\ 2x+2y+z&=4 \end{aligned}$$