**Chapter 6: Systems of Equations**

6.3 – Multivariable Linear Systems

The method of elimination can be applied to a system of linear equations in more than two variables. In fact, this method easily adapts to computer use for solving linear systems with dozens of variables.

When elimination is used to solve a system of linear equations, the goal is to rewrite the system in a form to which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be applied. To see how this works, consider the following two systems of linear equations.

Which one of the following equations do you think would be easier to solve?

$x-2y+3z= 9 $ $x-2y+3z=9$

 $-x+3y =-4$ $y+3z=5$

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

The system on the right is said to be in \_\_\_\_\_\_\_\_\_- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ form, which means that it has a “stair-step” pattern with leading coefficients of 1.

Let’s solve it!

Example 2: Solve the following system of equations using back substitution.

$$x-3y+3z=-18$$

$$ 2y+4z=-2$$

 $z=-3$

Example 3: Solve the following system of equations using back substitution.

$$x-y+2z=22$$

 $ 2x+3y=10$

 $ x= 8$

GAUSSIAN ELIMINATION

Two systems of equations are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if they have the same solution set. To solve a system that is NOT in row-echelon form, first convert it to an *equivalent* system that is in row-echelon form. To see how this is done let’s look at the method of elimination, as applied to a system of two linear equations.

Example 4: Solve the system of linear equations.

$$3x-2y=-1$$

 $x-y=0$

There are two strategies that we can use to solve this system. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Using back-substitution, you can determine that the solution is:

Now let’s try solving the harder equation from earlier in this section.

 $x-2y+3z= 9$ 🡪 Equation 1

 $-x+3y =-4$ 🡪 Equation 2

 $2x-5y+5z = 17$ 🡪 Equation 3