In this Chapter we will consider systems of equations, specifically Systems of Linear Equations. We will learn what they are, what their solutions are, how to find them, and what types of outcomes we can expect to get when looking for the solutions.

Def: A **system of equations** in two variables is two or more equations consisting of at most two variables which are being considered simultaneously.

In this chapter we will be looking at systems of linear equations only.

Consider the system of equations:

When we graph this system of linear equations, we get two lines.

Recall,

Def: The **solution** to an equation is the value of the unknown that makes the equation true.

From here the definition of a solution to a system of equations is only a small leap in our understanding.

Def: The **solution to a system of equations** is the value of the unknowns that makes ALL equations true.

Since solutions to an equation show up as points on the graph of an equation,

What will the solution to a system of equations be represented by on a graph?

What is the solution to the system of equations above?

Considering the solution to a system of equations is the intersection of the two lines, given any system of linear equations what are the possible outcomes?

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ We call this a consistent system.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ We call this an inconsistent system.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ We call this a dependent system.

Lets generalize some of the conditions in each scenario so we can easily tell by looking at a system which type of system we have.

Case 1: Case 2: Case 3:

Consistent System:

One Unique Solution

What will always be the case?

Inconsistent System:

No Solution



What will always be the case?

Consistent System:

Dependent Solution



What will always be the case?

## Methods of Solving Systems of Linear Equations

Method: Pros: Cons:

1. Graphical Method (3.1) Intuitive Not easy to be accurate
2. Substitution/elimination Method (3.2) Easy, fairly intuitive Takes some time
3. Using Matrices (3.6) Easy Not intuitive
4. Using Cramer’s Method (3.7) Fast Hard to remember/not intuitive

Ex: Determine if the system is Consistent, Inconsistent, or Dependent:

Ex: For system a) in the previous example, are the points solutions to the system?