Section 7.3 Systems of Linear Equations in Two Variables

# Objective 1: Determine whether an ordered pair is a solution of a linear system

A **system of linear equations in two variables** is the collection of two linear equations considered simultaneously. The solution to a system of equations in two variables is the set of all ordered pairs for which *both* equations are true.

Consider the following three systems of linear equations in two variables.

  

Notice in each of the three systems above that different variables were used. It does not matter what we call the two variables provided that both equations are linear. According to the definition of a system of linear equations in two variables, the solution is the set of all ordered pairs for which both equations are true.

# A solution to a system of linear equations in two variables is an ordered pair that satisfies both equations in the system.

# Objective 2: Solve linear systems by graphing

The solution to a system of linear equations can be found by graphing both equations in the same rectangular coordinate system. For a system with one solution, the coordinates of the point of intersection of the lines is the system’s solution.

We will learn two algebraic methods used for solving linear systems involving two equations and two variables. These methods are known as the *substitution method* and the *addition (or elimination) method.*

**Objective 3: Solve linear systems by substitution**

The substitution method involves solving one of the equations for one variable in terms of the other, then substituting that expression into the other equation. The substitution method can be summarized in the following steps.

 **Solving a System of Equations by the Method of Substitution**

**Step 1**: Choose an equation and solve for one variable in terms of the other variable.

**Step 2**: Substitute the expression from step 1 into the other equation.

**Step 3**: Solve the equation in one variable.

**Step 4**: Substitute the value found in step 3 into one of the original equations to find

the value of the other variable.

**Step 5**: Check the proposed solution in both of the system’s given equations.

**Objective 4: Solve linear systems by the Addition Method**

Another method used to solve a system of two equations is called the addition or elimination method. This method involves adding the two equations together in an attempt to eliminate one of the variables. To accomplish this task, the coefficients of one of the variables must differ only in sign. This can be done by multiplying one or both of the equations by a suitable constant. The addition / elimination method can be summarized in the following steps.

**Solving a System of Equations by the Method of Addition**

**Step 1**: If necessary, rewrite both equations in the form $Ax+By=C$.

**Step 2**: Multiply one or both equations by an appropriate nonzero constant so that the

 sum of the coefficients of one of the variables is zero.

**Step 3**: Add the two equations together to obtain an equation in one variable.

**Step 4**: Solve the equation in one variable.

**Step 5**: Substitute the value obtained in step 4 into one of the original equations to

solve for the other variable.

**Step 6:** Check the solution in both of the original equations.