Lesson 32

System of equations:

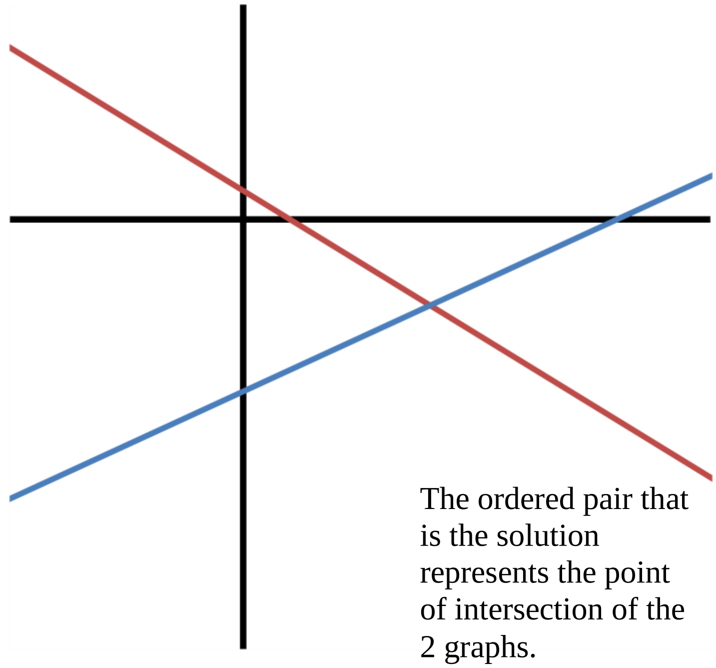
- two or more equations containing common variables
- the solution set of a system are the ordered pairs that make each equation true
  - when the equations are graphed, the solutions represents the points the graphs intersect
    - no solution means the graphs never interest
    - infinitely many solution means the graphs intersect at every point (same graph)

The two methods we will use to solve systems are substitution and elimination. **Substitution was covered in the last lesson and elimination is covered in this lesson.**

Method of Elimination:

1. multiply at least one equation by a nonzero constant so the coefficients for one variable will be opposites
2. add the equations so the variable with the opposite coefficients will be eliminated
3. take the result from step 2 and solve for the one variable
4. take the solution from step 3 and back substitute to any of the equations to solve for the remaining variable

Example 1: Solve the system. Enter your answer as an ordered pair. If the system has infinitely many solutions, express y in terms of x; if there is no solution, enter NO SOLUTION.



The ordered pair that is the solution represents the point of intersection of the 2 graphs.

a. $\begin{cases} 2x + 3y = 2 \\ x - 2y = 8 \end{cases}$

b. $\begin{cases} 2x + 5y = 16 \\ 3x - 7y = 24 \end{cases}$

c. $\begin{cases} 9u + 2v = 0 \\ 3u - 5v = 17 \end{cases}$

What happens if both variables are eliminated and we end up with an equation such as $0 = a$, where a is a nonzero constant?

(a false statement)

What happens if both variables are eliminated and we end up with an equation such as $0 = 0$?

(a true statement)

Example 2: Solve the system. Enter your answer as an ordered pair. If the system has infinitely many solutions, express y in terms of x; if there is no solution, enter NO SOLUTION.

a. $\begin{cases} 2x - 3y = 5 \\ -6x + 9y = 12 \end{cases}$

b. $\begin{cases} 3x - 4y = 2 \\ -6x + 8y = -4 \end{cases}$

Infinitely many solutions does not mean that every ordered pair is a solution; it means that every ordered pair that satisfies some criteria is a solution. You must write the solution as we did above using an algebraic expression for one variable.

You can verify whether your solution(s) is(are) correct by plugging the ordered pair(s) back into the original equations. If the ordered pair(s) in your solution set make both of the original equations true, it(they) are correct; if not, it(they) are incorrect.

Example 3: Solve the system. Enter your answer as an ordered pair. If the system has infinitely many solutions, express y in terms of x; if there is no solution, enter NO SOLUTION.

a. $\begin{cases} \frac{1}{3}c + \frac{1}{2}d = 5 \\ c - \frac{2}{3}d = -1 \end{cases}$

b. $\begin{cases} \frac{1}{2}x + \frac{3}{5}y = 3 \\ \frac{5}{3}x + 2y = 10 \end{cases}$

c. $\begin{cases} \frac{3}{2}x - \frac{1}{3}y = \frac{1}{2} \\ \frac{3}{2}x - y = \frac{1}{2} \end{cases}$

d. $\begin{cases} \frac{1}{3}x - \frac{1}{4}y = 2 \\ -8x + 6y = 10 \end{cases}$

e. $\begin{cases} 2y - 5x = 0 \\ 3y + 4x = 0 \end{cases}$