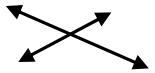
Math-3A
Lesson 11-7

Solving Systems of Equations by Substitution

Categories of Solutions:

Ways 2 lines can be graphed:



Cross → one solution

Parallel →no solutions

Same line → infinitely many solutions

How do you know how many solutions there are? (1, 0, or infinite #)

$y = 3x + 1$
$y = 2x + 1$

Not same line, not parallel → one solution.

$y = -2x + 3$
$y = -2x - 4$

parallel → no solutions

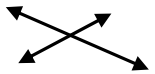
$2x + 2y = 2$
$x + y = 1$

1st equation is a multiple of the 2nd equation → same line

→ infinite # of solutions.

Which Category ?

$y = 2x + 6$
$y = 4x - 2$



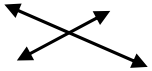
Cross → one solution

Parallel →no solutions

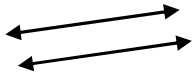
Same line → infinitely many solutions

Which Category ?

$$y = 2x + 4$$
$$y = 2x - 7$$



Cross → one solution

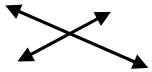


Parallel →no solutions

Same line → infinitely many solutions

Which Category ?

$$2x + 3y = 6$$
$$4x + 6y = 12$$



Cross → one solution

Parallel →no solutions

Same line → infinitely many solutions

Methods of Solving Systems

1. Graphing: The points of intersection are the solutions.

2. Substitution:

3. Elimination: we'll do this later.

Solve by graphing

$$6x + 2y = 3$$
$$y = -3x + 1$$

→ No solutions

$$6x + 2y = 3 \rightarrow y = -3x + \tfrac{3}{2}$$
$$y = -3x + 1$$

The lines were parallel.

x – 3y = 5
-x + 5y = 3

Solution: (17, 4)

y = 2x + 6
y = 5x + 8

Solution: (-2/3, 13/3)

$$2x - y = 2$$
$$4x + 2y = 8$$

Solution: (3/2, 1)

Substitution Method

1. Solve one equation for one of the variables (already done if in "y =" form).

2. Substitute the value of the variable into the other equation.

3. Solve for the single variable.

4. Substitute the value of the solved-for variable into either equation to find the other varable.

5. Test your solution (2, 4) in the other equation.

y = -2x + 8

y = 3x – 2

( ) = -2x + 8

3x – 2 = -2x + 8

+2x +2x

5x – 2 = 8 5x = 10

+2 +2 ÷5 ÷5

x = 2

y = 3x – 2 y = 3(2) – 2 y = 4

y = 3( ) – 2 y = 6 – 2

y = -2x + 8 (4) = -2(2) + 8

Solve the System of Equations Using the Substitution Method

y = -3
y = -6x + 21 (4, -3)

y = -8x + 22
y = 4x – 2 (2, 6)

y = 6x – 3
y = -4x – 3 (0, -3)

Equations in Standard Form

1. Solve both equations for the same variable.

2. Substitute the value of the variable into the other equation.

3. Solve for the single variable.

4. Substitute the value of the solved-for variable into either equation.

5. Test your solution (2, 4) in the other equation.

2x + y = 8

-3x + 3y = -3

y = -2x + 8 y = x – 1

-2x + 8 = x – 1

+2x +2x

8 = 3x – 1

+1 +1

9 = 3x

÷3 ÷3

x = 3

2x + y = 8 6 + y = 8

2(3) + y = 8 y = 2

-3(3) + 3(2) = -3

-9 + 6 = -3

How do you know how many solutions there are? (1, 0, or infinite #)

$6x+2y=3$ $6x+2(-3x+1)=3$ $2=3$

$y=-3x+1$ $6x-6x+2=3$

All the variables "disappeared" and the equation is false:

→ No solutions

How can that be?

$6x+2y=3$ → $y=-3x+\frac{3}{2}$

$y=-3x+1$ The lines were parallel.

How do you know how many solutions there are? (1, 0, or infinite #)

$6x+2y=4$ $\qquad$ $6x+2(-3x+2)=4$

$y=-3x+2$ $\qquad$ $6x-6x+4=4$

$4=4$

All the variables "disappeared" and the equation is true:

⟶ Infinitely many solutions

How can that be?

$6x+2y=4$ ⟶ $y=-3x+2$

$y=-3x+2$ Different versions of the same equation!