

# MA 109: September 14

Systems of Equations

Start of Class

Instructor Information

Name:

Email:

Office Hours:

Warm-up Questions

## Notes

Example: Solve the following system of equations using substitution.

$$\begin{cases} y - 3x = 5 \\ 9 = -x + 4y \end{cases}$$

Strategy:

- ① solve either equation for either of the variables
- ② plug that into the other equation
- ③ solve for the remaining variable
- ④ plug that into either equation to get the other variable

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$$\textcircled{1} \quad y - 3x = 5$$

$$y = 5 + 3x$$

$$\textcircled{2} \quad \begin{aligned} 9 &= -x + 4y \\ 9 &= -x + 4(5 + 3x) \end{aligned}$$

$$\textcircled{3} \quad 9 = -x + 4(5 + 3x)$$

$$9 = -x + 20 + 12x$$

$$9 = 11x + 20$$

$$-20 \quad -20$$

$$\frac{-11}{11} = \frac{11x}{11}$$

$$-1 = x$$

④

$$y = 5 + 3x$$

$$y = 5 + 3(-1)$$

$$y = 5 - 3$$

$$y = 2$$

Answer:  $(-1, 2)$

Now, we want to check our work.

plug the point in to make sure it "works" for both equations:

$$y - 3x \stackrel{?}{=} 5$$

$$(2) - 3(-1) \stackrel{?}{=} 5$$

$$2 + 3 \stackrel{?}{=} 5$$

$$5 = 5$$



$$9 \stackrel{?}{=} -x + 4y$$

$$9 \stackrel{?}{=} -(-1) + 4(2)$$

$$9 \stackrel{?}{=} 1 + 8$$

$$9 = 9$$



Example: Solve the following system of equations

$$\begin{cases} y = -3x + 5 \\ 9 = y + 3x \end{cases}$$

$$\textcircled{1} \quad y = -3x + 5$$

$$\textcircled{2} \quad \begin{aligned} 9 &= y + 3x \\ 9 &= (-3x + 5) + 3x \end{aligned}$$

$$\textcircled{3} \quad \begin{aligned} 9 &= -3x + 5 + 3x \\ 9 &= 5 \end{aligned}$$

since all the variables canceled out and we are left with a false statement, this system has

no solution

Example: Solve the following system of equations.

$$\begin{cases} y = -3x + 5 \\ 5 = y + 3x \end{cases}$$

$$\textcircled{1} \quad y = -3x + 5$$

$$\textcircled{2} \quad \begin{aligned} 5 &= y + 3x \\ 5 &= (-3x + 5) + 3x \end{aligned}$$

$$\textcircled{3} \quad \begin{aligned} 5 &= -3x + 5 + 3x \\ 5 &= 5 \end{aligned}$$

since all the variables canceled out and we are left with a true statement, this system has

infinitely many solutions

Summary

Always start by looking for a solution:

- ① solve one equation for one of the variables
- ② plug that into the other equation and solve for the remaining variable
- ③ plug that back into either equation to find the other variable

→ Don't forget to write your final answer as a point

If all the variables cancel out in step 2, there are two possibilities:

- If you are left with a false statement, there is no solution
- If you are left with a true statement, there are infinitely many solutions

## End of Class

Write a summary of what you learned today:

What questions do you have about the material from today?

What do you need to do between now and the next class meeting?