1- Introduction to Systems of Equations

January 6, 2019   6:07 PM

1. Introduction to systems of equations

A **system of** **linear equations** is _solving for 2 (or more) linear equations at once._

The **solution** to a system of linear equations can be represented three ways:

1. coordinates (x,y) ordered pair
2. show graphically → solution is the intersect.
3. words

means the point is on BOTH lines

Example #1: Is the point $(4, -1)$ a solution to the system of equations? Justify your answer.

use substitution to see if the point is on both lines.

$x \quad y$

① $3x + y = 11$
② $x - 2y = 6$

① $3(4) + (-1) = 11$
$12 - 1 = 11$
$11 = 11$ ✓
yes $(4,-1)$ is on this line

② $(4) - 2(-1) = 6$
$4 + 2 = 6$
$6 = 6$ ✓
yes $(4,-1)$ is on this line
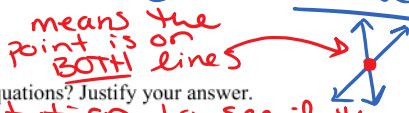
Example #2:

a) Graph the following system of linear equations.

$3x + 2y = -12$ (general form)

x-int: $y=0$
$3x + 2(0) = -12$
$\frac{3x}{3} = \frac{-12}{3}$
$x = -4$

y-int: $x=0$
$3(0) + 2y = -12$
$\frac{2y}{2} = \frac{-12}{2}$
$y = -6$

$2x + y = 1$
$+2x \qquad +2x$
$y = 2x + 1$

$y = mx + b$
slope   y int.
$= \frac{2}{1} = \frac{rise}{run}$ $= +1$

$(0,1)$
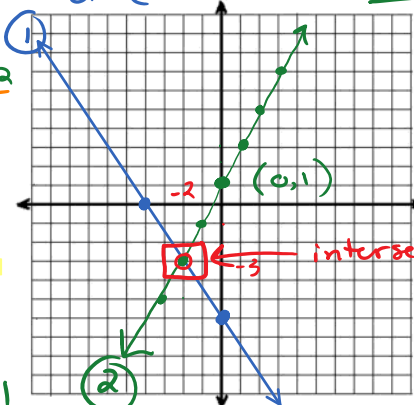
intersection

b) From your graph, identify the point of intersection – this is the solution to the system of equations.

$(x, y) = (-2, -3)$

c) Verify your solution algebraically.

① $3x + 2y = -12$
$3(-2) + 2(-3) = -12$
$-6 + (-6) = -12$
$-12 = -12$ ✓

② $-2x + y = 1$
$-2(-2) + (-3) = 1$
$4 - 3 = 1$
$1 = 1$ ✓

yes the point is on BOTH lines ∴ it the solution

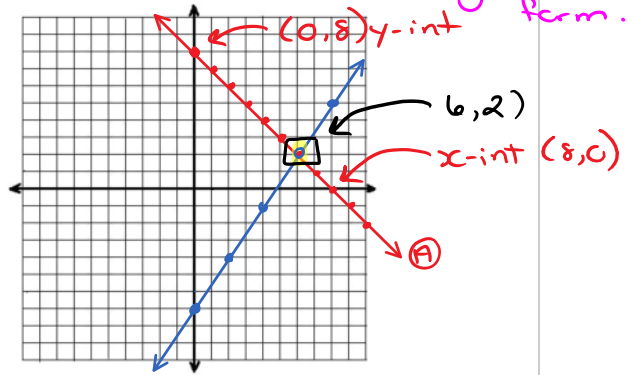The point that satisfies all of the equations in a system of equations is said to be the solution to the system.

Example #3:

Solve the system of equation **and** verify your solution.

Ⓐ $x + y = 8$

$-x \qquad -x$

$y = -x + 8 \qquad m = \frac{-1}{1}$

$\qquad\qquad\qquad y\text{-int} = +8$

Ⓑ $3x - 2y = 14$

$-3x \qquad -3x$

$\dfrac{-2y}{-2} = \dfrac{-3x + 14}{-2}$

$y = \frac{3}{2}x - 7 \qquad m = \frac{+3}{2}$

$\qquad\qquad\qquad y\text{-int} = -7$

① solve x-int and y-int.

② convert to $y = mx + b$ form.

must graph first

$(0,8)$ y-int

$(6,2)$

x-int $(8,0)$

Ⓐ

Verify Solution (check the intersect point $(6,2)$) satisfies BOTH equations.

① $x + y = 8$

$(6) + (2) = 8$

$8 = 8$ ✓

② $3x - 2y = 14$

$3(6) - 2(2) = 14$

$18 - 4 = 14$

$14 = 14$ ✓

∴ The point $(6,2)$ IS on both lines, because it "satisfies" (is true for) both equations

Homework

ASSIGNMENT # 1

pagPages 4-8 questions #1-25

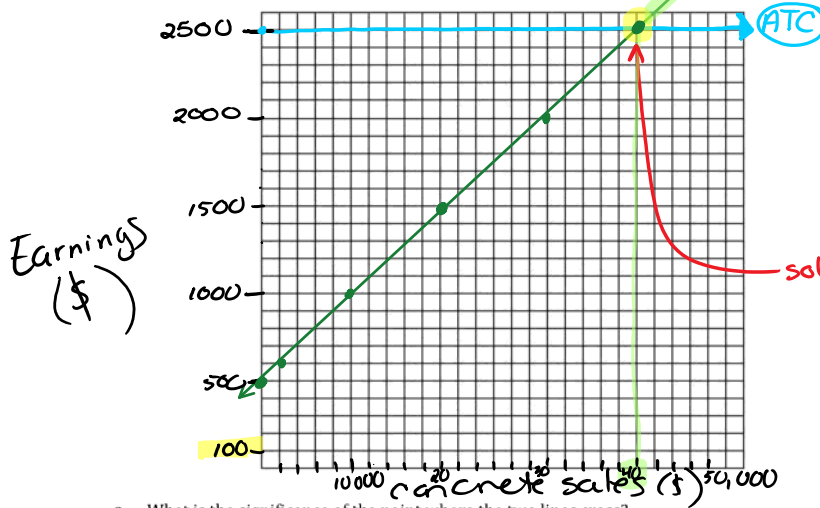④

Introduction: Systems of Linear Equations

Challenge

← CE

Jazhon is considering two job offers. Concrete Emporium will pay Jazhon a base monthly salary of $500 plus a commission rate of 5% on all sales each month. All Things Cement offers him a job that pays straight salary, $2500 per month.

Jazhon wants to consider the two jobs mathematically before he makes his decision. He writes the following equations to represent each job offer.

(CE) Concrete Emporium: $E = 0.05s + 500$
(ATC) All Things Cement: $E = 2500$

C.E.

E	S
500	$0.05(0) + 500$
600	$0.05(2000) + 500$
1000	$0.05(10\,000) + 500$
1500	$0.05(20\,000) + 500$
2000	$0.05(30\,000) + 500$
2500	$0.05(40\,000) + 500$

1. What does Jazhon need to consider before he can make an educated decision?

2. Graph the two equations on the grid below.

ATC

solution (40 000, 2500)

Earnings ($)

concrete sales ($)

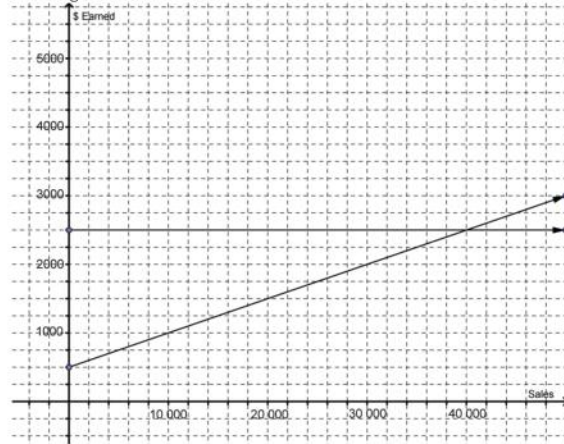3. What is the significance of the point where the two lines cross?

The point where Jazhon's earnings are equal

4. When does the job offered by Concrete Emporium pay more?

when the concrete sales are >$40,000

⑤

Challenge

Concrete Emporium: $E = 0.05s + 500$

All Things Cement: $E = 2500$

Where the lines cross→ earnings are equal.

Concrete Emporium will pay more if Jazhon sells more than $40 000 worth of concrete.

We call the scenario to the left a **System of Linear Equations**.

The point $(40000, 2500)$ is on both lines.

We say $(40000, 2500)$ is the **solution to the system**.

That is...it is the point that **satisfies both equations**.

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5. ## Challenge

Is $(1,3)$ a solution to the following system?

$$y = -2x + 5$$
$$y = x + 2$$

Explain your reasoning.

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Determine if the given point is a solution to the system of equations. Show your work.

6. Is (1,3) a solution to the following system? ① $y = -2x + 5$ ② $y = x + 2$ Substitue $x = 1$ and $y = 3$ into both equations. Equation ① equation ② $y = -2x + 5$ $y = x + 2$ $3 = -2(1) + 5$ $3 = 1 + 2$ $3 = -2 + 5$ $3 = 3$ $3 = 3$ Since the point "satisfies" both equations…it IS the solution. Answer: **YES**	7. Is (-1,1) a solution to the following system? $5x + 6y = 1$ $6x + 2y = -3$	8. Is (2,1) a solution to the following system? $x + 2y = 4$ $x - y = 1$
9. Is (3,3) a solution to the following system? $3y = x + 6$ $3y = -4x + 21$	10. Is (1,2) a solution to the following system? $2x + 2y = 6$ $y = 4x - 2$	11. Is (-1,1) a solution to the following system? $7x = 3y + 10$ $6x + 5y = -1$

12. Explain how you can determine if a given point is the solution to a system of linear equations.

Challenge

13. Find the solution to the following system of equations. $y = 2x + 1$ $y = -3x + 1$	Explain your steps and/or thinking.
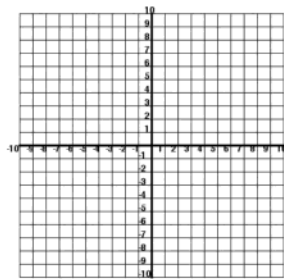
Find the solution to the following system of equations.

$$y = 2x + 1$$
$$y = -3x + 1$$
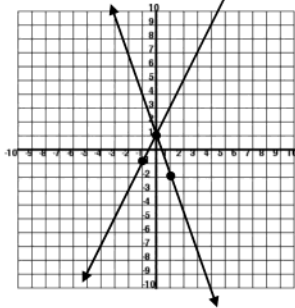
Explain your steps and/or thinking.

I graphed each of the lines.

I found the coordinates of the point that is on both lines
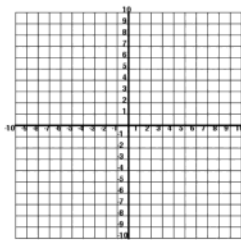
→ where the lines cross!

(0,1)

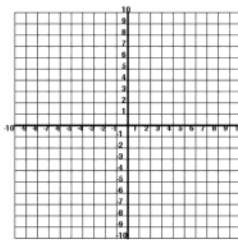Solve the following systems by graphing:

14. Solve:

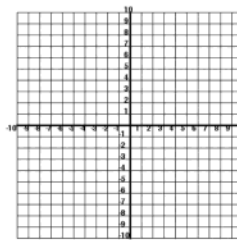$$y = 3x - 1$$
$$y = -2x + 4$$

15. Solve:

$$x - y = -2$$
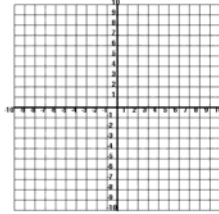$$4x + 2y = 16$$

16. Solve:

$$x + y = 5$$
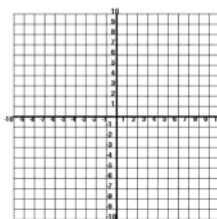$$3x - y = 3$$

Solve the following systems by graphing:

17. Solve:	18. Solve:	19. Solve:
$x + y = 4$ and $x - y = 2$	$y = x - 2$ and $y = \frac{2}{5}x + 1$	$y = -3x + 5$ and $x - 2y = 4$
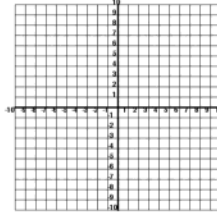
20. Solve:	21. Solve:	22. Solve:
$x + 2y = 8$ and $3x - y = 3$	$5x + 4y = 40$ and $5x + 6y = 60$	$x = 5$ and $y + 4 = 10$
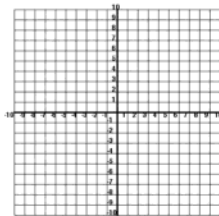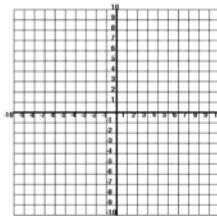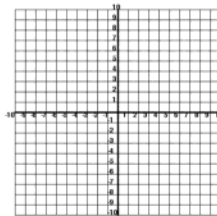
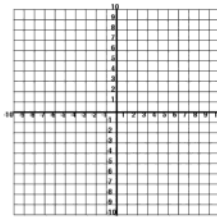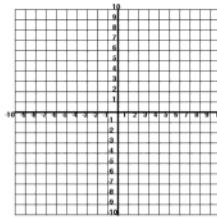| 23. Solve:	24. Solve:	25. Solve:
$y = 2x - 3$ and $y = 2x + 3$	$x - y = 1$ and $3y = 3x - 3$	$2y = 3x - 2$ and $4y + 4 = 6x$
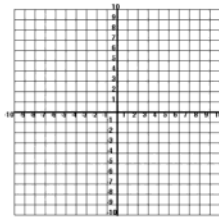
26. What do you notice about the equations above?	27. What do you notice about the equations above?	28. What do you notice about the equations above?

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