MAY 31, 2017

UNIT 4: SYSTEMS OF LINEAR EQUATIONS

7.4: USING A SUBSTITUTION STRATEGY TO SOLVE A SYSTEM OF LINEAR EQUATIONS

M. MALTBY INGERSOLL

NUMBERS, RELATIONS AND FUNCTIONS 10

WHAT'S THE POINT OF TODAY'S LESSON?

We will continue working on the NRF 10 Specific Curriculum Outcome (SCO) "Relations and Functions 10" OR "RF10" which states:

RF10: "Solve problems that involve systems of equations in two variables graphically and algebraically."

What does THAT mean???

SCO RF10 means that we will:

- **model a situation using a system of linear equations**
- **relate a system of linear equations to the context of a problem**
- **determine and verify the solution of a system of linear equations graphically**
- **explain the meaning of the point of intersection of a system of linear equations**
- **determine and verify the solution of a system of linear equations algebraically**
- **explain, using examples, why a system of equations may have no solution, one solution or an infinite number of solutions**
- **explain a strategy to solve a system of linear equations**
- **solve a problem that involves a system of linear equations**

WARM-UP:

page 409, #3 (look at graphs to solve)

a) $(-4, 2)$ and b) $x = -2$; $y = 3$

$x = -4$; $y = 2$ c) $x = 1$; $y = -3$

page 409, #5a (i) - Graph to solve:

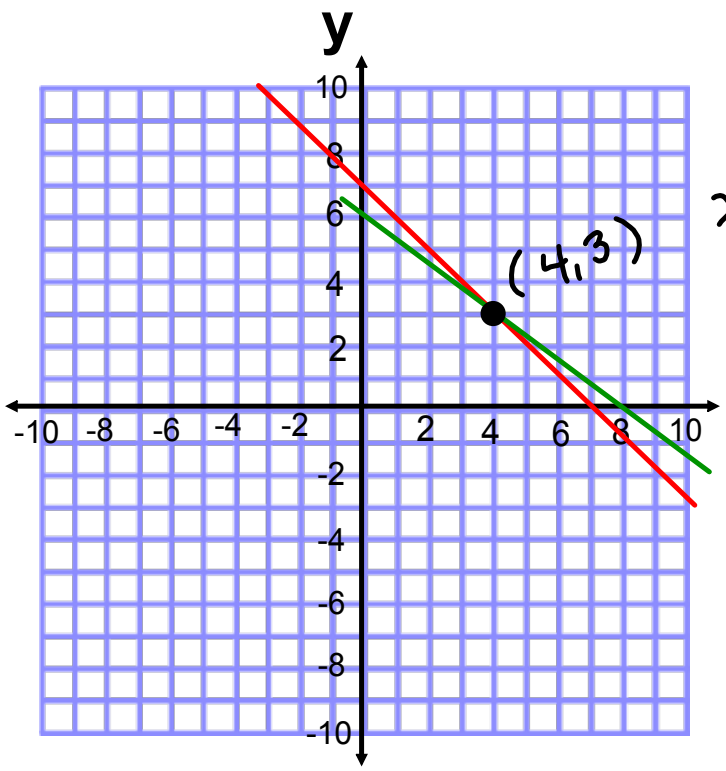
d) $x = -2$; $y = -1$

$x + y = 7$

$3x + 4y = 24$

x-int $= 8$

y-int $= 6$



$x = 4$;

$y = 3$

HOMEWORK QUESTIONS???

EXAMPLE:

a) Write a linear system to model this situation:
To visit the Head-Smashed-In Buffalo Jump interpretive centre near Fort Macleod, Alberta, the admission fee is $5 for a student and $9 for an adult. In one hour, 32 people entered the centre and a total of $180 in admission fees was collected.

b) Graph the linear system then solve this problem: How many students and how many adults visited the centre during this time?

a) The linear system is:

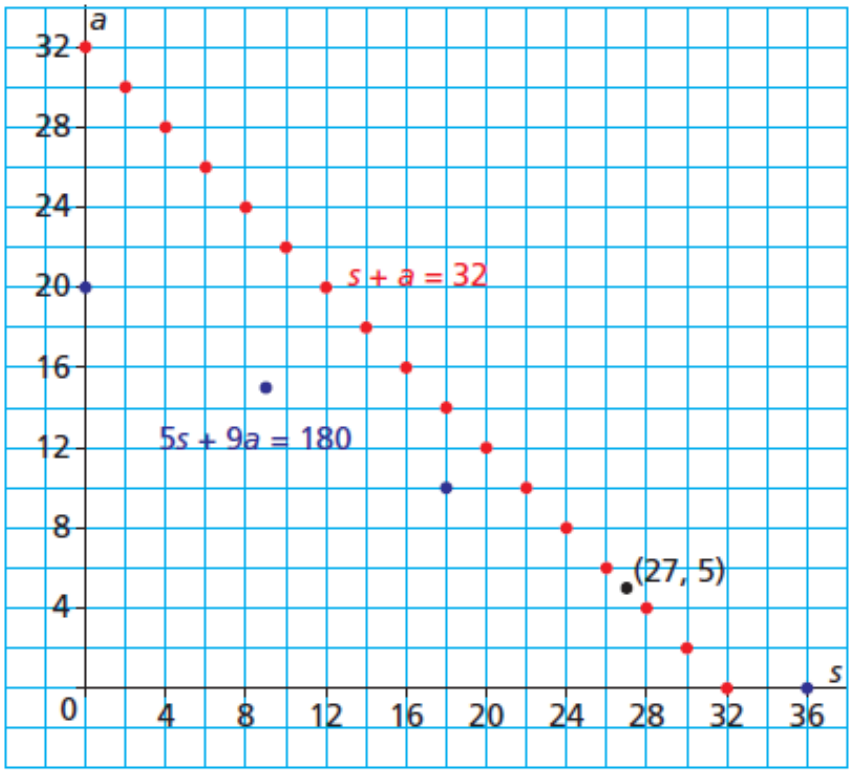
$$s + a = 32$$

$$5s + 9a = 180$$

EXAMPLE:

b) Use intercepts to graph each line.

Equation	a-intercept	s-intercept
$s + a = 32$	32	32
$5s + 9a = 180$	20	36



VERIFICATION: $(27, 5)$

$a + s = 32$

$5 + 27 = 32$ ✓

$9a + 5s = 180$

$9(5) + 5(27) = 180$

$45 + 135 = 180$

$180 = 180$

✓

You currently know how to solve linear systems GRAPHICALLY; however, this strategy is often time-consuming, and you can only approximate the solution then verify it.

We can use algebra to determine an EXACT solution. One algebraic strategy is called SOLVING BY SUBSTITUTION. We do this by transforming a system of two linear equations into a single equation in one variable that we can then solve.

EXAMPLE:

Consider this linear system.

$$3x + 4y = -4 \qquad ①$$

$$x + 2y = 2 \qquad ②$$

In equation ②, the variable x has coefficient 1. So, solve equation ② for x.

$$x + 2y = 2 \qquad ②$$

$$x = -2y + 2$$

Substitute $x = -2y + 2$ in equation ①.

$$3x + 4y = -4 \qquad ①$$

$$3(-2y + 2) + 4y = -4$$

$$-6y + 6 + 4y = -4$$

$$-2y = -10$$

$$y = 5$$

When we know the value of one variable, we substitute for that variable in one of the original equations then solve that equation for the other variable.

Substitute $y = 5$ in equation ②.

$$x + 2y = 2$$

$$x + 2(5) = 2$$

$$x + 10 = 2$$

$$x = -8$$

SOLUTION: x = -8 and y = 5

To verify the solution is correct, we substitute for both variables in the original equations.
In each equation, substitute: $x = -8$ and $y = 5$

$$\begin{aligned} 3x + 4y &= -4 \\ 3(-8) + 4(5) &= -4 \\ -24 + 20 &= -4 \\ -4 &= -4 \end{aligned}$$

$$\begin{aligned} x + 2y &= 2 \\ -8 + 2(5) &= 2 \\ -8 + 10 &= 2 \\ 2 &= 2 \end{aligned}$$

For each equation, the left side is equal to the right side, so the solution is:
$x = -8$ and $y = 5$

YOU TRY!

Solve and verify this linear system:

$2x - 4y = 7$ ①

$4x + y = 5$ ②

$4x + y = 5$ ②

$y = -4x + 5$

$2x - 4y = 7$ ①

$2x - 4(-4x + 5) = 7$

$2x + 16x - 20 = 7$

$18x = 27$

$x = \frac{27}{18}$

$x = \frac{3}{2}$

$x = 1.5$

$2x - 4y = 7$ ①

$2(1.5) - 4y = 7$

$3 - 4y = 7$

$-4y = 4$

$y = -1$

$x = 1.5$; $y = -1$

Verification: $2x - 4y = 7$ $\quad$ $4x + y = 5$

$2(1.5) - 4(-1) = 7$ $\quad$ $4(1.5) - 1 = 5$

$3 + 4 = 7$ $\quad$ $6 - 1 = 5$

$7 = 7$ $\quad$ $5 = 5$

✓

CONCEPT REINFORCEMENT:

***FPCM*:**
PAGE 425: #4 and #5

Attachments

Worksheet - Review of Coordinate Geometry (Math 10).doc

area of a triangle.doc

coord geom review.doc

Puzzle Worksheet - Graphing #2 (Coffee).pdf

Puzzle Worksheet - Graphing #1 (Cow).pdf

Puzzle Worksheet - Slope Point (given both).pdf

Puzzle Worksheet - Slope Point (given two points).pdf

Worksheet - Equation of a Line.pdf

Worksheet Solutions - Equation of a Line.pdf

Worksheet - Distance_Midpoint(2).pdf

Review - Coordinate Geometry.pdf