Day 4 – Solving Systems Using Substitution

Review: Yesterday you learned how to solve systems of equations. Solve the following systems:

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

$3x + 3y = -3$
$3x + 3(-4x + 2) = -3$
$3x - 12x + 6 = -3$
$-9x + 6 = -3$
$-6 \quad -6$
$-9x = -9$
$\frac{-9x}{-9} = \frac{-9}{-9}$
$x = 1$

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

Solution: $(1, -2)$

b. $y = 7x + 2$
$7x - y = -4$ (Be very careful on this one)

$7x - y = -4$
$7x - 1(7x + 2) = -4$
$7x - 7x - 2 = -4$
$-2 \neq -4$
False

Solution: No Solution

c. $-2x - y = -7$
$y = -3x + 7$ (Be very careful on this one)

$-2x - y = -7$
$-2x - 1(-3x + 7) = -7$
$-2x + 3x - 7 = -7$
$1x - 7 = -7$
$+7 \quad +7$
$\frac{1x}{1} = \frac{0}{1}$
$x = 0$

$y = -3x + 7$
$y = -3(0) + 7$
$y = 7$

Solution: $(0, 7)$

d. $y = 2x - 5$
$-2x - 3y = 15$

$-2x - 3y = 15$
$-2x - 3(2x - 5) = 15$
$-2x - 6x + 15 = 15$
$-8x + 15 = 15$
$-15 \quad -15$
$\frac{-8x}{-8} = \frac{0}{-8}$
$x = 0$

$y = 2x - 5$
$y = 2(0) - 5$
$y = -5$

Solution: $(0, -5)$

9

Problem Solving with Substitution

Example 1: Loren's marble jar contains plain marbles and colored marbles. If there are 32 more plain marbles than colored marbles, and there are 180 marbles total, how many of each kind of marble does she have?

a. Define your variables (what two things are you comparing?)

b. Create two equations to describe the scenario.

Equation 1: _____ (relationship between plain and colored marbles)

Equation 2: _____ (number of marbles total)

c. Solve the system:

Example 2: A bride to be had already finished assembling 16 wedding favors when the maid of honor came into the room for help. The bride assembles at a rate of 2 favors per minute. In contrast, the maid of honor works at a speed of 3 favors per minute. Eventually, they will both have assembled the same number of favors. How many favors will each have made? How long did it take?

a. Define your variables (what two things are you comparing?)

x = # minutes

y = total # of favors

b. Create two equations to describe the scenario.

Equation 1: $y = 2x + 16$ (bride's rate)

Equation 2: $y = 3x$ (maid of honor's rate) or $y = 3x + 0$

c. Solve the system:

$y = 2x + 16$

$y = 3x$

$3x = 2x + 16$

$-2x \quad -2x$

$x = 16$ minutes

$y = 3x$

$y = 3(16)$

$y = 48$ favors

(16 min, 48 favors)

10

Example 3: Ben plans to attend the Mercer County Fair and is trying to decide what would be better deal. He can pay $30 for unlimited rides, including admission, or he can pay $12 for admission plus $1 per ride. If Ben goes on a certain number of rides, the two options wind up costing the same amount.

a. Define your variables (what two things are you comparing?)

x = # rides

y = total cost to attend fair

b. Create two equations to describe the scenario.

Equation 1: $y = 30$ or $y = 0x + 30$ (Unlimited Rides)

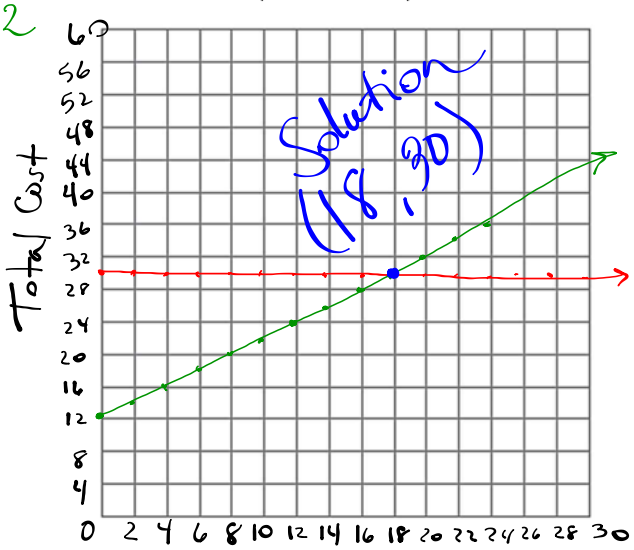
Equation 2: $y = 1x + 12$ (Admission plus number of rides)

c. Create a table of values for each equation:

x y = 30 y = 1x + 12

# of Rides	Unlimited Option	Admission Option
0	30	12
2	30	14
4	30	16
6	30	18
8	30	20
10	30	22
12	30	24
14	30	26
16	30	28
18	30	same 30
20	30	32
22	30	34
24	30	36

d. Graph the two equations:



e. Solve the system algebraically:

$y = 30$

$y = 1x + 12$

$y = 1x + 12$

$30 = 1x + 12$

$-12 \quad -12$

$18 = 1x$

$x = 18$

# of rides

(18 , 30)

rides $

- How many rides can Ben ride to where the two options are the same amount?

  Ben must ride 18 rides.

- When is the Unlimited rides a better option?

  The unlimited option is better when Ben rides more than 18 rides.

- When is the Admission plus number of rides a better option?

  The admission option is better when Ben rides less than 18 rides.

11