Section 2 – Topic 8
Solving Linear Systems Using Substitution

We can use the substitution method to solve and understand the solutions to a real-world problem.

Let's Practice!

1. *U-Haul* charges $25 per day for their small truck rental plus an additional $0.25 per mile. *Ryder* charges $40 plus $0.10 per mile. Let x represent the number of miles driven, $f(x)$ represent *U-Haul's* total charge, and $g(x)$ represent *Ryder's* total charge.

    a. Write expressions for $f(x)$ and $g(x)$ that represent each company's rental charges.

$$f(x) = 25 + .25x \qquad g(x) = 40 + .10x$$

b. What is the solution to the system?

$$25 + .25x = 40 + .10x$$
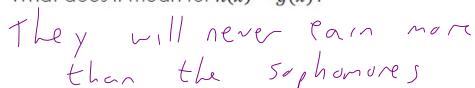$$-25 - .10x \quad -25 - .10x$$
$$.15x = 15$$
$$x = 100$$

c. What does the solution represent?

At 100 miles, the cost is the same.

2. The freshman and sophomore classes are raising money for *Relay for Life*. The freshman class purchased **500** gourmet flavored lollipops for **$240**. They plan to sell their lollipops for **$2** each. The sophomore class purchased **600** candy bars for **$750**. They plan to sell their candy bars for **$3** each. Let x represent the number of items each class could sell, $h(x)$ represent total potential profit for the freshman class and $g(x)$ represent total potential profit for the sophomore class.

a. Write expressions for $h(x)$ and $g(x)$.

freshman

$$h(x) = 2x - 240 \qquad g(x) = 3x - 750$$

b. For what value of x does $h(x) = g(x)$?

$$2x - 240 = 3x - 750$$
$$-2x + 750 \qquad -2x + 750$$
$$510 = x$$
$$x = 510$$

c. What does it mean for $h(x) = g(x)$?

They will never earn more than the sophomores

d. What is a reasonable domain for $h(x)$?

$\{0 \leq x \leq 500\}$ x is an integer

e. What is a reasonable domain for $g(x)$?

$\{0 \leq x \leq 600\}$

f. What do the domains tell us about this situation?

The amount of items they can sell

3. Moviegoers at the local cinema can purchase a large tub of popcorn for $9. For a limited time, the cinema is offering popcorn in a large commemorative *Hunger Games* tub for $25. Moviegoers purchase *Hunger Games* tub refills up to 10 times for $4 each over the next six months.

Let x represent the number of large tubs of popcorn consumed, $f(x)$ represent amount spent on the $9 tubs, and $g(x)$ represent the amount spent on the *Hunger Games* tubs.

a. Write expressions for $f(x)$ and $g(x)$.

$$f(x) = 9x$$

$$g(x) = 25 + 4(x-1)$$
$$25 + 4x - 4 = 21 + 4x$$

b. For what value of x does $f(x) = g(x)$?

$$9x = 21 + 4x$$
$$-4x \qquad\qquad -4x$$
$$\frac{5x}{5} = 21/5$$

$$x = 4.2$$

c. What does it mean for $f(x) = g(x)$?

the cost is the same for both.

d. Write a reasonable domain for $g(x)$.

$$\circledcirc \ \{0 \leq x \leq 16\}$$

e. Explain when it would be a better deal to purchase the commemorative tub.

$$g(x) = 4(10) + 21$$
$$= 40 + 21$$
$$= {}^{\$}61$$

$$g(7) = 63$$

If you purchase the $9 popcorn tub 7 times or more, the commemorative tub is a better deal.

BEAT THE TEST!

Axis Training Studio offers three options for small group training. With Option A, members pay a $50 membership fee per month and $15 per training session. With Option B, members pay $150 per month for unlimited training sessions. With Option C, members pay $1500 per year for unlimited monthly training sessions. The following system represents the monthly rate for the three options, where x represents the number of training sessions attended each month.

$$f(x) = 50 + 15x$$ Option A
$$g(x) = 125$$ Option C
$$h(x) = 150$$ Option B

50+15(6)
50+90=140

Which of the following are true? Select all that apply.

50+15(5)
50+75
125

☑ The monthly rate of Option A is represented by $f(x)$.
☐ The monthly rate for Option C is represented by $h(x)$.
☑ A reasonable domain for the functions is $x \geq 0$.
☐ If a member attends 6 training sessions during a given month, the monthly cost of Option B would be the best deal.
☑ If a member attends 5 training sessions during a given month, the monthly cost of Option A would be equal to the monthly cost of Option C.