

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.

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

$$b) \quad 40 + .10x = 25 + .25x$$

$$\begin{array}{r} 40 = 25 + .15x \\ -25 \quad -25 \end{array}$$

$$\begin{array}{r} 15 = .15x \\ \hline .15 \quad .15 \end{array}$$

$$x = 100$$

c) = At 100 miles, the cost is the same.

$$\begin{array}{r} .15 \overline{)15} \\ 15 \overline{)1500} \end{array}$$

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 $g(x)$.

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

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

$$\begin{array}{r} 2x - 240 = 3x - 750 \\ +240 \qquad +240 \\ \hline 2x = 3x - 510 \\ -3x \quad -3x \\ \hline -x = -510 \\ x = 510 \end{array}$$

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

At 510 pieces sold, the profits will be the same

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

$[0, 500]$

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

$[0, 600]$

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

The freshman class will not earn more than the sophomore class

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 $g(x)$.

$$f(x) = 9x \qquad g(x) = 25 + 4x$$

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

The cost of the popcorn is the same

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

$$\begin{array}{r} 9x = 25 + 4x \\ -4x \quad -4x \end{array} \quad x = 5 \text{ refills}$$

$$5x = 25$$

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

$$[0, 10]$$

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

~~$$\begin{array}{l} 9(4) = 36 \\ 25 + 4(4) \\ 25 + 16 = 41 \end{array}$$~~

$$\begin{array}{l} 9(6) = 54 \\ 25 + 4(6) = \\ 25 + 24 = 49 \end{array}$$

When buying 6 to 10 refills, the commemorative tub is the 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.

c) $\frac{1500}{12}$
 c) 125

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

$50 + 15(6)$
 $50 + 90 = 140$

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

- 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.

$50 + 15(5) = 125$
 $50 + 75 = 125$
 $125 = 125$

