

1.

Two neighboring towns are not having population growth. In fact, they both have been losing population since 1995. The population decline for one of the towns (in thousands) can be represented by the expression $-\frac{2}{5}(x - 500)$, where x represents the number of years since 1995. The population decline for the other town (in thousands) can be represented by the expression $-\frac{1}{2}x + \frac{1}{10}(x + 2000)$, where x represents the number of years since 1995.

- a. In what year will the populations of both towns be the same? Write and solve an equation that represents this situation.

$$-\frac{2}{5}x + 200 = -\frac{5}{10}x + \frac{1}{10}x + 200 \quad -\frac{2}{5}x = -\frac{2}{5}x$$

$$-\frac{2}{5}x + 200 = -\frac{4}{10}x + 200$$

- b. What does your answer from part (a) suggest about the graphs of the two population declines?

They are the same

2.

The Franklin Lee Middle School Glee Club is hosting a Talent Show competition to raise money for a community that was recently hit by a flood. All the members are asked to go out in the community to sell tickets to the show.

- Patrick sold 30 more tickets than Jose. $30 + j$
- Gabriella sold 25 less than two times the amount Patrick sold. $2(30 + j) - 25$
- Owen sold a third of the amount of tickets than Patrick sold. $\frac{1}{3}(30 + j)$
- Desmond sold 15 less than Owen. $\frac{1}{3}(30 + j) - 15$

1. Define a variable for the number of tickets Jose sold.

j

- a. Write algebraic expressions for the number of tickets that each student sold in terms of the number of tickets Jose sold.

- The number of tickets Patrick sold: $30 + j$
 - The number of tickets Gabriella sold: $2(30 + j) - 25$
 - The number of tickets Owen sold: $\frac{1}{3}(30 + j)$
 - The number of tickets Desmond sold: $\frac{1}{3}(30 + j) - 15$
- $P = 30 + 30 = 60$
 $G = 2(30 + 30) - 25 = 95$
 $O = \frac{1}{3}(60) = 20$
 $D = \frac{1}{3}(60) - 15 = 5$

b. If Jose sold 30 tickets, how many did each person sell?

$P = 60$ $O = 20$
 $G = 95$ $D = 5$

3.

Determine if there is one solution, no solution, or an infinite number of solutions.

$$2(3x + 4) - (x - 8) = 3(4x + 2) - 7x + 10$$

$$6x + 8 - x + 8 = 12x + 6 - 7x + 10$$

$$5x + 16 = 5x + 16$$

infinite, $m=5$, $b=16$

4. Solve and check your solution.

$$\frac{-2(5x + 4)}{3} = -3(3x + 2) - \frac{7}{3}$$

$$\frac{3}{1} \left(\frac{-10x - 8}{3} \right) = \left(-9x - 6 - \frac{7}{3} \right) \frac{3}{1}$$

$$-10x - 8 = -27x - 18 - 7$$

$$\begin{array}{r} -10x - 8 = -27x - 25 \\ +27x \quad +27x \\ \hline \end{array}$$

$$17x - 8 = -25$$

$$17x = -17$$

$$x = -1$$

5. Solve and check your solution.

$$\frac{-3(2x + 1)}{4} = 3(x + 4) + \frac{3}{4}$$

$$\frac{4}{1} \left(\frac{-6x - 3}{4} \right) = \left(3x + 12 + \frac{3}{4} \right) \frac{4}{1}$$

$$-6x - 3 = 12x + 48 + 3$$

$$\begin{array}{r} -6x - 3 = 12x + 51 \\ +3 \quad +3 \\ \hline \end{array}$$

$$-6x = 12x + 54$$

$$\begin{array}{r} -6x = 12x + 54 \\ -12x \quad -12x \\ \hline \end{array}$$

$$-18x = 54$$

$$x = -3$$

6.

A submarine is 575 feet below sea level. It is descending at a rate of 325 feet per minute.

a. How many feet below sea level will the submarine be in 5 minutes?

$$2200 \qquad -575 - 325(5)$$

b. How many feet below sea level will the submarine be in 8 minutes?

$$3175 \qquad -575 - 325(8)$$

c. Define a variable for the amount of time the submarine descends. Then use the variable to write an expression that represents the number of feet below sea level the submarine is, given the number of minutes it has been descending.

$$-575 + -325m$$

d. In how many minutes will the submarine be 2850 feet below sea level? Explain your reasoning.

$$\begin{aligned} -575 + -325m &= 2850 \\ m &= 7 \end{aligned}$$

7. Solve and check your solution.

$$\frac{3}{8}(x + 8) = \frac{3}{4}(x + 5) + \frac{1}{8}$$

$$\frac{8}{1} \left(\frac{3}{8}x + 3 = \frac{3}{4}x + \frac{15}{4} + \frac{1}{8} \right)$$

$$3x + 24 = 6x + 30 + 1$$

$$\begin{array}{r} 3x + 24 = 6x + 31 \\ -3x \qquad -3x \\ \hline \end{array}$$

$$\begin{array}{r} 24 = 3x + 31 \\ -31 \qquad -31 \\ \hline \end{array}$$

$$-7 = 3x$$

$$\frac{-7}{3} = x$$

8.

Which is the solution to the equation $\frac{4(x-8)}{5} = -2(3x+1) + \frac{2}{5}$?

a. $\frac{12}{17}$

b. 16

c. no solution

d. infinite solutions

$$\frac{5}{1} \left(\frac{4x-32}{5} \right) = \left(-6x-2 + \frac{2}{5} \right) \frac{5}{1}$$

$$4x-32 = -30x-10+2$$

$$\begin{array}{r} 4x-32 = -30x-8 \\ +30x \qquad +30x \end{array}$$

$$\begin{array}{r} 34x = 32 = -8 \\ +32 \quad +32 \end{array}$$

$$34x = 24$$

$$x = \frac{24}{34} = \frac{12}{17}$$

9.

Ben is the youngest of four children. Bob is 5 years older than Ben, Bridget is twice as old as Bob, and Brian is 3 years younger than Bridget. If Ben is 2 years old, how old is each of his siblings?

$$\text{Ben} = b = 2$$

$$\text{Bob} = b+5 = 2+5$$

$$\text{Bridget} = 2(b+5) = 2(2+5)$$

$$\text{Brian} = 2(b+5) - 3 = 2(2+5) - 3$$

$$\text{Ben} = 2$$

$$\text{Bob} = 7$$

$$\text{Bridget} = 14$$

$$\text{Brian} = 11$$

10.

Which is the solution of the equation $\frac{1}{4}(3x-1) = 2x - \frac{2}{3}$?

a. $\frac{5}{6}$

b. $\frac{1}{3}$

c. no solution

d. infinite solutions

$$\frac{12}{1} \left(\frac{\frac{3}{4}x - \frac{1}{4}}{4} \right) = \left(2x - \frac{2}{3} \right) \frac{12}{1}$$

$$\begin{array}{r} 9x-3 = 24x-8 \\ -9x \qquad -9x \end{array}$$

$$\begin{array}{r} -3 = 15x-8 \\ +8 \qquad +8 \end{array}$$

$$\begin{array}{r} 5 = 15x \\ 15 \quad 15 \end{array}$$

$$\frac{1}{3} = x$$