

## Solving Linear Equations

**Linear Equation** – An equation containing a variable that is raised to the first power. These equations will generally have one variable in the rule of the equation and another variable that names the equation.

**Revenue** – The amount of money brought into a business through sales. Revenue is often calculated as revenue = price \* quantity sold.

**Cost** – The amount of money spent by a business to create and/or sell a product. Cost usually includes both fixed costs and variable costs. Fixed costs are the same each month or year, and variable costs change depending on the number of items produced and/or sold.

**Profit** – The amount of money left after all costs. Profit = Revenue – Cost.

**Break-even point** – A company breaks even when their revenue equals their cost or when their profit is zero.

Examples:

1. You plan to purchase custom-printed lunch coolers for your school staff. If you order 50 or more lunch coolers, there will be a \$45 setup fee, and each lunch cooler will cost \$3.
  - a. Write an equation for the total cost,  $C$ , in dollars for purchasing  $L$  lunch coolers.

$$C = 45 + 3L$$

- b. How much would 75 lunch coolers cost?

$$75 = L$$
$$C = 45 + 3(75) = \$270$$

- c. How many lunch coolers can you purchase with a budget of \$400?

find  $L$

$$\begin{array}{r} 400 = 45 + 3L \\ -45 \quad -45 \\ \hline 355 = 3L \end{array} \rightarrow \frac{355}{3} = \frac{3L}{3} \rightarrow L = 118.\bar{3}$$

118 lunch coolers

2. Determine which given value seems the most reasonable for the given situation.  $S$  is a cook's monthly salary in dollars from working at White Castle Hamburgers.

- a.  $S = 10.50$

- b.  $S = 1600$  *poss. ble*

c.  $S = 28,000$

3. The Squeaky Clean Window Cleaning Company has several costs included in cleaning windows for a business. The materials and cleaning solutions cost about \$1.50 per window. Insurance and salaries for the day will cost about \$230. <sup>fixed</sup> <sup>variable</sup>

- a. Write an equation for the total cost to clean windows for a day depending on the  $n =$  number of windows cleaned.

$$C = 1.50n + 230$$

- b. How much will it cost if the company cleans 60 windows?

$$\begin{aligned} C &= 1.50(60) + 230 \\ &= 90 + 230 \\ &= 320 \end{aligned}$$

- c. How many windows can the company clean if the total cost cannot exceed a budget of \$450?

$$\begin{array}{r} 450 = 1.50n + 230 \\ -230 \quad -230 \\ \hline 220 = 1.50n \\ \frac{220}{1.50} = \frac{1.50n}{1.50} \\ 146.\bar{6} = n \end{array}$$

They can clean 146 windows

4. Golf Carts To Go sells refurbished golf carts in southern Florida. The company has fixed costs of \$26,000 per month for rent, salary, and utilities. They can buy used carts and refurbish them for an average of \$1,400 each. They sell the carts for an average price of \$2,500 each. Golf Carts To Go can refurbish only 55 carts a month.

- a. Write an equation for the monthly cost of refurbishing  $n$  carts.

$$C = 1400n + 26000$$

- b. Write an equation for the monthly revenue from selling golf carts.

$$R = 2500n$$

- c. Write an equation for the monthly profit the company makes if they refurbish and sell  $n$  carts.

$$P = R - C = 2500n - (1400n + 26,000)$$

$$P = 1100n - 26,000$$

- d. What is the profit of refurbishing and selling 25 golf carts?

$$P = 1100(25) - 26,000 = 1,500$$

profit \$1500  
selling 25 g.c

- e. How many golf carts does the company have to refurbish and sell to earn \$20,000 profit?

$$\begin{array}{r} 25,000 = 1100n - 26,000 \\ + 26,000 \quad + 26,000 \\ \hline 51,000 = 1100n \\ \frac{51,000}{1100} = \frac{1100n}{1100} \\ 46.\overline{36} = n \end{array}$$

Sell 47 golf carts

- f. How many golf carts does the company have to refurbish and sell to earn \$40,000 profit?

$$\begin{array}{r} 40,000 = 1100n - 26,000 \\ 26,000 \quad + 26,000 \\ \hline 66,000 = 1100n \\ \frac{66,000}{1100} = \frac{1100n}{1100} \\ 60 = n \end{array}$$

→ No way for company to earn \$40K in a month  
55 is max, 60 is needed

Review Examples: Solve each equation

$$1. \frac{3}{4}x - 17 = 20$$

$$\frac{4}{3} \cdot \frac{3}{4}x = 37 \cdot \frac{4}{3}$$

$$x = \frac{148}{3}$$

$LCD = 8 \cdot 9 = 72$

$$2. \frac{3}{8}p - \frac{4}{9} = \frac{5}{8}p + 7$$

$$72\left(\frac{3}{8}p\right) - 72\left(\frac{4}{9}\right) = 72\left(\frac{5}{8}p\right) + 72 \cdot 7$$

$$\begin{array}{r} 27p - 32 = 45p + 504 \\ -45p + 37 \quad -45p + 37 \\ \hline -18p = 536 \\ -18 \quad -18 \\ \hline p = -\frac{268}{9} \end{array}$$

$$3. \left(\frac{3}{7}(2z-5)\right) = \left(\frac{4}{7}(-3z+9)\right)$$

$$3(2z-5) = 4(-3z+9)$$

$$\begin{array}{r} 6z - 15 = -12z + 36 \\ +12z \quad +12z \\ \hline 18z - 15 = 36 \\ +15 \quad +15 \\ \hline 18z = 51 \\ 18 \quad 18 \\ \hline z = \frac{17}{6} \end{array}$$

$\frac{51}{18} = \frac{17}{6}$

$LCD = 28$

$$4. \left(-\frac{2}{7}(4x+2)\right) = \left(\frac{3}{28}x\right) - 15$$

$$-8(4x+2) = 3x - 420$$

$$\begin{array}{r} -32x - 16 = 3x - 420 \\ -3x + 16 \quad -3x + 16 \\ \hline -35x = -404 \\ -35 \quad -35 \\ \hline x = \frac{404}{35} \end{array}$$