

## Section 3.1

### Linear Equations in Two Unknowns

A linear equation in two unknowns is an equation that can be written in the form  $ax + by = c$  with  $a, b$ , and  $c$  being real numbers. A **solution** of an equation consists of a pair of numbers: a value for  $x$  and a value for  $y$  that satisfy the equation.

### Possible Outcomes for a System of Two Linear Equations in Two Unknowns

- a) **A single (or unique) solution** This happens when the lines corresponding to the two equations are distinct and not parallel so that they intersect at a single point.
- b) **No solution** This happens when the two lines are parallel. We say that the system is inconsistent.
- c) **An infinite number of solutions** This occurs when the two equations represent the same line, and we say that such a system is **redundant**, or **dependent**. In this case, we can represent the solutions by choosing one variable arbitrarily and solving for the other.

In cases a) and c), we say that the system of equations is **consistent** because it has at least one solution.

**Problem 1.** Find all solutions of the given system of equations.

a) 
$$\begin{aligned}x + y &= 4 \\x - y &= 2\end{aligned}$$

b) 
$$\begin{aligned}\frac{x}{3} - \frac{y}{2} &= 1 \\ \frac{x}{4} + y &= -2\end{aligned}$$

c) 
$$\begin{aligned} 0.5x + 0.1y &= 0.7 \\ 0.2x - 0.2y &= 0.6 \end{aligned}$$

d) 
$$\begin{aligned} 2x + 3y &= 1 \\ -x - \frac{3y}{2} &= -\frac{1}{2} \end{aligned}$$

e) 
$$\begin{aligned} 3x - 4y &= 2 \\ 9x - 12y &= 5 \end{aligned}$$

**Problem 2.** Gerber Mixed Cereal for Baby contains, in each serving, 60 calories and 11 grams of carbohydrates. Gerber Mango Tropical Fruit Dessert contains, in each serving, 80 calories and 21 grams of carbohydrates. If you want to provide your child with 200 calories and 43 grams of carbohydrates, how many servings of each should you use?

**Problem 3.** Elena purchased brand  $X$  pens for \$4.00 apiece and brand  $Y$  pens for \$2.80 apiece. If Elena purchased a total of 12 of these pens for \$42.00, how many brand  $X$  pens did she purchase?

**Problem 4.** The demand and supply functions for pet chias are, respectively,  $q = -60p + 150$  and  $q = 80p - 60$ , where  $p$  is the price in dollars. At what price should the chias be marked so that there is neither a surplus nor a shortage of chias?

**Problem 5.** In December, 2003, Bank of America (BAC) cost \$80 per share and yielded 4% per year in dividends, while Royal Bank of Scotland (RBS-K) cost \$28 per share and yielded 7.5% per year in dividends. If you invested a total of \$6800 in these stocks and earned \$370 in dividends in a year, how many shares of each stock did you purchase? (Assume the dividend rate was unchanged for the year).

Homework for this section: Read the section and watch the videos/tutorials. Then do these problems in preparation for the quiz: do #10, 28, 35, 40, 44