

# Linear Models - Word Problems

Write an equation, in slope-intercept form, to model each situation.

1. You rent a bicycle for \$20 plus \$2 per hour.

$$y = 2x + 20$$

$$\begin{aligned} y &= \text{cost (\$)} \\ x &= \text{hours} \end{aligned}$$

2. An auto repair shop charges \$50 plus \$25 per hour.

$$y = 25x + 50$$

$$\begin{aligned} y &= \text{cost (\$)} \\ x &= \text{hours} \end{aligned}$$

3. A candle is 6 inches tall and burns at a rate of  $\frac{1}{2}$  inch per hour.

$$y = -\frac{1}{2}x + 6$$

$$\begin{aligned} y &= \text{height (in)} \\ x &= \text{hours} \end{aligned}$$

4. The temperature is  $15^\circ$  and is expected to fall  $2^\circ$  each hour during the night.

$$y = -2x + 15$$

$$\begin{aligned} y &= \text{temp } (^\circ) \\ x &= \text{hours} \end{aligned}$$

5. A computer technician charges \$75 for a consultation plus \$35 per hour.

$$y = 35x + 75$$

$$\begin{aligned} y &= \text{cost (\$)} \\ x &= \text{hours} \end{aligned}$$

6. The population of Pine Bluff is 6791 and is decreasing at the rate of 7 per year.

$$y = -7x + 6791$$

$$\begin{aligned} y &= \text{population} \\ x &= \text{years} \end{aligned}$$

7. In 1995, Orlando, Florida, was about 175,000. At that time, the population was growing at a rate of about 2000 per year. Write an equation, in slope-intercept form to find Orlando's population for any year.

$$y = 2000x + 175000$$

$x = \text{years after 1995}$   
 $y = \text{population}$

8. Predict what Orlando's population will be in 2010.

$$2010 - 1995 = 15 \text{ years} = x$$

$$y = 2000(15) + 175000 = 30000 + 175000 = 205,000$$

9. Couples are marrying later. The median age of men who tied the knot for the first time in 1970 was 23.2. In 1998, the median age was 26.7. Write an equation, in slope-intercept form to predict the median age that men marry  $M$  for any year  $t$ .

~~23.2~~ In 28 years, age grew 3.5  
 So slope =  $\frac{3.5}{28} = \frac{1}{8}$

$$M = \frac{1}{8}t + 23.2$$

$M = \text{age}, t = \text{years after 1970}$

10. Use the equation in #9 to predict the median age of men who marry for the first time in 2005.

$$2005 = 35 \text{ years after 1970}$$

$$M = \frac{1}{8}(35) + 23.2$$

$$4.375 + 23.2$$

$$M = 27.575$$

11. The cost for 7 dance lessons is \$82. The cost for 11 lessons is \$122. Write a linear equation, slope-intercept form, to find the total cost  $C$  for  $L$  lessons.

$$\begin{aligned} 122 - 82 &= 40 & \text{Slope} &= \frac{40}{4} = 10 \\ 11 - 7 &= 4 \end{aligned}$$

$$C = 10L + ? \rightarrow \boxed{C = 10L + 12}$$

$$\begin{aligned} 82 &= 10 \cdot 7 + ? \\ 82 &= 70 + 12 \end{aligned}$$

12. Use the equation in #11 to find the cost of 4 lessons.

$$\begin{aligned} C &= 10 \cdot 4 + 12 \\ &= 40 + 12 \\ &= 52 \end{aligned}$$

13. It is  $76^\circ$  F at the 6000-foot level of a mountain, and  $49^\circ$  F at the 12,000-foot level of the mountain. Write a linear equation, in slope-intercept form, to find the temperature  $T$  at an elevation  $e$  on the mountain, where  $e$  is in thousands of feet.

$$\begin{aligned} 76 - 49 &= 27 & \text{Slope} &= \frac{27}{-6000} = -\frac{9}{2000} \\ 6000 - 12000 &= -6000 \end{aligned}$$

$$T = -\frac{9}{2000}e + ? \rightarrow T = -\frac{9}{2000}e + 103$$

$$76 = -\frac{9}{2000} \cdot 6 + ?$$

$$76 = -\frac{27}{1000} + ?$$

$$103 = ?$$

14. Use the equation in #13 to predict the temperature at an elevation of 20,000 feet.

$$T = -\frac{9}{2000} \cdot 20 + 103$$

$$T = -90 + 103$$

$$T = 13$$

15. Between 1990 and 1999, the number of movie screens in the United States increased by about 1500 each year. In 1996, there were 29,690 movie screens. Write an equation of a line, in slope-intercept form, to find the total number of screens  $y$  for any year  $x$ .

$$y = 1500x + 29690$$

$y = \# \text{ of movie screens}$   
 $x = \text{years after 1996}$

16. Predict the number of movie screens in the United States in 2005.

2005 = 9 years after 1996.

$$y = 1500 \cdot 9 + 29690$$

$$13500 + 29690 = 43190$$

17. A construction company charges \$15 per hour for debris removal, plus a one-time fee for the use of a trash dumpster. The total fee for 9 hours of service is \$195. Write an equation of a line, in slope-intercept form, to find the total fee  $y$  for any number of hours  $x$ .

$$y = 15x + ?$$

$$195 = 15 \cdot 9 + ?$$

$$195 = 135 + ?$$

$$60 = ?$$

$$y = 15x + 60$$

18. What is the fee for the use of a trash dumpster for 5 hours?

$$y = 15 \cdot 5 + 60$$

$$75 + 60$$

$$y = 135$$