

### Linear Equations Word Problems

1. One of your friends gives you \$10 for a charity walkathon. Another friend gives you an amount per mile. After 5 miles, you have raised \$13.50. Write an equation that represents the amount of money  $y$  you have raised after  $x$  miles.
2. A boa constrictor is 18 inches long at birth and grows 8 inches per year. Write an equation that represents the length  $y$  (in feet) of a boa constrictor that is  $x$  years old.
3. You are parasailing and are being pulled down at a rate of 10 feet per second. After 2 seconds, you are 25 feet above the boat.
  - a. Write the equation that represents your height  $y$  (in feet) above the boat after  $x$  seconds.
  - b. At what height were you parasailing before being pulled in?
4. Your class is taking a trip to the public library. You can travel in small and large vans. A small van holds 8 people and a large van holds 12 people. Your class has 144 people.
  - a. Write an equation that models the possible combinations of small vans and large vans that your class could fill.
  - b. Give three possible combinations of vans.
5. A band is performing at an auditorium for a fee of \$1500. In addition, the band receives 30% of each \$20 ticket sold. The maximum capacity of the auditorium is 800 people.
  - a. Write an equation that represents the band's revenue  $R$  when  $x$  tickets are sold.
  - b. The band needs \$5000 for new equipment. How many tickets must be sold for the band to earn enough money to buy the new equipment?
6. At  $0^{\circ}\text{C}$ , the volume of gas is 22 liters. For each degree the temperature  $T$  (in degrees Celsius) increases, volume (in liters) of the gas increases by  $\frac{2}{25}$ . Write an equation that represents the volume of the gas in terms of the temperature.
7. The initial fee to have a website set up using a server is \$48. It costs \$44 a month to maintain the website.
  - a. Write an equation that gives the total cost of setting up and maintaining a website as a function of the number of months it is maintained.
  - b. Find the total cost of setting up and maintaining the website for 6 months.
8. A dog kennel charges \$20 per night to board your dog. You can also have a doggie treat delivered to your dog for \$5.
  - a. Write an equation that models the possible combinations of nights at the kennel and number of doggie treats that you can buy for \$100.
  - b. What do the intercepts mean in this situation?
9. A camera shop charges \$3.99 for an enlargement of a photograph. Enlargements can be delivered for a charge of \$1.49 per order.
  - a. Write an equation that gives the total cost of an order with delivery as a function of the number of enlargements
  - b. Find the total cost of ordering 8 photograph enlargements with delivery.
10. After it is purchased, the value of a new car decreases \$4000 each year. After 3 years, the car is worth \$18,000.
  - a. Write an equation that represents the value (in dollars) of the car  $x$  years after it is purchased.
  - b. What was the original value of the car?
11. A 100-point test has  $x$  questions worth 2 points apiece and  $y$  questions worth 4 points apiece.
  - a. Write an equation that describes all possible numbers of questions that may be on the test.

- b. If you have 24 questions worth 4 points apiece, how many questions will be worth 2 points apiece?
12. Your family spends \$30 for tickets to an aquarium and \$3 per hour for parking.
- Write an equation that gives the total cost of your family's aquarium visit as a function of the number of hours that you are there.
  - How many hours can you stay at the aquarium if you only have \$50 to spend for the day?
13. You water the plants in our classroom at a constant rate. After 5 seconds, your watering can contains 58 ounces of water. 15 seconds later, the can contains 28 ounces of water.
- Write an equation that represents the amount  $y$  (in ounces) of water in the can after  $x$  seconds.
  - How much water was in the can when you started watering the plants?
  - When is the watering can empty?
14. Louise has \$36 in five-dollar bills and singles.
- Write an equation that describes the number of each type of bill she has.
  - If Louise has 2 five-dollar bills, how many singles does she have?
15. The annual household cost of telephone service in the United States increased at a relatively constant rate of \$27.80 per year from 1981 to 2001. In 2001, the annual household cost of telephone service was \$914.
- Write an equation that gives the annual household cost of telephone service as a function of the number of years since 1981 (Hint:  $x$  = time since 1981; 1981 would be  $x = 0$ )
  - Find the household cost of telephone service in the year you were born.
16. The Ray family bought 4 sandwiches and 3 salads. They spent \$24. Let  $x$  be the cost of a sandwich and  $y$  be the cost of a salad.
- Write an equation that describes the costs of sandwiches and salads.
  - If each sandwich costs \$3.75, how much did each salad cost?
17. From 1990 to 2001, the number of airports in the United States increased at a relatively constant rate of 175 airports per year. There were 19,306 airports in the United States in 2001.
- Write an equation that gives the number of US airports as a function of a number of years since 1990.
  - Find the year in which the number of US airports reached 19,200.
18. At age 12, Patrick weighed 43 kg; at age 14 he weighed 50 kg. Patrick's age and weight are related.
- Find a linear equation relative Patrick's weight to his age.
  - Use your equation to find out Patrick's age when he weighed 38 kg.
19. The store at which Andy usually shops is having a sale. Roast beef is \$4 a pound and shrimp costs \$10 a pound.
- Write an equation to describe different possible combinations of Roast beef and shrimp that he can buy for \$96.
  - What is the greatest amount of shrimp he can buy?
20. The first month a company was open, it had two employees. At the end of 6 months, the company had 10 employees.
- If the number of employees increases at a steady rate, write an equation that illustrates this situation.
  - How many people will be employed by the company after 1 year?

Answers:

1.  $X = \# \text{ miles}$ ,  $y = \text{amount of } \$$

y-intercept = 10 (0, 10)

(5, 13.50)

$$m = \frac{3.5}{5} = \$0.7 \text{ per mile}$$

$$y - 13.50 = .7(x - 5) \text{ or } y = 0.7x + 10$$

2.  $X = \text{years}$ ,  $y = \text{inches}$

$m = 8 \text{ inches per year}$

$b = 18 \text{ inches at birth}$

$$y = 8x + 18$$

3.  $X = \text{seconds}$ ,  $y = \text{height in feet}$

$M = -10 \text{ feet per second}$

(2, 25)

a.  $y - 25 = -10(x - 2)$

b.  $y - 25 = -10(x - 2)$

$$y - 25 = -10x + 20$$

$$y = -10x + 45$$

You were at a height of 45 feet before being pulled in.

4.  $X = \# \text{ small vans}$ ,  $y = \# \text{ large vans}$

small van = 8 people per van

large van = 12 people per van

total = 144

a.  $8x + 12y = 144$

b. *A few examples:*

c.  $8x + 12y = 144$

$$8(3) + 12y = 144$$

$$24 + 12y = 144$$

$$12y = 120$$

$$y = 10$$

3 small and

10 large

$$8x + 12y = 144$$

$$8(9) + 12y = 144$$

$$72 + 12y = 144$$

$$12y = 72$$

$$y = 6$$

9 small and

6 large

$$8x + 12y = 144$$

$$8(6) + 12y = 144$$

$$48 + 12y = 144$$

$$12y = 96$$

$$y = 8$$

6 small and

8 large

5.  $X = \# \text{ tickets}, R = \text{revenue}$   
 y- intercept = \$1500  
 $m = 30\% \text{ of } \$20 = 6$   
 a.  $R = 6x + 1500$   
 b.  $5000 = 6x + 1500$   
 $3500 = 6x$   
 $583.\bar{3} = x$   
 The band needs to sell at least 584 tickets to buy the new equipment
6.  $X = \text{temperature}, y = \text{volume}$   
 $(0, 22)$   
 $M = \frac{2}{25}$   
 $y = \frac{2}{25}x + 22$
7.  $X = \# \text{ months}, y = \text{total cost}$   
 y-intercept = 48  
 $m = \$44 \text{ per month}$   
 a.  $y = 44x + 48$   
 b.  $y = 44(6) + 48$   
 $y = 264 + 48$   
 $y = 312$   
 The cost of maintaining the website for 6 months is \$312.
8.  $X = \# \text{ nights}, y = \# \text{ treats}$   
 Nights = \$20 per night  
 Treats = \$5 per treat  
 a. Total = \$100  
 $20x + 5y = 100$   
 b. X-intercept is how many nights can be bought for \$100 with no treats  
 Y-intercept is how many treats can be bought for \$100 with no nights
9.  $X = \# \text{ of enlargements}, y = \text{total cost}$   
 y- intercept = \$3.99  
 $m = \$1.49 \text{ per order}$   
 a.  $y = 1.49x + 3.99$   
 b.  $y = 1.49(8) + 3.99$   
 $y = 11.92 + 3.99$   
 $y = 15.91$   
 The total cost of 8 enlargements with delivery is \$15.91

10.  $X$  = years,  $y$  = value of car

$M = -\$4000$  per year

(3, 18,000)

a.  $y - 18000 = -4000(x - 3)$

b.  $y - 18000 = -4000(x - 3)$

$$y - 18000 = -4000x + 12000$$

$$y = -4000x + 30000$$

The original value of the car is \$30,000

11.  $X$  = #2 point questions,  $y$  = #4 point questions

2 point questions = 2 points per question

4 point questions = 4 points per question

Total = 100 points

a.  $2x + 4y = 100$

b.  $2x + 4(24) = 100$

$$2x + 96 = 100$$

$$2x = 4$$

$$x = 2$$

If there are 24 4 point questions, there will be 2 2-point questions

12.  $X$  = # hours,  $y$  = total cost

$y$ -intercept = \$30

$m = \$3$  per hour

a.  $y = 3x + 30$

b.  $50 = 3x + 30$

$$20 = 3x$$

$$6.\bar{6} = x$$

For only \$50, you can stay no longer than 6 hours and 40 minutes.

13.  $X$  = seconds,  $y$  = water ounces in can

(5, 58)

(20, 28)

a.  $M = -6$

$$y - 58 = -6(x - 5)$$

b.  $y - 58 = -6x + 30$

$$y = -6x + 88$$

When I started watering, there was 88 ounces in the can.

c.  $0 = -6x + 88$

$$-88 = -6x$$

$$14.\bar{6} = x$$

The can is empty after about 14.7 seconds.

14.  $X$  = # 5 dollar bills,  $y$  = # 1 dollar bills

5 dollar bills = \$5 per bill

1 dollar bills = \$1 per bill

Total = \$36

a.  $5x + y = 36$

b.  $5(2) + y = 36$

$$10 + y = 36$$

$$y = 26$$

If Louise has 2 \$5 bills, then she has \$26 singles.

15.  $X$  = years single 1981,  $y$  = cost of telephone service

$M = \$27.80$  per year

(20, 914)

a.  $y - 914 = 27.80(x - 20)$

b.  $y - 914 = 27.80(2 - 20)$

$$y - 914 = 27.80(-18)$$

$$y - 914 = -500.4$$

$$y = 413.5$$

The cost of telephone service in 1983 was \$413.50

16.  $X$  = cost of a sandwich,  $y$  = cost of a salad

Total = \$24

a.  $4x + 2y = 24$

b.  $4(3.75) + 2y = 24$

$$15 + 2y = 24$$

$$2y = 9$$

$$y = 4.5$$

If a sandwich costs \$3.75, then a salad costs \$4.50.

17.  $X$  = years since 1990,  $y$  = # US airports

$M = 175$  airports per year

(11, 19306)

a.  $y - 19306 = 175(x - 11)$

b.  $19200 - 19306 = 175(x - 11)$

$$-106 = 175x - 1925$$

$$1819 = 175x$$

$$10.39 \approx x$$

There were 19,200 airports sometime between 2000 and 2001.

18.  $X$  = Patrick's age,  $y$  = Patrick's height

(12, 43)

(14, 50)

a.  $M = 3.5$

$$y - 50 = 3.5(x - 14)$$

b.  $38 - 50 = 3.5(x - 14)$

$$-12 = 3.5x - 49$$

$$37 = 3.5x$$

$$10.57 \approx x$$

Patrick was about 10 ½ when he weighed 38 kg.

19.  $X$  = pounds of roast beef,  $y$  = pounds of shrimp

Roast beef = \$4 per pound

Shrimp = \$10 per pound

a. Total \$96

$$4x + 10y = 96$$

b.  $4(0) + 10y = 96$

$$10y = 96$$

$$y = 9.6$$

The most shrimp Andy can buy is 9.6 lbs

20.  $X$  = # months,  $y$  = # employees

$y$ -intercept = 2 (0, 2)

(6, 10)

a.  $M = \frac{4}{3}$  employees per month

b.  $y = \frac{4}{3}x + 2$

$$y = \frac{4}{3}(12) + 2$$

$$y = 16 + 2$$

$$y = 18$$

There will be 18 employees employed after 1 year.