

LINEAR FUNCTIONS

Section 2.1

9. The number of calories in a waffle with t tablespoons of maple syrup is given by the formula $C(t)=82+52t$.

- (a) What does the 52 in the formula represent?
- (b) What does the 82 in the formula represent?

10. The population of a town, t years after it is founded, is given by $P(t)=5000+350t$.

- (a) What is the population when it is founded?
- (b) What is the population of the town one year after it is founded? How much does it increase by during the first year? During the second year?

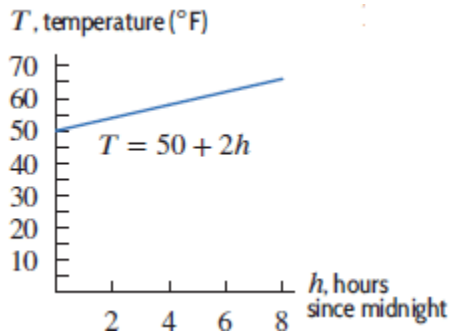
11. The cost, $\$C$, of renting a limousine for h hours above the 4-hour minimum is given by $C=300+100h$.

- (a) What does the 300 represent?(b)

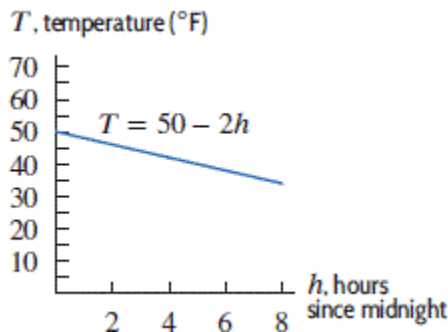
What is the hourly rate?

In Exercises 12 and 13, describe in words how the temperature changes with time, where h is hours since midnight.

12.



13.



In Exercise 16-24, identify the initial value and the rate of change, and explain their meanings in practical terms using units.

16. The population, P , of a city is predicted to be $P=9000+500t$ in t years from now.

17. An orbiting spaceship releases a probe that travels directly away from Earth. The probe's distance s (in km) from Earth after t seconds is given by $s=600+5t$.

18. After a rain storm, the water in a trough begins to evaporate. The amount in gallons remaining after t days is given by $V=50-1.2t$.

19. On a spring day the temperature in degrees Fahrenheit is $T=50+1.2h$, where h is the number of hours since noon.

20. The value of an antique is $2500+80n$ dollars, where n is the number of years since the antique is purchased.

21. A professor calculates a homework grade of $100-3n$ for n missing homework assignments.

22. The cost, C , in dollars, of a high school dance attended by n students is given by $C=500+20n$.

23.

The total amount, C , in dollars, spent by a company on a piece of heavy machinery after t years in service is given by $C=20,000+1500t$.

24. The distance, d , in meters from the shore, of a surfer riding a wave is given by $d=120-5t$, where t is the number of seconds since she caught the wave.

■ In Exercises 25-28,

(a) Is the function linear? (b) Justify your answer.

25. The cost, in dollars, of a ticket for n bus rides is $C(n)=1.60n$.

26. The cost, in dollars, of a video game t months after its release is $C(t)=59-2t$.

27. The cost, in dollars, of having n sandwiches delivered is $C(n)=4.5(n+2)$.

28. The number of gallons of paint needed to paint a square wall with height and length x feet is $P(x)=x^2/350$.

29. If the tickets for a concert cost p dollars each, the number of people who will attend is $2500-80p$.

Which of the following best describes the meaning of the 80 in this expression?

- i. The price of an individual ticket.
- ii. The slope of the graph of attendance against ticket price.
- iii. The price at which no one will go to the concert.
- iv. The number of people who will decide not to go if the price is raised by one dollar.

In Problems 30-35, identify the slope and y-intercept and graph the function.

30.

$$f(x)=2x+3$$

31. $f(x)=4-x$

32. $f(x)=-2+0.5x$

33. $f(x)=3x-2$

34. $f(x)=-2x+5$

35. $f(x)=-0.5x-0.2$

36. PSEG Long Island charges its residential customers a monthly service charge plus an energy charge based on the amount of electricity used.

The monthly cost of electricity is approximated by the function: $C=f(h)=37.60+0.10h$, where h represents the number of kilowatt hours (kWh) of electricity used in excess of 250 kWh.

(a) What does the coefficient 0.10 mean in terms of the cost of electricity?

(b) Find $f(50)$ and interpret its meaning.

■ In Problems 37-40, does the description lead to a linear function? Explain.

37. The distance traveled is the speed, 45 mph, times the number of hours, t .

38. The area of a circle of radius r is πr^2 .

39. The area of a rectangular plot of land w ft wide and 20 ft long is $20w$ ft².

40. The area of a square plot of land x ft on a side is x^2 ft².

44. The following functions describe four different collections of baseball cards. The collections begin with different numbers of cards and cards are bought and sold at different rates. The number, B , of cards in each collection is a function of the number of years, t , that the collection has been held. Describe each of these collections in words.

- (a) $B=200+100t$
- (b) $B=100+200t$
- (c) $B=2000-100t$
- (d) $B=100-200t$

45. The velocity of an object tossed up in the air is modeled by the function $v(t)=48-32t$, where t is measured in seconds, and $v(t)$ is measured in feet per second.

- (a) Create a table of values for the function.
- (b) Graph the function.
- (c) Explain what the constants 48 and -32 tell you about the velocity.
- (d) What does a positive velocity indicate? A negative velocity?

46. The weight, in pounds, of a paperback book with p pages is given by the function $w(p)=20+p1000$.

- (a) Show that this function is linear by writing it in the form $w(p)=b+mp$, where b and m are constants.
- (b) What is the weight of one page of the book?
- (c) Explain the significance of the number 20 in the original form of the formula for $w(p)$.

Section 2.2

In Exercises 7-12, give the constant term and the coefficient of x for each of the linear expressions.

- 7. $3x+4$
- 8. $5x-x+5$
- 9. $w+wx+1$
- 10. $x+rx$
- 11. $mx+mn+5x+m+7$
- 12. $5-2(x+4)+6(2x+1)$

18. When n guests are staying in a room, where $n \geq 2$, the Happy Place Hotel charges, in dollars, $C(n)=79+10(n-2)$.

What is the practical meaning of the 79 and the 10?

19. A salesperson receives a weekly salary plus a commission when the weekly sales exceed \$1000.

The person's total income in dollars for weekly sales of s dollars (where $s \geq 1000$) is given by $T(s)=600+0.15(s-1000)$. What is the practical meaning of the 600 and the 0.15?

20. Ashley receives an MP3 player as a gift. The number of songs in her collection t months after receiving the MP3 player is given by

$$C(t)=500+19(t-24).$$

- (a) What is the practical interpretation of the constants 24 and 500 in the expression for C ?
- (b) Express $C(t)$ in slope-intercept form and interpret the slope and intercept.

21. A company's profit after t months of operation is given by $P(t)=1000+500(t-4)$.

- (a) What is the practical meaning of the constants 4 and 1000?

(b) Rewrite the function in slope-intercept form and give a practical interpretation of the constants.

22. After t hours, Liza's distance from home, in miles, is given by $D(t)=138+40(t-3)$.

(a) What is the practical interpretation of the constants 3 and 138?

(b) Rewrite the function in slope-intercept form and give a practical interpretation of the constants.