

## 140 Chapter 3 Lines, Parabolas, and Systems

b. Find the average weight of a hen when  $d = 10$ .

**Solution:** When  $d = 10$ ,  $w = \frac{127}{5}(10) + 40 = 254 + 40 = 294$ . Thus, the average weight of a hen 10 days after the beginning of the diet is 294 grams.

Now Work Problem 19 <

## PROBLEMS 3.2

In Problems 1–6, find the slope and vertical-axis intercept of the linear function, and sketch the graph.

1.  $y = f(x) = -4x$
2.  $y = f(x) = x + 1$
3.  $h(t) = 5t - 7$
4.  $f(x) = 3(5 - x)$
5.  $p(q) = \frac{5 - q}{3}$
6.  $h(q) = 0.5q + 0.25$

In Problems 7–14, find  $f(x)$  if  $f$  is a linear function that has the given properties.

7. slope = 4,  $f(2) = 8$
8.  $f(0) = 3$ ,  $f(4) = -5$
9.  $f(1) = 2$ ,  $f(-2) = 8$
10. slope =  $-5$ ,  $f(\frac{1}{4}) = 0$
11. slope =  $-\frac{2}{3}$ ,  $f(-\frac{2}{3}) = -\frac{2}{3}$
12.  $f(1) = 1$ ,  $f(2) = 2$
13.  $f(-2) = -1$ ,  $f(-4) = -3$
14. slope = 0.01,  $f(0.1) = 0.01$

**15. Demand Equation** Suppose consumers will demand 60 units of a product when the price is \$15.30 per unit and 35 units when the price is \$19.30 each. Find the demand equation, assuming that it is linear. Find the price per unit when 40 units are demanded.

**16. Demand Equation** The demand per week for a CD is 26,000 copies when the price is \$12 each, and 10,000 copies when the price is \$18 each. Find the demand equation for the CD, assuming that it is linear.

**17. Supply Equation** A refrigerator manufacturer will produce 3000 units when the price is \$940, and 2200 units when the price is \$740. Assume that price,  $p$ , and quantity,  $q$ , produced are linearly related and find the supply equation.

**18. Supply Equation** Suppose a manufacturer of shoes will place on the market 50 (thousand pairs) when the price is 35 (dollars per pair) and 35 when the price is 30. Find the supply equation, assuming that price  $p$  and quantity  $q$  are linearly related.

**19. Cost Equation** Suppose the cost to produce 10 units of a product is \$40 and the cost of 20 units is \$70. If cost,  $c$ , is linearly related to output,  $q$ , find a linear equation relating  $c$  and  $q$ . Find the cost to produce 35 units.

**20. Cost Equation** An advertiser goes to a printer and is charged \$89 for 100 copies of one flyer and \$93 for 200 copies of another flyer. This printer charges a fixed setup cost plus a charge for every copy of single-page flyers. Find a function that describes the cost of a printing job, if  $x$  is the number of copies made.

**21. Electric Rates** An electric utility company charges

total monthly charges for electricity if  $x$  is the number of kilowatt-hours used in a month.

**22. Radiation Therapy** A cancer patient is to receive drug and radiation therapies. Each cubic centimeter of the drug to be used contains 210 curative units, and each minute of radiation exposure gives 305 curative units. The patient requires 2410 curative units. If  $d$  cubic centimeters of the drug and  $r$  minutes of radiation are administered, determine an equation relating  $d$  and  $r$ . Graph the equation for  $d \geq 0$ , and  $r \geq 0$ ; label the horizontal axis as  $d$ .

**23. Depreciation** Suppose the value of a mountain bike decreases each year by 10% of its original value. If the original value is \$1800, find an equation that expresses the value  $v$  of the bike  $t$  years after purchase, where  $0 \leq t \leq 10$ . Sketch the equation, choosing  $t$  as the horizontal axis and  $v$  as the vertical axis. What is the slope of the resulting line? This method of considering the value of equipment is called *straight-line depreciation*.

**24. Depreciation** A new television depreciates \$120 per year, and it is worth \$340 after four years. Find a function that describes the value of this television, if  $x$  is the age of the television in years.

**25. Appreciation** A new house was sold for \$1,183,000 six years after it was built and purchased. The original owners calculated that the house appreciated \$53,000 per year while they owned it. Find a linear function that describes the appreciation of the building, in thousands of dollars, if  $x$  is the number of years since the original purchase.

**26. Appreciation** A house purchased for \$245,000 is expected to double in value in 15 years. Find a linear equation that describes the house's value after  $t$  years.

**27. Repair Charges** A business-copier repair company charges a fixed amount plus an hourly rate for a service call. If a customer is billed \$159 for a one-hour service call and \$287 for a three-hour service call, find a linear function that describes the price of a service call, where  $x$  is the number of hours of service.

**28. Sheep Wool Length** For sheep maintained at high environmental temperatures, respiratory rate,  $r$  (per minute), increases as wool length,  $l$  (in centimeters), decreases.<sup>2</sup> Suppose sheep with a wool length of 2 cm have an (average) respiratory rate of 160, and those with a wool length of 4 cm have a respiratory rate of 125. Assume that  $r$  and  $l$  are linearly related. (a) Find an equation that gives  $r$  in terms of  $l$ . (b) Find the respiratory rate of sheep with a wool length of 1 cm.

**29. Iso-cost Line** In production analysis, an *iso-cost line* is a line whose points represent all combinations of two factors of production that can be purchased for the same amount. Suppose a

charge each month. One customer's monthly bill comes to \$51.65 for 380 kilowatt-hours. Find a linear function that describes the

fertilizer (costing \$200 per ton) and  $y$  acres of land (costing \$2000 per acre). Find an equation of the isocost line that describes the

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<sup>3</sup>Adapted from G. E. Folk, Jr., *Textbook of Environmental Physiology*, 2nd ed. (Philadelphia: Lea & Febiger, 1974).