EXERCISE SET 3.5

MathXL® MyMathLab

Warm-Up Exercises

Fill in the blanks with the appropriate word, phrase, or symbol(s) from the following list.

standard form point-slope form slope-intercept form parallel perpendicular negative reciprocals the same

1. Two lines that have the same slope are _____ lines.
2. Perpendicular lines have slopes that are _____ of each other.
3. The _____ of the equation of a line is $y - y_1 = m(x - x_1)$.
4. The _____ form of the equation of a line is $y = mx + b$.

Practice the Skills

Use the point-slope form to find the equation of a line with the properties given. Then write the equation in slope-intercept form.

5. Slope = 3, through (2, 1)
6. Slope = −3, through (1, −2)
7. Slope = $-\frac{1}{2}$, through (4, −1)
8. Slope = $-\frac{7}{8}$, through (−8, −2)
9. Slope = $\frac{1}{2}$, through (−1, −5)
10. Slope = $-\frac{3}{2}$, through (7, −4)
11. Through (2, −3) and (−6, 9)
12. Through (4, −2) and (1, 9)
13. Through (4, −3) and (6, −2)
14. Through (1, 0) and (−4, −1)

Two points on l_1 and two points on l_2 are given. Determine whether l_1 is parallel to l_2, l_1 is perpendicular to l_2, or neither.

15. l_1: (−2, 0) and (0, 2); l_2: (−3, 0) and (0, 3)
16. l_1: (7, 6) and (3, 9); l_2: (5, −1) and (9, −4)
17. l_1: (4, 6) and (5, 7); l_2: (−1, −1) and (1, 4)
18. l_1: (−3, 4) and (4, −3); l_2: (−5, −6) and (6, −5)
19. l_1: (3, 2) and (−1, −2); l_2: (2, 0) and (3, −1)
20. l_1: (3, 5) and (9, 1); l_2: (4, 0) and (6, 3)

Determine whether the two equations represent lines that are parallel, perpendicular, or neither.

21. $y = x + 9$
    $y = -x + 2$
22. $2x + 3y = 11$
    $y = -\frac{2}{3}x + 4$
23. $4x + 2y = 8$
    $8x = 4 - 4y$
24. $2x - y = 4$
    $3x + 6y = 18$
25. $2x - y = 4$
    $-x + 4y = 4$
26. $6x + 2y = 8$
    $4x - 5 = -y$
27. $y = \frac{1}{2}x - 6$
    $-4y = 8x + 15$
28. $2y - 8 = -5x$
    $y = -\frac{5}{2}x - 2$
29. $y = \frac{1}{2}x + 6$
    $-2x + 4y = 8$
30. $-4x + 6y = 11$
    $2x - 3y = 5$
31. $x - 2y = -9$
    $y = x + 6$
32. $\frac{1}{2}x - \frac{3}{4}y = 1$
    $\frac{3}{5}x + \frac{2}{5}y = -1$

Find the equation of a line with the properties given. Write the equation in the form indicated.

33. Through (2, 5) and parallel to the graph of $y = 2x + 4$ (slope-intercept form)
34. Through (−1, 6) and parallel to the graph of $4x - 2y = 6$ (slope-intercept form)
35. Through (−3, −5) and parallel to the graph of $2x - 5y = 7$ (standard form)
36. Through (−1, 4) and perpendicular to the graph of $y = -2x - 1$ (standard form)
37. With x-intercept (3, 0) and y-intercept (0, 5) (slope-intercept form)
38. Through (−2, −1) and perpendicular to the graph of $f(x) = -\frac{1}{5}x + 1$ (function notation)
39. Through (1, 2) and perpendicular to the graph of $y = -\frac{1}{4}x + 5$ (function notation)
40. Through (−3, 5) and perpendicular to the line with x-intercept (2, 0) and y-intercept (0, 2) (standard form)
41. Through (6, 2) and perpendicular to the line with x-intercept (2, 0) and y-intercept (0, −3) (slope-intercept form)
42. Through the point (1, 2) and parallel to the line through the points (3, 5) and (−2, 3) (function notation)

Problem Solving

43. Treadmill The number of calories burned in 1 hour on a treadmill is a function of the speed of the treadmill. A person walking on a treadmill at a speed of 2.5 miles per hour will burn about 210 calories. At 6 miles per hour the person will burn about 370 calories. Let C be the calories burned in 1 hour and s be the speed of the treadmill.

a) Determine a linear function $C(s)$ that fits the data.

b) Estimate the calories burned by the person on a treadmill in 1 hour at a speed of 5 miles per hour.

44. Inclined Treadmill The number of calories burned for 1 hour on a treadmill going at a constant speed is a function of the incline of the treadmill. At 4 miles per hour a person on a 5° incline will burn 525 calories. At 4 mph on a 15° incline the person will burn 880 calories. Let C be the calories burned and d be the degrees of incline of the treadmill.

a) Determine a linear function $C(d)$ that fits the data.

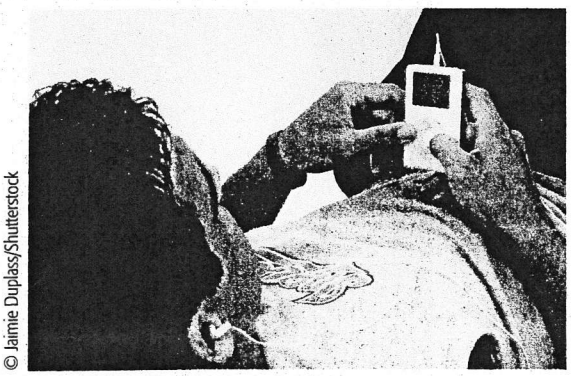
b) Determine the number of calories burned by the person in 1 hour on a treadmill going 4 miles per hour and at a 9° incline.

45. Demand for iPods The *demand* for a product is the number of items the public is willing to buy at a given price. Suppose the demand, d, for iPods sold in 1 month is a linear function of the price, p, for $\$150 \le p \le \$400$. If the price is \$200, then 50 iPods will be sold each month. If the price is \$300, only 30 iPods will be sold.

a) Using ordered pairs of the form (p, d), write an equation for the demand, d, as a function of price, p.

b) Using the function from part **a)**, determine the demand when the price of the iPods is \$260.

c) Using the function from part **a)**, determine the price charged if the demand for iPods is 45.



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46. Demand for New Sandwiches The marketing manager of Arby's restaurants determines that the demand, d, for a new sandwich is a linear function of the price, p, for $\$0.80 \le p \le \$4.00$. If the price is \$1.00, then 530 sandwiches will be sold each month. If the price is \$2.00, only 400 sandwiches will be sold each month.

a) Using ordered pairs of the form (p, d), write an equation for the demand, d, as a function of price, p.

b) Using the function from part **a)**, determine the demand when the price of the sandwich is \$2.60.

c) Using the function from part **a)**, determine the price charged if the demand for sandwiches is 244 sandwiches.

47. Supply of Kites The *supply* of a product is the number of items a seller is willing to sell at a given price. The maker of a new kite for children determines that the number of kites she is willing to supply, s, is a linear function of the selling price p for $\$2.00 \le p \le \$4.00$. If a kite sells for \$2.00, then 130 per month will be supplied. If a kite sells for \$4.00, then 320 per month will be supplied.

a) Using ordered pairs of the form (p, s), write an equation for the supply, s, as a function of price, p.

b) Using the function from part **a)**, determine the supply when the price of a kite is \$2.80.

c) Using the function from part **a)**, determine the price paid if the supply is 225 kites.

48. Supply of Baby Strollers The manufacturer of baby strollers determines that the supply, s, is a linear function of the selling price, p, for $\$200 \le p \le \$300$. If a stroller sells for \$210.00, then 20 strollers will be supplied per month. If a stroller sells for \$230.00, then 30 strollers will be supplied per month.

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a) Using ordered pairs of the form (p, s), write an equation for the supply, s, as a function of price, p.

b) Using the function from part **a)**, determine the supply when the price of a stroller is \$220.00.

c) Using the function from part **a)**, determine the selling price if the supply is 35 strollers.

49. High School Play The income, i, from a high school play is a linear function of the number of tickets sold, t. When 80 tickets are sold, the income is \$1000. When 200 tickets are sold, the income is \$2500.

a) Use these data to write the income, i, as a function of the number of tickets sold, t.

b) Using the function from part **a)**, determine the income if 120 tickets are sold.

c) If the income is \$2200, how many tickets were sold?

50. Gas Mileage of a Car The gas mileage, m, of a specific car is a linear function of the speed, s, at which the car is driven, for $30 \le s \le 60$. If the car is driven at a rate of 30 mph, the car's gas mileage is 35 miles per gallon. If the car is driven at 60 mph, the car's gas mileage is 20 miles per gallon.

a) Use this data to write the gas mileage, m, as a function of speed, s.

b) Using the function from part **a)**, determine the gas mileage if the car is driven at a speed of 48 mph.

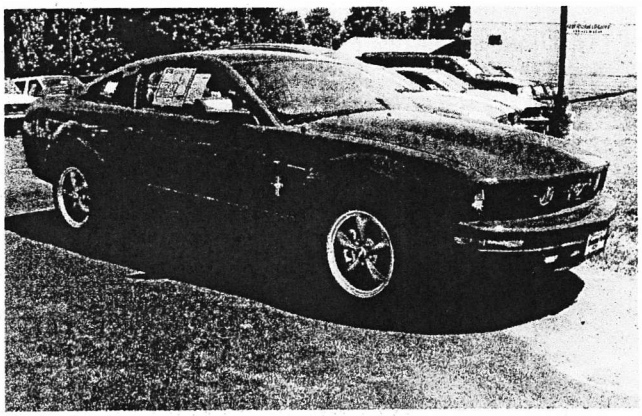
c) Using the function from part **a)**, determine the speed at which the car must be driven to get gas mileage of 40 miles per gallon.

51. Auto Registration The registration fee, r, for a vehicle in a certain region is a linear function of the weight of the vehicle, w, for $1000 \leq w \leq 6000$ pounds. When the weight is 2000 pounds, the registration fee is \$30. When the weight is 4000 pounds, the registration fee is \$50.

a) Use these data to write the registration fee, r, as a function of the weight of the vehicle, w.

b) Using the function from part **a)**, determine the registration fee for a 2006 Ford Mustang if the weight of the vehicle is 3613 pounds.

c) If the cost of registering a vehicle is \$60, determine the weight of the vehicle.



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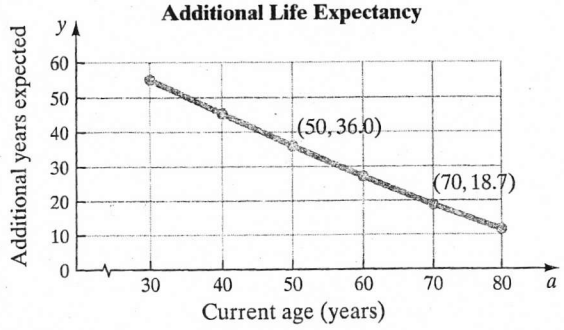
52. Lecturer Salary Suppose the annual salary of a lecturer at Chaumont University is a linear function of the number of years of teaching experience. A lecturer with 9 years of teaching experience is paid \$41,350. A lecturer with 15 years of teaching experience is paid \$46,687.

a) Use this data to write the annual salary of a lecturer, s, as a function of the number of years of teaching experience, n.

b) Using the function from part **a)**, determine the annual salary of a lecturer with 10 years of teaching experience.

c) Using the function from part **a)**, estimate the number of years of teaching experience a lecturer must have to obtain an annual salary of \$44,908.

53. Life Expectancy As seen in the following graph, the expected number of remaining years of life of a person, y, *approximates* a linear function. The expected number of remaining years is a function of the person's current age, a, for $30 \leq a \leq 80$.



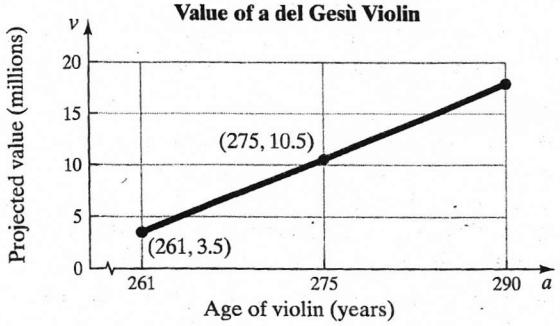
Source: TIAA/CREF

a) Using the two points on the graph, determine the function $y(a)$ that can be used to approximate the graph.

b) Using the function from part **a)**, estimate the additic life expectancy of a person who is currently 37 years

c) Using the function from part **a)**, estimate the current ag a person who has an additional life expectancy of 25 ye

54. Guarneri del Gesù Violin The graph below shows that projected value, v, of a Guarneri del Gesù violin is a lin function of the age, a, in years, of the violin, for $261 \leq a \leq 2$

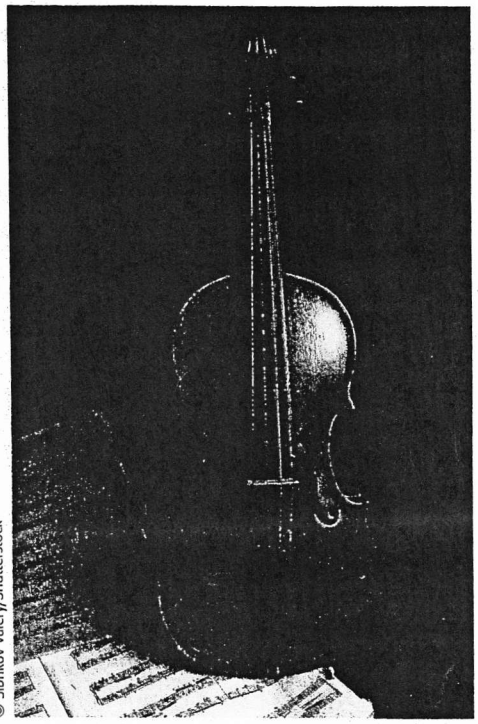


Source: Machold Rare Violins, LTD

a) Determine the function $v(a)$ represented by this line.

b) Using the function from part **a)**, determine the project value of a 265-year-old Guarneri del Gesù violin.

c) Using the function from part **a)**, determine the age of Guarneri del Gesù violin with a projected value of \$ million.



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Guarneri del Gesù, "Sainton," 1741

55. Boys' Weights The diagram on page 193 shows percentile for boys' lengths (heights) and weights from birth to age 36 months. Certain portions of the graphs can be approximated with a linear function. For example, the graph representing the 95th percentile of boys' weights (the top red line) from age 18 months to age 36 months is approximately linear