CHAPTER 3 REVIEW EXERCISES

Section 3.1

For each of the following relations, determine the domain and range and determine whether the relation is a function.

1. $R = \{(-2,9),(-3,-3),(-2,2),(-2,-9)\}$

2. $f = \{(-3,0),(-1,4),(0,3),(3,3),(4,-1)\}$

3. $R = \{(x,2) | x \in \mathbb{R}\}$

4. $S = \{(x,4x) | x \in \mathbb{Z}\}$

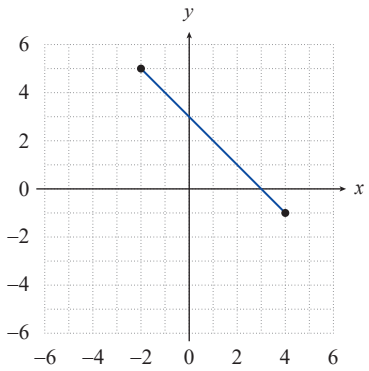
5. $3x - 4y = 17$

6. $x = y^2 - 6$

7. $x = \sqrt{y-4}$

8. $y = -5$

9.



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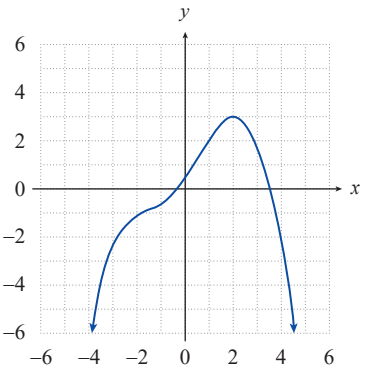
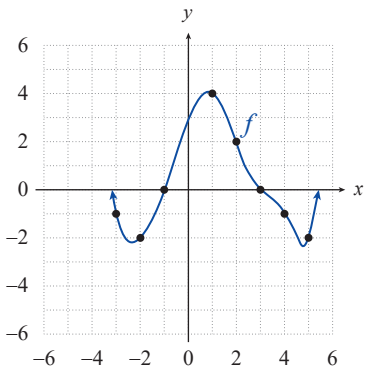


Rewrite each of the following relations as a function of x. Then evaluate the function at $x = -2$.

11. $\dfrac{y+4}{\sqrt{x+11}} - 3y = 3(1-y)$

12. $x^2 - 4x + 3y = x + 2y$

Use the graph below of the function f to answer each of the following questions.



13. What is the value of $f(1)$?

14. What is the value of $f(3)$?

15. For what integer value(s) of x is $f(x) = 0$?

16. For what integer values(s) of x is $f(x) = -2$?

Given $f(x)=\sqrt{x}$ and $g(x)=\sqrt[3]{x^2}$, evaluate the following.

17. $f(x+h)$

18. $\dfrac{f(x+h)-f(x)}{x+h}$

19. $g(x+h)$

20. $\dfrac{g(x+h)-g(x)}{h}$

Identify the domain, the codomain, and the range of each of the following functions.

21. $g:\mathbb{N}\to\mathbb{R}$ by $g(x)=\dfrac{3x}{4}$

22. $h:\mathbb{R}\to\mathbb{R}$ by $h(x)=5x+1$

Determine the implied domain of each of the following functions.

23. $f(x)=\sqrt{|-x-3|}$

24. $f(x)=\dfrac{x}{1-x}$

Section 3.2

Graph the following linear functions.

25. $f(x)=7x-2$

26. $g(x)=\dfrac{2x-6}{3}$

27. $p(x)=-2x-3$

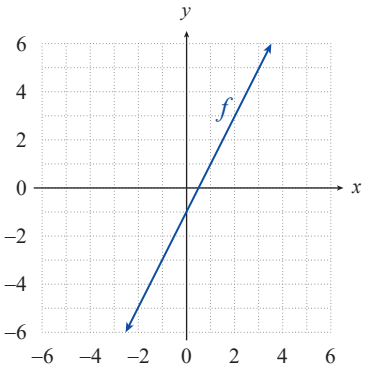
28. $h(x)=-5+\dfrac{x}{4}$

29. $k(x)=2(1-2x)+x$

30. $f(x)=\dfrac{4x+3}{2}-2x$

Find a formula for the linear function depicted in each of the following graphs.

31.



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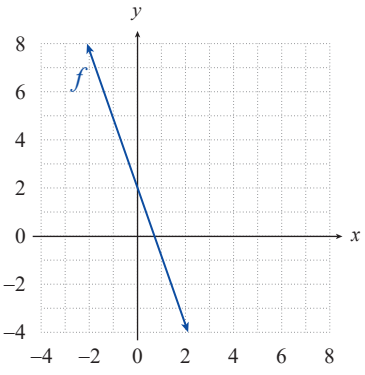


For the given points, **a.** use linear regression to find and graph the line of best fit along with the points, and **b.** find the Pearson correlation coefficient *r*.

33. $(1,2),(2,2),(3,4),(4,6),(5,5)$

Section 3.3

Graph the following quadratic functions, accurately locating the vertices and *x*-intercepts (if any).

34. $f(x) = (x-1)^2 - 1$

35. $g(x) = -(x+3)^2 - 2$

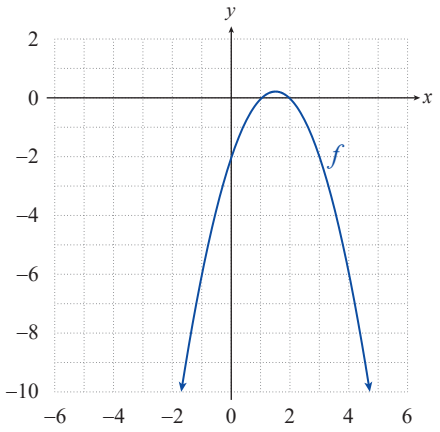
36. $p(x) = x^2 - 2$

37. $k(x) = -x^2 + 4x$

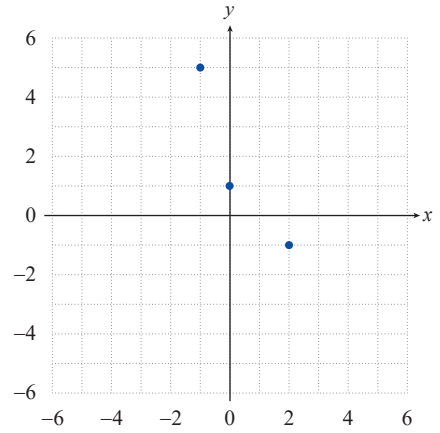
38. $h(x) = x^2 + 2x - 3$

39. $f(x) = -x^2 + 5$

40. For the parabolic graph, **a.** find a formula for the corresponding quadratic function, and **b.** use the formula to determine the coordinates of the parabola's vertex.



41. Given the points graphed in the following figure, **a.** find the quadratic function that best fits the points, and **b.** use your result to determine the coordinates of the vertex of the best-fitting parabola.



42. The total revenue for McDaniel's Storage Plus is given as the function

$$R(x) = -0.4x^2 + 100x - 5250,$$

where x is the number of storage units rented. What number of units rented produces the maximum revenue?

Section 3.4

Sketch the graphs of the following functions. Pay particular attention to intercepts, if any, and locate these accurately.

43. $f(x) = -4|x|$

44. $g(x) = 3\sqrt{x}$

45. $r(x) = \dfrac{1}{x^2}$

46. $p(x) = -2x^4$

47. $q(x) = -\dfrac{1}{x^3}$

48. $k(x) = \dfrac{\sqrt[3]{x}}{2}$

49. $f(x) = 4x^3$

50. $f(x) = -\dfrac{2}{x^2}$

51. $f(x) = \left[\!\left[\dfrac{2x}{3}\right]\!\right]$

52. $f(x) = \begin{cases} x^2 & \text{if } x < 1 \\ \dfrac{1}{x} & \text{if } x \geq 1 \end{cases}$

53. $g(x) = \begin{cases} (x+1)^2 - 1 & \text{if } x \leq 0 \\ \sqrt[3]{x} & \text{if } x > 0 \end{cases}$

54. $h(x) = \begin{cases} -|x| & \text{if } x < 3 \\ (x-4)^2 + 1 & \text{if } x \geq 3 \end{cases}$

55. $f(x) = \begin{cases} x^2 & \text{if } x \leq -2 \\ \dfrac{1}{x^2} & \text{if } x > -2 \end{cases}$

56. $q(x) = \begin{cases} 3x - 1 & \text{if } x < 1 \\ x^4 & \text{if } x \geq 1 \end{cases}$

57. $g(x) = \begin{cases} 2|x| & \text{if } x < 2 \\ \sqrt{x} & \text{if } x \geq 2 \end{cases}$

Section 3.5

Find the mathematical model for each of the following verbal statements.

58. The quantity V varies directly as the product of r squared and h.

59. The value of y varies directly as the cube of a and inversely as the square root of b.

Solve the following variation problems.

60. Suppose that y varies directly as the square of x and that $y = 567$ when $x = 9$. What is y when $x = 4$?

61. Suppose that y is inversely proportional to the square root of x and that $y = 45$ when $x = 64$. What is y when $x = 25$?

62. A video store manager observes that the number of videos rented seems to vary inversely as the price of a rental. If the store's customers rent 1050 videos per month when the price per rental is \$3.49, how many videos per month does he expect to rent if he lowers the price to \$2.99?

Section 3.6

63. Determine the approximate distance between Earth, which has a mass of approximately 6.4×10^{24} kg, and an object that has a mass of 6.42×10^{22} kg, if the gravitational force between them equals approximately 4.95×10^{21} N. Remember, $F=\dfrac{km_1m_2}{d^2}$ and the universal gravitational constant equals $6.67\times10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2$.

64. **a.** Find a model for the volume of a cylindrical can in terms of the can's radius r, given that the surface area of the rectangle used to make the cylindrical portion of the can is constrained to be 100 in^2.
b. Find the height of such a can if the volume is to be 150 in^3.

65. Robert is planning to build a fenced rectangular garden by the side of a road, with fencing that costs \$8/ft for the length along the road and fencing that costs \$5/ft for the other three sides. He wants the garden to have an area of 1200 ft^2.

a. Find a model for the total cost of the fencing.
b. Estimate the size of the garden that will minimize the total cost of the fencing and estimate that minimum cost.

66. Carlotta throws a baseball straight up as hard as she can. It reaches a maximum height of 30 meters, and the table below shows its height in quarter-second intervals from that point on.

a. Graph the heights (either by hand or with a graphing utility) and estimate the time the ball hits the ground.
b. Find the linear function of best fit that models the height of the ball, and graph the function along with the given heights. By the linear model, what is the extrapolated time when the ball hits the ground? What is the calculated linear-model height of the ball at time $t=0$?
c. Find the quadratic function of best fit that models the height of the ball, and graph the function along with the given heights. By the quadratic model, what is the extrapolated time when the ball hits the ground? What is the calculated quadratic-model height of the ball at time $t=0$?

Time t (in seconds)	Height (in meters)
0	30
0.25	29.4
0.5	27.6
0.75	24.5
1.0	20.2
1.25	14.7
1.5	8.0