

Exercises

Answers to selected odd-numbered problems begin on page ANS-7.

blems 1–6, find the indicated function values.

1. $f(x) = x^2 - 1$; $f(-5)$, $f(-\sqrt{3})$, $f(3)$, and $f(6)$

2. $f(x) = -2x^2 + x$; $f(-5)$, $f(-\frac{1}{2})$, $f(2)$, and $f(7)$

3. $f(x) = \sqrt{x+1}$; $f(-1)$, $f(0)$, $f(3)$, and $f(5)$

4. If $f(x) = \sqrt{2x+4}$; $f(-\frac{1}{2})$, $f(\frac{1}{2})$, $f(\frac{3}{2})$, and $f(4)$

5. If $f(x) = \frac{3x}{x^2+1}$; $f(-1)$, $f(0)$, $f(1)$, and $f(\sqrt{2})$

6. If $f(x) = \frac{x^2}{x^3-2}$; $f(-\sqrt{2})$, $f(-1)$, $f(0)$, and $f(\frac{1}{2})$

In Problems 7 and 8, find

$$f(x), f(2a), f(a^2), f(-5x), f(2a+1), \text{ and } f(x+h)$$

for the given function f and simplify as much as possible.

7. $f(x) = -2(x)^2 + 3(x)$

8. $f(x) = (x)^3 - 2(x)^2 + 20$

9. For what values of x is $f(x) = 6x^2 - 1$ equal to 23?

10. For what values of x is $f(x) = \sqrt{x-4}$ equal to 4?

In Problems 11–20, find the domain of the given function f .

11. $f(x) = \sqrt{4x-2}$

12. $f(x) = \sqrt{15-5x}$

13. $f(x) = \frac{10}{\sqrt{1-x}}$

14. $f(x) = \frac{2x}{\sqrt{3x-1}}$

15. $f(x) = \frac{2x-5}{x(x-3)}$

16. $f(x) = \frac{x}{x^2-1}$

17. $f(x) = \frac{1}{x^2-10x+25}$

18. $f(x) = \frac{x+1}{x^2-4x-12}$

19. $f(x) = \frac{x}{x^2-x+1}$

20. $f(x) = \frac{x^2-9}{x^2-2x-1}$

In Problems 21–26, use the sign-chart method to find the domain of the given function f .

21. $f(x) = \sqrt{25-x^2}$

22. $f(x) = \sqrt{x(4-x)}$

23. $f(x) = \sqrt{x^2-5x}$

24. $f(x) = \sqrt{x^2-3x-10}$

25. $f(x) = \sqrt{\frac{3-x}{x+2}}$

26. $f(x) = \sqrt{\frac{5-x}{x}}$

In Problems 27–30, determine whether the graph in the figure is the graph of a function.

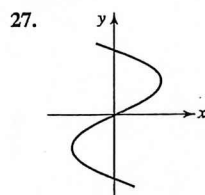


FIGURE 3.1.9 Graph for Problem 27

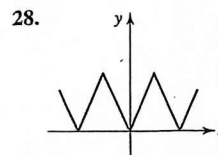


FIGURE 3.1.10 Graph for Problem 28

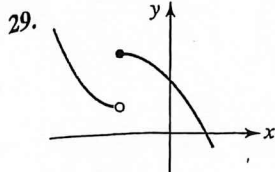


FIGURE 3.1.11 Graph for Problem 29

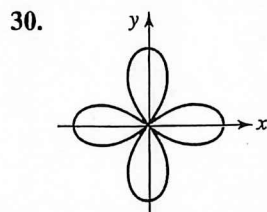


FIGURE 3.1.12 Graph for Problem 30

In Problems 31–34, use the graph of the function f given in the figure to find its domain and range.

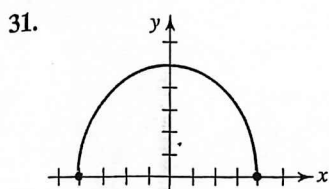


FIGURE 3.1.13 Graph for Problem 31

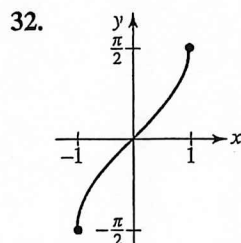


FIGURE 3.1.14 Graph for Problem 32

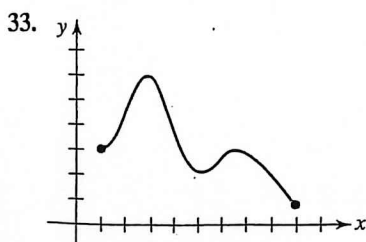


FIGURE 3.1.15 Graph for Problem 33

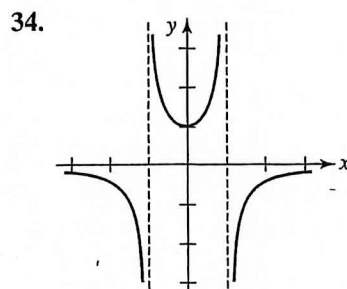


FIGURE 3.1.16 Graph for Problem 34

In Problems 35–42, find the zeros of the given function f .

35. $f(x) = 5x + 6$

36. $f(x) = -2x + 9$

37. $f(x) = x^2 - 5x + 6$

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

39. $f(x) = x(3x - 1)(x + 9)$

40. $f(x) = x^3 - x^2 - 2x$

41. $f(x) = x^4 - 1$

42. $f(x) = 2 - \sqrt{4 - x^2}$

In Problems 43–50, find the x - and y -intercepts, if any, of the graph of the given function f . Do not graph.

43. $f(x) = \frac{1}{2}x - 4$

44. $f(x) = x^2 - 6x + 5$

45. $f(x) = 4(x - 2)^2 - 1$

46. $f(x) = (2x - 3)(x^2 + 8x + 16)$

47. $f(x) = \frac{x^2 + 4}{x^2 - 16}$

48. $f(x) = \frac{x(x + 1)(x - 6)}{x + 8}$

49. $f(x) = \frac{3}{2}\sqrt{4 - x^2}$

50. $f(x) = \frac{1}{2}\sqrt{x^2 - 2x - 3}$

In Problems 51 and 52, find two functions $y = f_1(x)$ and $y = f_2(x)$ defined by the given equation. Find the domain of the functions f_1 and f_2 .

51. $x = y^2 - 5$

52. $x^2 - 4y^2 = 16$

In Problems 53 and 54, use the graph of the function f given in the figure to estimate the values of $f(-3)$, $f(-2)$, $f(-1)$, $f(1)$, $f(2)$, and $f(3)$. Estimate the y -intercept.

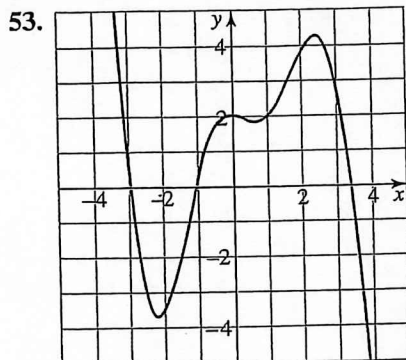


FIGURE 3.1.17 Graph for Problem 53

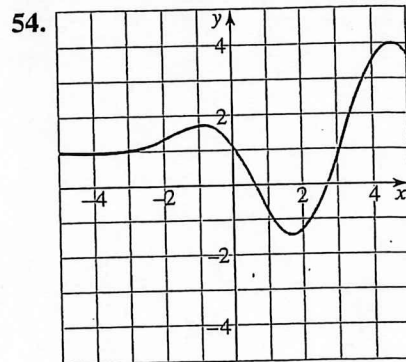


FIGURE 3.1.18 Graph for Problem 54

In Problems 55 and 56, use the graph of the function f given in the figure to estimate the values of $f(-2)$, $f(-1.5)$, $f(0.5)$, $f(1)$, $f(2)$, and $f(3.2)$. Estimate the x -intercepts.

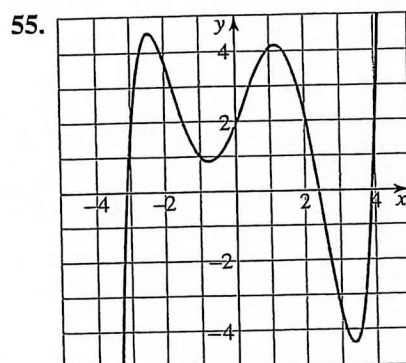


FIGURE 3.1.19 Graph for Problem 55

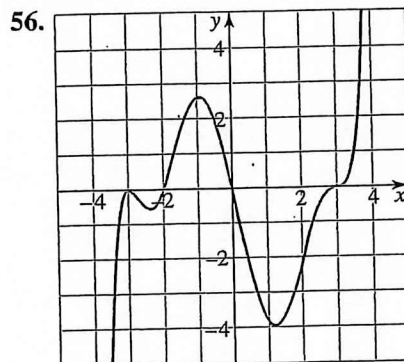


FIGURE 3.1.20 Graph for Problem 56

57. **Factorial Function** In your study of mathematics some of the functions that you will encounter have as their domain the set of positive integers n . The factorial function $f(n) = n!$ is defined as the product of the first n positive integers, that is,

$$f(n) = n! = 1 \cdot 2 \cdot 3 \cdots (n-1) \cdot n.$$

- (a) Evaluate $f(2)$, $f(3)$, $f(5)$, and $f(7)$.
- (b) Show that $f(n+1) = f(n) \cdot (n+1)$.
- (c) Simplify $f(n+2)/f(n)$.

58. **A Sum Function** Another function of a positive integer n gives the sum of the first n squared positive integers:

$$S(n) = \frac{1}{6}n(n+1)(2n+1) = 1^2 + 2^2 + \cdots + n^2.$$

- (a) Find the value of the sum $1^2 + 2^2 + \cdots + 99^2 + 100^2$.
- (b) Find n such that $300 < S(n) < 400$. [Hint: Use a calculator.]