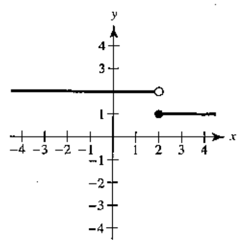
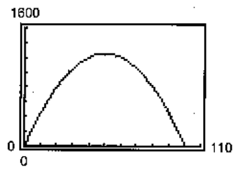
(f) $-H(x-2)+2=\begin{cases}1, & x \geq 2\\ 2, & x < 2\end{cases}$



5. (a) $A(x)=x\left(\dfrac{100-x}{2}\right)$; Domain: $(0, 100)$

(b)



Dimensions $50 \text{ m} \times 25 \text{ m}$ yield maximum area of 1250 square meters.

(c) $50 \text{ m} \times 25 \text{ m}$; Area $= 1250$ square meters

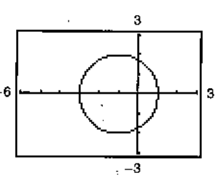
7. $T(x)=\dfrac{2\sqrt{4+x^2}+\sqrt{(3-x)^2+1}}{4}$

9. (a) 5, less (b) 3, greater (c) 4.1, less (d) $4+h$

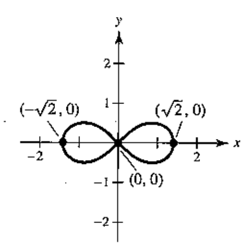
(e) 4; Answers will vary.

11. (a) $x=1, x=-3$

(b) $(x+1)^2+y^2=4$



13. Answers will vary.



Chapter 1

Section 1.1 (page 47)

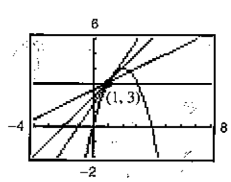
1. Precalculus: 300 feet

3. Calculus: Slope of the tangent line at $x=2$ is 0.16.

5. Precalculus: $\frac{15}{2}$ square units

7. Precalculus: 24 cubic units

9. (a)



(b) The graphs of y_2 approach the tangent line to y_1 at $x=1$.

(c) 2; Use numbers increasingly closer to zero such as 0.2, 0.01, 0.001, ...

11. (a) 5.66 (b) 6.11

(c) Increase the number of line segments.

Section 1.2 (page 54)

1.

x	1.9	1.99	1.999	2.001	2.01	2.1
$f(x)$	0.3448	0.3344	0.3334	0.3332	0.3322	0.3226

$\lim_{x\to 2}\dfrac{x-2}{x^2-x-2}\approx 0.3333$ $\left(\text{Actual limit is } \dfrac{1}{3}.\right)$

3.

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$	0.2911	0.2889	0.2887	0.2887	0.2884	0.2863

$\lim_{x\to 0}\dfrac{\sqrt{x+3}-\sqrt{3}}{x}\approx 0.2887$ $\left(\text{Actual limit is } \dfrac{1}{2\sqrt{3}}.\right)$

5.

x	2.9	2.99	2.999
$f(x)$	-0.0641	-0.0627	-0.0625

x	3.001	3.01	3.1
$f(x)$	-0.0625	-0.0623	-0.0610

$\lim_{x\to 3}\dfrac{[1/(x+1)]-(1/4)}{x-3}\approx -0.0625$ $\left(\text{Actual limit is } -\dfrac{1}{16}.\right)$

7.

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$	0.9983	0.99998	1.0000	1.0000	0.99998	0.9983

$\lim_{x\to 0}\dfrac{\sin x}{x}\approx 1.0000$ (Actual limit is 1.)

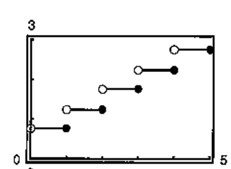
9. 1 **11.** 2

13. Limit does not exist. The function approaches 1 from the right side of 5 but it approaches -1 from the left side of 5.

15. Limit does not exist. The function increases without bound as x approaches $\dfrac{\pi}{2}$ from the left and decreases without bound as x approaches $\dfrac{\pi}{2}$ from the right.

17. Limit does not exist. The function oscillates between 1 and -1 as x approaches 0.

19. (a)



(b)

t	3	3.3	3.4	3.5	3.6	3.7	4
C	1.75	2.25	2.25	2.25	2.25	2.25	2.25

$\lim_{t\to 3.5} C(t)=2.25$

(c)

t	2	2.5	2.9	3	3.1	3.5	4
C	1.25	1.75	1.75	1.75	2.25	2.25	2.25

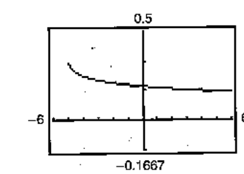
The limit does not exist, because the limits from the right and left are not equal.

21. $\delta = \frac{1}{11} \approx 0.91$ **23.** $L = 8$. Let $\delta = \frac{0.01}{3} \approx 0.0033$.

25. $L = 1$. Assume $1 < x < 3$ and let $\delta = \frac{0.01}{5} = 0.002$.

27. 5 **29.** -3 **31.** 3 **33.** 0 **35.** 4 **37.** 2

39. Answers will vary.

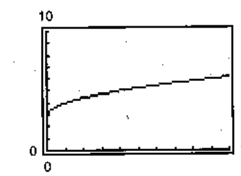


$\lim_{x \to 4} f(x) = \frac{1}{6}$

Domain: $[-5, 4) \cup (4, \infty)$

The graph has a hole at $x = 4$.

41. Answers will vary.



$\lim_{x \to 9} f(x) = 6$

Domain: $[0, 9) \cup (9, \infty)$

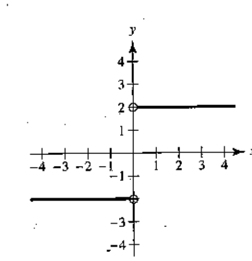
The graph has a hole at $x = 9$.

43. Answers will vary. Sample answer: As x approaches 8 from either side, $f(x)$ becomes arbitrarily close to 25.

45. Examples will vary.

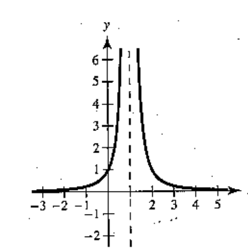
Type 1: $f(x)$ approaches a different number from the right of c than it approaches from the left.

$\lim_{x \to 0} \frac{|2x|}{x}$



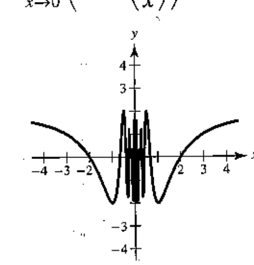
Type 2: $f(x)$ increases or decreases without bound as x approaches c.

$\lim_{x \to 1} \left(\frac{1}{x-1}\right)^2$



Type 3: $f(x)$ oscillates between two fixed values as x approaches c.

$\lim_{x \to 0} \left(2 \cos\left(\frac{\pi}{x}\right)\right)$

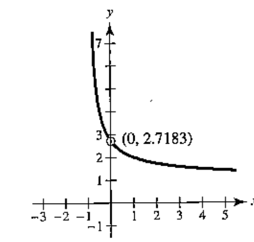


47.

x	-0.001	-0.0001	-0.00001
$f(x)$	2.7196	2.7184	2.7183

x	0.00001	0.0001	0.001
$f(x)$	2.7183	2.7181	2.7169

$\lim_{x \to 0} f(x) \approx 2.7183$



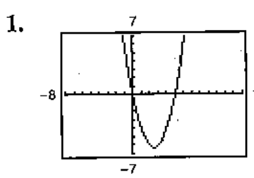
49. False: the existence or nonexistence of $f(x)$ at $x = c$ has no bearing on the existence of the limit of $f(x)$ as $x \to c$.

51. False: see Exercise 11.

53. Answers will vary. **55.** Proof **57.** Proof

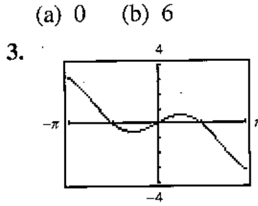
Section 1.3 (page 65)

1.



(a) 0 (b) 6

3.



(a) 0 (b) ≈ 0.52 or $\frac{\pi}{6}$

5. 16

7. -1 **9.** 0 **11.** 7 **13.** $\frac{1}{2}$

15. $-\frac{2}{5}$ **17.** $\frac{35}{3}$ **19.** 2 **21.** 1

23. (a) 4 (b) 64 (c) 64 **25.** (a) 3 (b) 2 (c) 2

27. 1 **29.** $-\frac{1}{2}$ **31.** 1 **33.** $\frac{1}{2}$ **35.** -1

37. (a) 15 (b) 5 (c) 6 (d) $\frac{2}{3}$

39. (a) 64 (b) 2 (c) 12 (d) 8

41. (a) 1 (b) 3

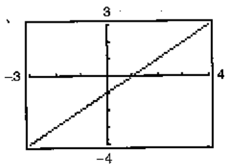
$g(x) = \frac{-2x^2 + x}{x}$ and $f(x) = -2x + 1$ agree except at $x = 0$.

43. (a) 2 (b) 0

$g(x) = \frac{x^3 - x}{x - 1}$ and $f(x) = x^2 + x$ agree except at $x = 1$.

45. -2

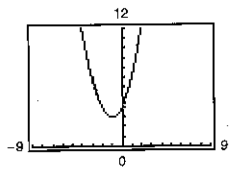
$f(x) = \dfrac{x^2 - 1}{x + 1}$ and $g(x) = x - 1$ agree except at $x = -1$.



The graph has a hole at $x = -1$.

47. 12

$f(x) = \dfrac{x^3 - 8}{x - 2}$ and $g(x) = x^2 + 2x + 4$ agree except at $x = 2$.

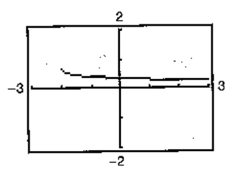


The graph has a hole at $x = 2$.

49. $\dfrac{1}{10}$ **51.** $\dfrac{5}{6}$ **53.** $\dfrac{\sqrt{5}}{10}$ **55.** $\dfrac{1}{6}$

57. $-\frac{1}{9}$ **59.** 2 **61.** $2x - 2$

63.



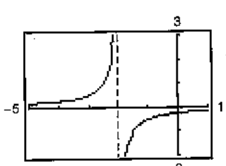
The graph has a hole at $x = 0$.

Answers will vary. Example:

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$	0.358	0.354	0.354	0.354	0.353	0.349

$\displaystyle\lim_{x \to 0} \frac{\sqrt{x+2} - \sqrt{2}}{x} \approx 0.354 \quad \left(\text{Actual limit is } \frac{1}{2\sqrt{2}} = \frac{\sqrt{2}}{4}.\right)$

65.



The graph has a hole at $x = 0$.

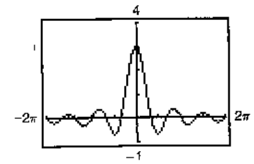
Answers will vary. Example:

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$	-0.263	-0.251	-0.250	-0.250	-0.249	-0.238

$\displaystyle\lim_{x \to 0} \frac{[1/(2+x)] - (1/2)}{x} \approx -0.250 \quad \left(\text{Actual limit is } -\frac{1}{4}.\right)$

67. $\frac{1}{5}$ **69.** 0 **71.** 0 **73.** 0 **75.** 1 **77.** $\frac{3}{2}$

79.



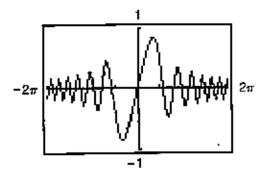
The graph has a hole at $t = 0$.

Answers will vary. Example:

t	-0.1	-0.01	0	0.01	0.1
$f(t)$	2.96	2.9996	?	2.9996	2.96

$\displaystyle\lim_{t \to 0} \frac{\sin 3t}{t} = 3$

81.



The graph has a hole at $x = 0$.

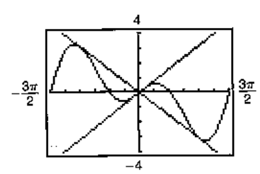
Answers will vary. Example:

x	-0.1	-0.01	-0.001	0	0.001	0.01	0.1
$f(x)$	-0.1	-0.01	-0.001	?	0.001	0.01	0.1

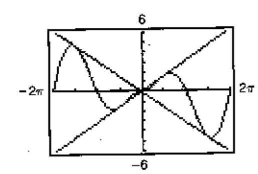
$\displaystyle\lim_{x \to 0} \frac{\sin x^2}{x} = 0$

83. 2 **85.** $-\dfrac{4}{x^2}$ **87.** 4

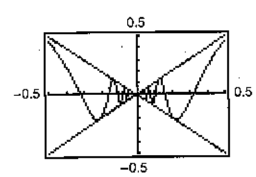
89. 0



91. 0



93. 0

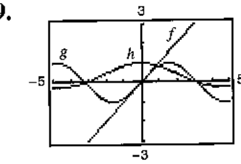


The graph has a hole at $x = 0$.

95. f and g agree at all but one point if c is a real number such that $f(x) = g(x)$ for all $x \neq c$.

97. An indeterminate form is obtained when evaluating a limit using direct substitution produces a meaningless fractional form, such as $\frac{0}{0}$.

99.



The magnitudes of $f(x)$ and $g(x)$ are approximately equal when x is "close to" 0. Therefore, their ratio is approximately 1.

101. 160 feet per second **103.** -29.4 meters per second

105. Let $f(x) = \dfrac{1}{x}$ and $g(x) = -\dfrac{1}{x}$.

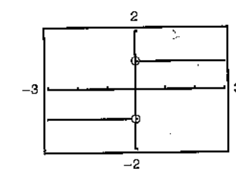
$\lim_{x\to 0} f(x)$ and $\lim_{x\to 0} g(x)$ do not exist.

However, $\lim_{x\to 0}[f(x) + g(x)] = \lim_{x\to 0}\left[\dfrac{1}{x} + \left(-\dfrac{1}{x}\right)\right] = \lim_{x\to 0} 0 = 0$

and therefore does exist.

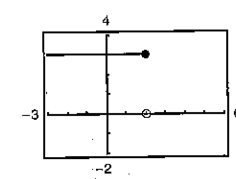
107. Proof **109.** Proof **111.** Proof

113. False. The limit does not exist because the function approaches 1 from the right side of 0 and approaches -1 from the left side of 0. (See graph below.)



115. True. Theorem 1.7

117. False. The limit does not exist because $f(x)$ approaches 3 from the left side of 2 and approaches 0 from the right side of 2. (See graph below.)



119. Let $f(x) = \begin{cases} 4, & \text{if } x \ge 0 \\ -4, & \text{if } x < 0 \end{cases}$

$\lim_{x\to 0} |f(x)| = \lim_{x\to 0} 4 = 4$

$\lim_{x\to 0} f(x)$ does not exist because for $x < 0$, $f(x) = -4$ and for $x \ge 0$, $f(x) = 4$.

121. $\lim_{x\to 0} f(x)$ does not exist because $f(x)$ oscillates between two fixed values as x approaches 0.

$\lim_{x\to 0} g(x) = 0$ because, as x gets increasingly closer to 0, the values of $g(x)$ become increasingly closer to 0.

123. (a) $\dfrac{1}{2}$

(b) Because $\dfrac{1 - \cos x}{x^2} \approx \dfrac{1}{2}$, it follows that

$$1 - \cos x \approx \frac{1}{2}x^2$$

$$\cos x \approx 1 - \frac{1}{2}x^2 \text{ when } x \approx 0.$$

(c) 0.995

(d) Calculator: $\cos(0.1) \approx .9950$

Section 1.4 (page 76)

1. (a) 1 (b) 1 (c) 1

$f(x)$ is continuous on $(-\infty, \infty)$.

3. (a) 0 (b) 0 (c) 0

Discontinuity at $x = 3$

5. (a) 2 (b) -2 (c) Limit does not exist.

Discontinuity at $x = 4$

7. $\frac{1}{10}$

9. Limit does not exist. The function decreases without bound as x approaches -3 from the left.

11. -1 **13.** $-\dfrac{1}{x^2}$ **15.** $\dfrac{5}{2}$ **17.** 2

19. Limit does not exist. The function decreases without bound as x approaches π from the left and increases without bound as x approaches π from the right.

21. 4

23. Limit does not exist. The function approaches 5 from the left side of 3 but approaches 6 from the right side of 3.

25. Discontinuous at $x = -2$ and $x = 2$

27. Discontinuous at every integer

29. Continuous on $[-5, 5]$ **31.** Continuous on $[-1, 4]$

33. Continuous for all real x **35.** Continuous for all real x

37. Nonremovable discontinuity at $x = 1$

Removable discontinuity at $x = 0$

39. Continuous for all real x

41. Removable discontinuity at $x = -2$

Nonremovable discontinuity at $x = 5$

43. Nonremovable discontinuity at $x = -2$

45. Continuous for all real x

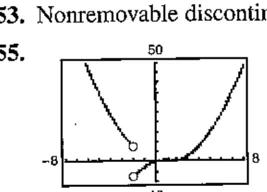
47. Nonremovable discontinuity at $x = 2$

49. Continuous for all real x

51. Nonremovable discontinuities at integer multiples of $\dfrac{\pi}{2}$

53. Nonremovable discontinuity at each integer

55.



$\lim_{x\to 0^+} f(x) = 0$

$\lim_{x\to 0^-} f(x) = 0$

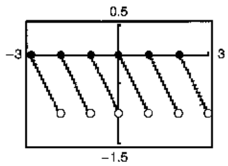
Discontinuity at $x = -2$

57. $a = 2$ **59.** $a = -1$, $b = 1$

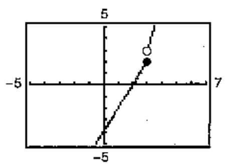
61. Continuous for all real x

63. Nonremovable discontinuities at $x = 1$ and $x = -1$

65. Nonremovable discontinuity at each integer



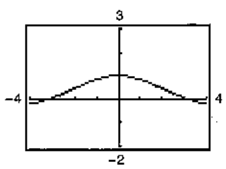
67. Discontinuous at $x = 3$



69. Continuous on $(-\infty, \infty)$

71. $f(x)$ is continuous on the open intervals $\ldots (-6, -2), (-2, 2), (2, 6), \ldots$.

73.



The graph has a hole at $x = 0$.

The graph appears continuous but the function is not continuous on $[-4, 4]$.

It is not obvious from the graph that the function has a discontinuity at $x = 0$.

75. Because $f(x)$ is continuous on the interval $[1, 2]$ and $f(1) = 2.0625$ and $f(2) = -4$, by the Intermediate Value Theorem there exists a real number c in $[1, 2]$ such that $f(c) = 0$.

77. Because $f(x)$ is continuous on the interval $[0, \pi]$ and $f(0) = -3$ and $f(\pi) \approx 8.87$, by the Intermediate Value Theorem there exists a real number c in $[0, \pi]$ such that $f(c) = 0$.

79. 0.68, 0.6823 **81.** 0.56, 0.5636

83. $f(3) = 11$ **85.** $f(2) = 4$

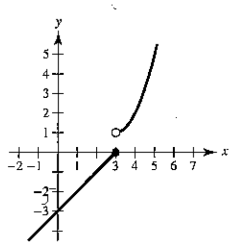
87. (a) The limit does not exist at $x = c$.

(b) The function is not defined at $x = c$.

(c) The limit exists, but it is not equal to the value of the function at $x = c$.

(d) The limit does not exist at $x = c$.

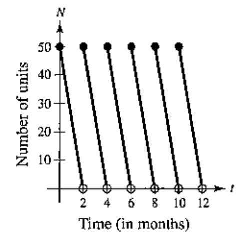
89.



Not continuous because $\lim_{x\to 3} f(x)$ does not exist.

91. $g(x) = f(x)$ where x is an integer, but $g(x) = f(x) + 1$ elsewhere.

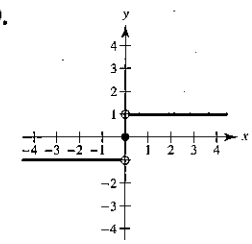
93. The function is discontinuous at every even positive integer. The company must replenish every two months.



95. Because $V(1) = \frac{4}{3}\pi$, $V(5) = 523.6$, and V is continuous, there is at least one real number r, $1 \le r \le 5$, such that $V(r) = 275$.

97. If c is an element of the real numbers, then $\lim_{x\to c} f(x)$ does not exist since there are both rational and irrational numbers arbitrarily close to c. Therefore, f is not continuous at c.

99.



(a) -1

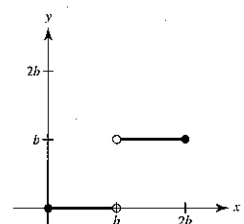
(b) 1

(c) Limit does not exist.

101. True

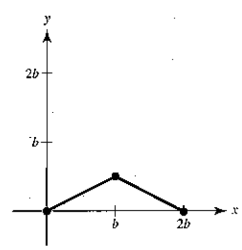
103. False. $f(x)$ is not defined at $x = 1$.

105. (a) $f(x) = \begin{cases} 0, & 0 \le x < b \\ b, & b < x \le 2b \end{cases}$



$f(x)$ is not continuous. There is a discontinuity at $x = b$.

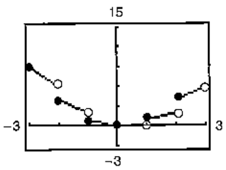
(b) $g(x) = \begin{cases} \frac{1}{2}x, & 0 \le x \le b \\ b - \frac{1}{2}x, & b \le x \le 2b \end{cases}$



$g(x)$ is continuous on $[0, 2b]$ because $g(x)$ is continuous on $[0, b]$ and on $[b, 2b]$, and $\lim_{x\to b} g(x) = g(b)$.

107. Domain: $[-c^2, 0) \cup (0, \infty)$; Let $f(0) = \dfrac{1}{2c}$.

109. $h(x)$ has a nonremovable discontinuity at every integer except 0.



Section 1.5 (page 85)

1. $\lim\limits_{x\to-2^+} 2\left|\dfrac{x}{x^2-4}\right| = \infty \qquad \lim\limits_{x\to-2^-} 2\left|\dfrac{x}{x^2-4}\right| = \infty$

3. $\lim\limits_{x\to-2^+} \tan\dfrac{\pi x}{4} = -\infty \qquad \lim\limits_{x\to-2^-} \tan\dfrac{\pi x}{4} = \infty$

5.

x	−3.5	−3.1	−3.01	−3.001
$f(x)$	0.31	1.64	16.6	167

x	−2.999	−2.99	−2.9	−2.5
$f(x)$	−167	−16.6	−1.7	−0.36

$\lim\limits_{x\to-3^+} f(x) = -\infty \qquad \lim\limits_{x\to-3^-} f(x) = \infty$

7.

x	−3.5	−3.1	−3.01	−3.001
$f(x)$	3.8	16	151	1501

x	−2.999	−2.99	−2.9	−2.5
$f(x)$	−1499	−149	−14	−2.3

$\lim\limits_{x\to-3^+} f(x) = -\infty \qquad \lim\limits_{x\to-3^-} f(x) = \infty$

9. $x = 0$ **11.** $x = 2, \quad x = -1$ **13.** $x = \pm 2$

15. No vertical asymptote

17. $x = \dfrac{\pi}{4} + \dfrac{n\pi}{2}$, n is an integer. **19.** $t = 0$

21. $x = -2, \quad x = 1$ **23.** No vertical asymptote

25. No vertical asymptote **27.** $t = n\pi$, n is a nonzero integer.

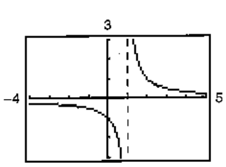
29. Removable discontinuity at $x = -1$

31. Vertical asymptote at $x = -1$

33. $-\infty$ **35.** ∞ **37.** $\frac{4}{5}$ **39.** $\frac{1}{2}$

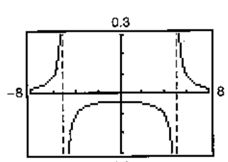
41. $-\infty$ **43.** ∞ **45.** 0 **47.** Does not exist

49.



$\lim\limits_{x\to1^+} f(x) = \infty$

51.

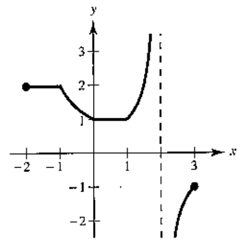


$\lim\limits_{x\to5^-} f(x) = -\infty$

53. Answers will vary.

55. Answers will vary. Example: $f(x) = \dfrac{x-3}{x^2-4x-12}$

57.



59. ∞

61. (a) \$176 million (b) \$528 million (c) \$1584 million

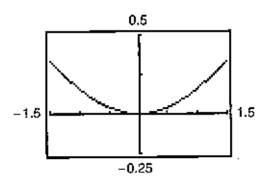
(d) ∞; As the percentage of drugs seized increases and approaches 100%, the cost to the government increases without bound.

63. (a) $\frac{7}{12}$ foot per second (b) $\frac{3}{2}$ feet per second (c) ∞

65. (a)

x	1	0.5	0.2	0.1
$f(x)$	0.1585	0.0411	0.0067	0.0017

x	0.01	0.001	0.0001
$f(x)$	1.7×10^{-5}	1.7×10^{-7}	1.7×10^{-9}

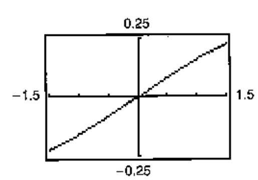


The graph has a hole at $x = 0$.

(b)

x	1	0.5	0.2	0.1
$f(x)$	0.1585	0.0823	0.0333	0.0167

x	0.01	0.001	0.0001
$f(x)$	0.0017	1.7×10^{-4}	1.7×10^{-5}

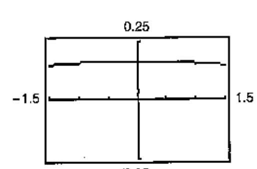


The graph has a hole at $x = 0$.

(c)

x	1	0.5	0.2	0.1
$f(x)$	0.1585	0.1646	0.1663	0.1666

x	0.01	0.001	0.0001
$f(x)$	0.1667	0.1667	0.1667

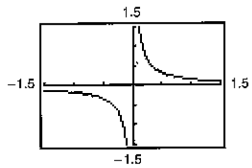


The graph has a hole at $x = 0$.

(d)

x	1	0.5	0.2	0.1
$f(x)$	0.1585	0.3292	0.8317	1.666

x	0.01	0.001	0.0001
$f(x)$	16.67	166.7	1667



The value of the limit when the power on x in the denominator is greater than 3 is ∞.

67. (a) 850 revolutions per minute

(b) Reverse direction

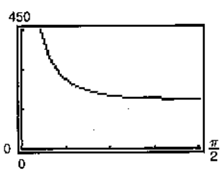
(c) $L = 60 \cot \phi + 30(\pi + 2\phi)$

Domain: $\left(0, \frac{\pi}{2}\right)$

(d)

ϕ	0.3	0.6	0.9	1.2	1.5
L	306.2	217.9	195.9	189.6	188.5

(e)



(f) $60\pi \approx 188.5$

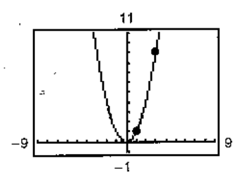
(g) ∞

69. False: let $f(x) = \dfrac{1}{x^2 + 1}$. **71.** False: let $f(x) = \begin{cases} \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$

73. Proof **75.** Proof

Review Exercises for Chapter 1 (page 88)

1. Calculus



Estimate: 8.261

3.

x	−0.1	−0.01	−0.001	0.001
$f(x)$	−1.0526	−1.0050	−1.0005	−0.9995

x	0.01	0.1
$f(x)$	−0.9950	−0.9524

The estimate of the limit of $f(x)$, as x approaches zero, is -1.00.

5. (a) -2 (b) -3

7. 2; Proof **9.** 1; Proof **11.** $\sqrt{6} \approx 2.45$ **13.** $-\frac{1}{4}$

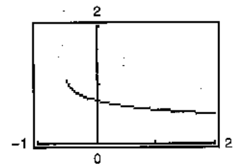
15. $\frac{1}{4}$ **17.** -1 **19.** 75 **21.** 0 **23.** $\frac{\sqrt{3}}{2}$ **25.** $-\frac{1}{2}$

27. (a)

x	1.1	1.01	1.001	1.0001
$f(x)$	0.5680	0.5764	0.5773	0.5773

$\lim_{x\to 1^+} f(x) \approx 0.5773$

(b)



The graph has a hole at $x = 1$.
$\lim_{x\to 1^+} f(x) \approx 0.5774$

(c) $\frac{\sqrt{3}}{3}$

29. -39.2 meters per second **31.** -1 **33.** 0

35. Limit does not exist. The limit as t approaches 1 from the left is 2 whereas the limit as t approaches 1 from the right is 1.

37. Nonremovable discontinuity at each integer
Continuous on $(k, k + 1)$ for all integers k

39. Removable discontinuity at $x = 1$
Continuous on $(-\infty, 1) \cup (1, \infty)$

41. Nonremovable discontinuity at $x = 2$
Continuous on $(-\infty, 2) \cup (2, \infty)$

43. Nonremovable discontinuity at $x = -1$
Continuous on $(-\infty, -1) \cup (-1, \infty)$

45. Nonremovable discontinuity at each even integer
Continuous on $(2k, 2k + 2)$ for all integers k

47. $c = -\frac{1}{2}$ **49.** Proof

51. (a) -4 (b) 4 (c) Limit does not exist.

53. $x = 0$ **55.** $x = 10$ **57.** $-\infty$ **59.** $\frac{1}{3}$

61. $-\infty$ **63.** $-\infty$ **65.** $\frac{4}{5}$ **67.** ∞

69. (a) $14,117.65 (b) $80,000.00 (c) $720,000.00 (d) ∞

P.S. Problem Solving (page 90)

1. (a) Perimeter $\triangle PAO = 1 + \sqrt{(x^2 - 1)^2 + x^2} + \sqrt{x^4 + x^2}$
Perimeter $\triangle PBO = 1 + \sqrt{x^4 + (x - 1)^2} + \sqrt{x^4 + x^2}$

(b)

x	4	2	1
Perimeter $\triangle PAO$	33.0166	9.0777	3.4142
Perimeter $\triangle PBO$	33.7712	9.5952	3.4142
$r(x)$	0.9777	0.9461	1.0000

x	0.1	0.01
Perimeter $\triangle PAO$	2.0955	2.0100
Perimeter $\triangle PBO$	2.0006	2.0000
$r(x)$	1.0475	1.005

(c) 1

3. (a) Area (hexagon) $= \frac{3\sqrt{3}}{2} \approx 2.5981$

Area (circle) $= \pi \approx 3.1416$

Area (circle) − Area (hexagon) ≈ 0.5435

(b) $A_n = \frac{n}{2}\sin\left(\frac{2\pi}{n}\right)$

(c)

n	6	12	24	48	96
A_n	2.5981	3.0000	3.1058	3.1326	3.1394

(d) 3.1416 or π

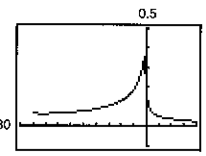
5. (a) $m = -\frac{12}{5}$ (b) $y = \frac{5}{12}x - \frac{169}{12}$

(c) $m_x = \frac{-\sqrt{169 - x^2} + 12}{x - 5}$

(d) $\frac{5}{12}$; It is the same as the slope of the tangent line found in (b).

7. (a) Domain: $[-27, 1) \cup (1, \infty)$

(b)

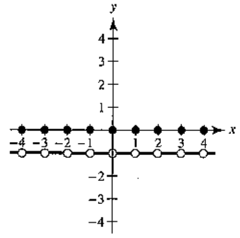


The graph has a hole at $x = 1$.

(c) $\frac{1}{14}$ (d) $\frac{1}{12}$

9. (a) g_1, g_4 (b) g_1 (c) g_1, g_3, g_4

11.



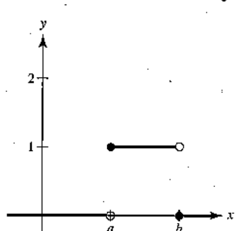
The graph jumps at every integer.

(a) $f(1) = 0,\ f(0) = 0,\ f\left(\frac{1}{2}\right) = -1,\ f(-2.7) = -1$

(b) $\lim_{x\to 1^-} f(x) = -1,\ \lim_{x\to 1^+} f(x) = -1,\ \lim_{x\to 1/2} f(x) = -1$

(c) There is a discontinuity at each integer.

13. (a)



(b) (i) $\lim_{x\to a^+} P_{a,b}(x) = 1$ (ii) $\lim_{x\to a^-} P_{a,b}(x) = 0$

(iii) $\lim_{x\to b^+} P_{a,b}(x) = 0$ (iv) $\lim_{x\to b^-} P_{a,b}(x) = 1$

(c) Continuous for all positive real numbers except a and b

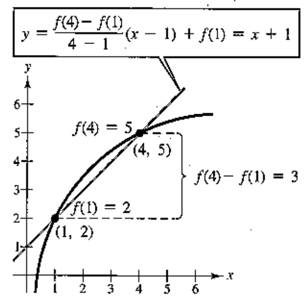
(d) The area under the curve gives a value of 1.

Chapter 2

Section 2.1 (page 101)

1. (a) $m = 0$ (b) $m = -3$

3.



5. $m = -2$ 7. $m = 2$ 9. $m = 3$

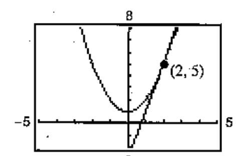
11. $f'(x) = 0$ 13. $f'(x) = -5$ 15. $h'(s) = \frac{2}{3}$

17. $f'(x) = 4x + 1$ 19. $f'(x) = 3x^2 - 12$

21. $f'(x) = \frac{-1}{(x - 1)^2}$ 23. $f'(x) = \frac{1}{2\sqrt{x + 1}}$

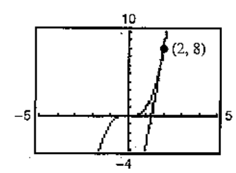
25. (a) Tangent line: $y = 4x - 3$

(b)



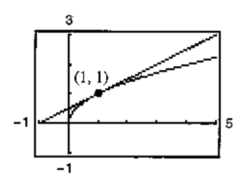
27. (a) Tangent line: $y = 12x - 16$

(b)



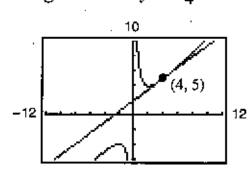
29. (a) Tangent line: $y = \frac{1}{2}x + \frac{1}{2}$

(b)



31. (a) Tangent line: $y = \frac{3}{4}x + 2$

(b)



33. $y = 3x - 2$; $y = 3x + 2$

35. $y = -\frac{1}{2}x + \frac{3}{2}$