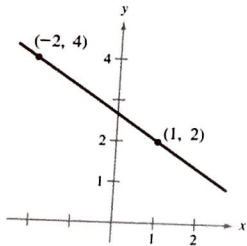


11. $m = -\frac{2}{3}$

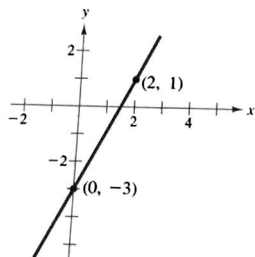


13. (0, 1), (1, 1), (3, 1)

15. (0, 10), (2, 4), (3, 1)

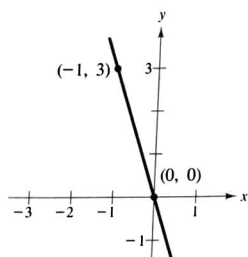
19. m is undefined, no y -intercept

21. $2x - y - 3 = 0$

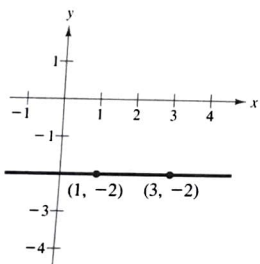


17. $m = -\frac{1}{5}, (0, 4)$

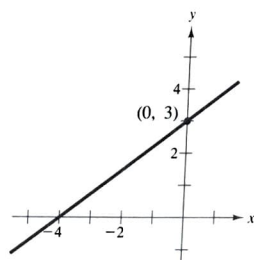
23. $3x + y = 0$



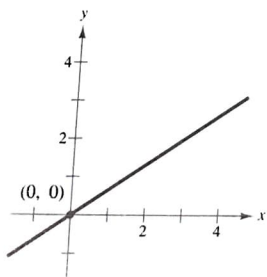
25. $y + 2 = 0$



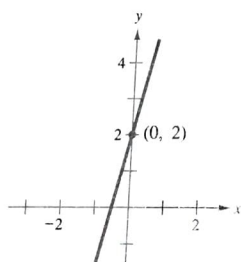
27. $3x - 4y + 12 = 0$



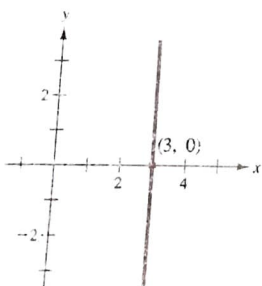
29. $2x - 3y = 0$



31. $4x - y + 2 = 0$



33. $x - 3 = 0$



35. $3x + 2y - 6 = 0$

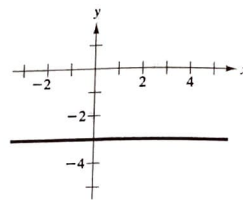
37. $12x + 3y + 2 = 0$

41. (a) $2x - y - 3 = 0$

43. (a) $40x + 24y - 53 = 0$

45. (a) $x - 2 = 0$

47.



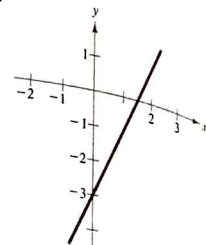
39. $x + y - 3 = 0$

(b) $x + 2y - 4 = 0$

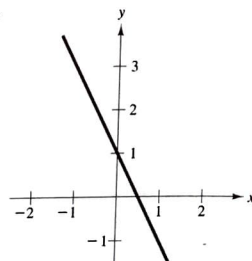
(b) $24x - 40y + 9 = 0$

(b) $y - 5 = 0$

49.



51.



53. $2x - y = 0$

55. Not collinear, because $m_1 \neq m_2$

57. $(0, \frac{-a^2 + b^2 + c^2}{2c})$

59. $(b, \frac{a^2 - b^2}{c})$

61. $5F - 9C - 160 = 0$

63. $C = 0.25x + 95$

65. $y = 875 - 175t$ where $0 \leq t \leq 5$

67. (a) $x = \frac{1}{15}(1130 - p)$

(b) 45 units

(c) 49 units

69. 2 71. $\frac{5\sqrt{2}}{2}$

73. $2\sqrt{2}$

Section 1.5

1. (a) -3 (b) -9 (c) $2b - 3$ (d) $2x - 5$

3. (a) 1 (b) 3 (c) $\sqrt{c + 3}$

(d) $\sqrt{x + \Delta x + 3}$

5. (a) 1 (b) -1 (c) 1 (d) $\frac{|x - 1|}{x - 1}$

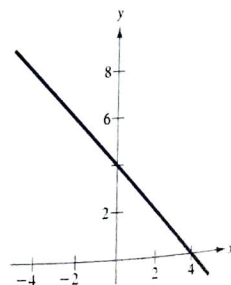
7. $3 + \Delta x$ 9. $3x^2 + 3x\Delta x + (\Delta x)^2$

11. $\frac{-1}{\sqrt{x - 1}(1 + \sqrt{x - 1})}$

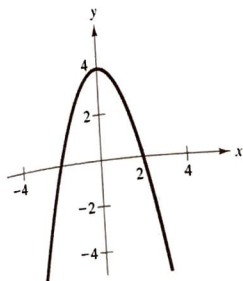
13. $f(x) = 4 - x$

Domain: $(-\infty, \infty)$

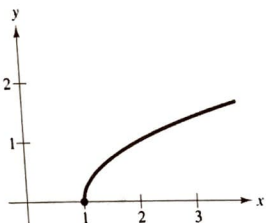
Range: $(-\infty, \infty)$



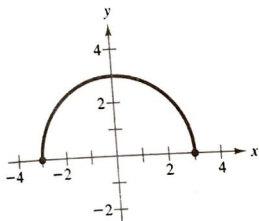
15. $f(x) = 4 - x^2$
 Domain: $(-\infty, \infty)$
 Range: $(-\infty, 4]$



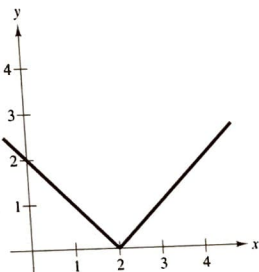
17. $h(x) = \sqrt{x - 1}$
 Domain: $[1, \infty)$
 Range: $[0, \infty)$



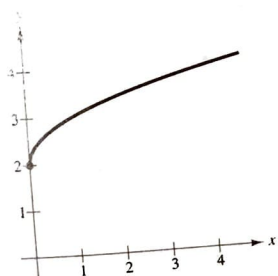
19. $f(x) = \sqrt{9 - x^2}$
 Domain: $[-3, 3]$
 Range: $[0, 3]$



21. $f(x) = |x - 2|$
 Domain: $(-\infty, \infty)$
 Range: $[0, \infty)$

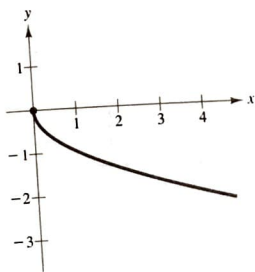


- 23. y is a function of x
- 27. y is a function of x
- 31. y is a function of x
- 35. y is not a function of x
- 37. (a) $y = \sqrt{x + 2}$

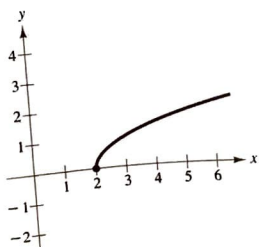


- 25. y is not a function of x
- 29. y is not a function of x
- 33. y is a function of x

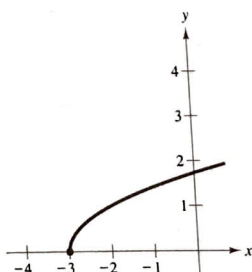
(b) $y = -\sqrt{x}$



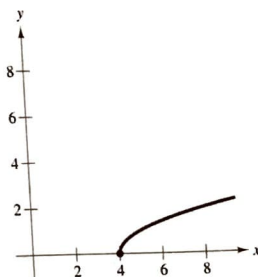
(c) $y = \sqrt{x - 2}$



(d) $y = \sqrt{x + 3}$



(e) $y = \sqrt{x - 4}$



(f) $y = 2\sqrt{x}$



- 39. (a) $y = (x + 3)^2$ (b) $y = x^2 + 3$
- 41. (a) 0 (b) 0 (c) -1 (d) $\sqrt{15}$
- (e) $\sqrt{x^2 - 1}$ (f) $x - 1$

43. $(f \circ g)(x) = x$
 Domain: $[0, \infty)$
 $(g \circ f)(x) = |x|$
 Domain: $(-\infty, \infty)$

45. $(f \circ g)(x) = \frac{x + 1}{x}$
 Domain: $(-\infty, 0), (0, \infty)$
 $(g \circ f)(x) = \frac{1}{x + 1}$
 Domain: $(-\infty, -1), (-1, \infty)$

- 47. $x = \pm 3$ 49. $\frac{10}{7}$ 51. Even 53. Odd

59. $R(x) = 4 - \frac{x^2}{2}$, $r(x) = 2$

61. $h(x) = x^2$, $p(x) = x$

63. $A = xy = x\left(\frac{100 - 2x}{2}\right) = x(50 - x)$

65. $V = x(12 - 2x)^2$ 67. $V = 108x^2 - 4x^3$

69. $T = \frac{\sqrt{x^2 + 4}}{2} + \frac{\sqrt{x^2 - 6x + 10}}{4}$

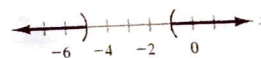
71. $(A \circ r)(t) = 0.36\pi t^2$
 $A \circ r$ represents the area of the circle at time t .

Review Exercises for Chapter 1

1. $-1 \leq x \leq 5$



3. $x < -5$, $x > -1$

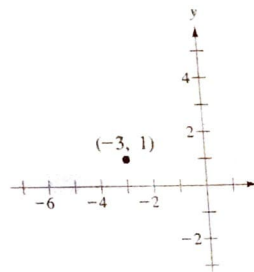
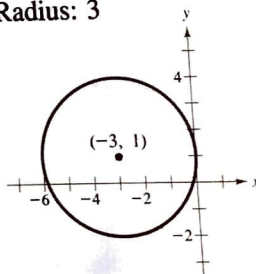


5. $\frac{27}{16}$ 7. $(-1, 3), (3, 2), (1, 1)$

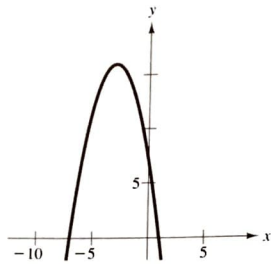
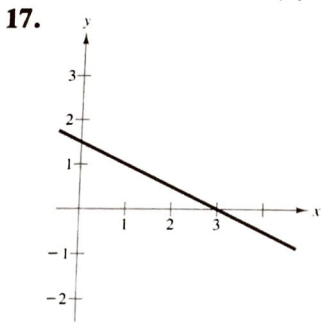
9. Center: $(-3, 1)$

Radius: 3

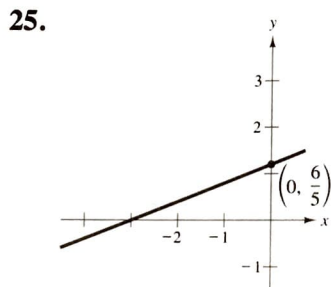
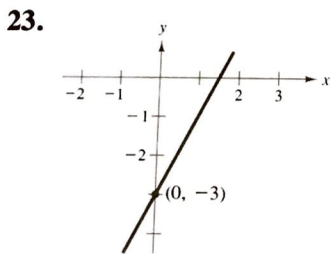
11. Point: $(-3, 1)$



13. $c = -21$ 15. $x^2 + y^2 - 2x - 4y - 4 = 0$
 (a) on the circle
 (b) inside the circle
 (c) outside the circle
 (d) inside the circle



21. The points are not collinear.

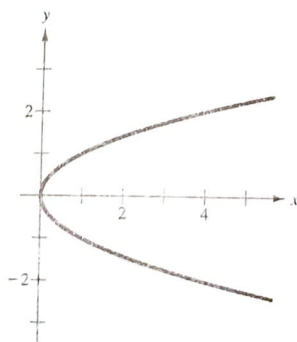
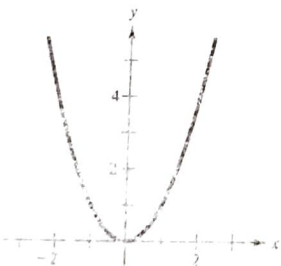


27. (a) $7x - 16y + 78 = 0$ 29. $(-4, 5)$ 31. $(4, 1)$
 (b) $5x - 3y + 22 = 0$
 (c) $y + 2x = 0$
 (d) $x + 2 = 0$

33. $v = 850a + 300,000$ 35. $s = 6x^2$
 Domain: $\{a: a \geq 0\}$ Domain: $\{x: x \geq 0\}$

37. $d = 45t$ 39. $P(x) = 500x - x^2$
 Domain: $\{t: t \geq 0\}$

41. Function 43. Not a function

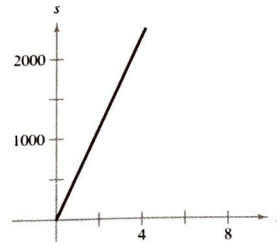


45. Function



47. (a) $-x^2 + 2x + 2$
 (b) $-x^2 - 2x$
 (c) $-2x^3 - x^2 + 2x + 1$
 (d) $\frac{1 - x^2}{2x + 1}$
 (e) $-4x^2 - 4x$
 (f) $3 - 2x^2$

49. (a) 51. $C = 0.30x + 150$



- (b) Speed of the plane is 560 mi/hr

Chapter 2

Section 2.1

1.

x	1.9	1.99	1.999
$f(x)$	0.3448	0.3344	0.3334

x	2.001	2.01	2.1
$f(x)$	0.3332	0.3322	0.3226

$$\lim_{x \rightarrow 2} \frac{x - 2}{x^2 - x - 2} \approx 0.3333 \quad (\text{Actual limit is } \frac{1}{3}.)$$

3.

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

x	0.001	0.01	0.1
$f(x)$	0.2887	0.2884	0.2863

$$\lim_{x \rightarrow 0} \frac{\sqrt{x+3} - \sqrt{3}}{x} \approx 0.2887 \quad (\text{Actual limit is } \frac{1}{2\sqrt{3}}.)$$

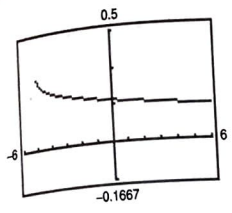
5.

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

$$\lim_{x \rightarrow 3} \frac{[1/(x+1)] - (1/4)}{x-3} \approx -0.0625$$

7. 1
 13. $\frac{4}{3}$
 23. $\frac{1}{2}$
 27. (a) 15 (b) 5 (c) 6 (d) $\frac{2}{3}$
 29. (a) 64 (b) 2 (c) 12 (d) 8
 31. $\lim_{x \rightarrow 4} f(x) = \frac{1}{6}$



33.

n	$4 \pm [0.1]^n$	$f(4 \pm [0.1]^n)$
1	3.9000	6.9000
2	3.9900	6.9900
3	3.9990	6.9990
4	3.9999	6.9999
4	4.0001	7.0001
3	4.0010	7.0010
2	4.0100	7.0100
1	4.1000	7.1000

35. If $\lim_{x \rightarrow 2} f(x) = 4$, we cannot conclude anything about $f(2)$. $f(2)$ may not exist at all, or $f(2)$ may be some value other than 4.

Section 2.2

1. (a) 1 (b) 3 3. (a) 2 (b) 0 5. -2
 7. $\frac{1}{6}$ 9. 12 11. 2 13. $2x - 2$ 15. $\frac{1}{10}$
 17. $\frac{3}{2}$ 19. $\frac{\sqrt{3}}{6}$ 21. $-\frac{1}{4}$

23.

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

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

$\lim_{x \rightarrow 0} \frac{\sqrt{x+2} - \sqrt{2}}{x} \approx 0.354$ (Actual limit is $\frac{1}{2\sqrt{2}}$)

25.

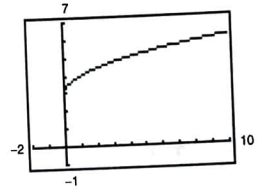
x	-0.1	-0.01	-0.001
$f(x)$	-0.263	-0.251	-0.250

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

$\lim_{x \rightarrow 0} \frac{[1/(2+x)] - (1/2)}{x} \approx -0.250$

(Actual limit is $-\frac{1}{4}$.)

27. (a) 1 (b) 1 (c) 1
 29. (a) 0 (b) 0 (c) 0
 31. (a) 3 (b) -3 (c) Limit does not exist.
 33. $\frac{1}{10}$ 35. Limit does not exist. 37. 2
 39. $-\frac{1}{x^2}$ 41. Limit does not exist.
 43. Limit does not exist. 45. 2 47. -2
 49. 1 51. -16 ft/sec
 53.



Domain: $\{x: 0 \leq x < 9, x > 9\}$

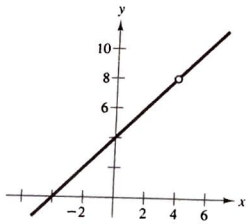
$\lim_{x \rightarrow 9} f(x) = 6$

It is not obvious from the graph that the function does not exist at $x = 9$.

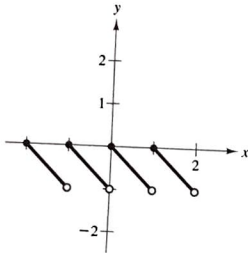
Section 2.3

1. Continuous for all real x
 3. Discontinuous at $x = -1$
 5. Discontinuous at $x = 1$
 7. Continuous for all real x
 9. Nonremovable discontinuity at $x = 1$
 11. Continuous for all real x
 13. Removable discontinuity at $x = -2$; nonremovable discontinuity at $x = 5$
 15. Continuous for all real x
 17. Nonremovable discontinuity at $x = 2$
 19. Nonremovable discontinuity at $x = -2$
 21. Continuous for all real x
 23. Nonremovable discontinuities at each integer
 25. Continuous for all real x
 27. Continuous for all real x
 29. Removable discontinuity at $x = 1$

31. Removable discontinuity at $x = 4$



33. Nonremovable discontinuity at each integer



35. $(-\infty, -6)$, $(-6, 6)$, $(6, \infty)$ 37. $(-\infty, \infty)$

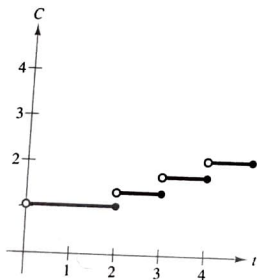
41. (a) $(0.6, 0.7)$ (b) $(0.68, 0.69)$

43. $f(3) = 11$ 45. $f(2) = 4$ 47. $a = 2$

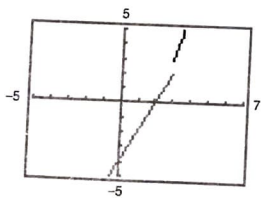
49. Yes, f is continuous on $[-1, 1]$.

51. $C = \begin{cases} 1.04, & 0 < t \leq 2 \\ 1.04 + 0.36\lceil t - 1 \rceil, & t > 2, t \text{ is not an integer} \\ 1.04 + 0.36(t - 1), & t > 2, t \text{ is an integer} \end{cases}$

Nonremovable discontinuity at each integer greater than 2



53. Discontinuous at $x = 3$



Section 2.4

1. $\lim_{x \rightarrow -2^+} \frac{1}{(x+2)^2} = \infty$ $\lim_{x \rightarrow -2^-} \frac{1}{(x+2)^2} = \infty$

3. $\lim_{x \rightarrow -3^+} \frac{1}{x^2 - 9} = -\infty$ $\lim_{x \rightarrow -3^-} \frac{1}{x^2 - 9} = \infty$

5. $\lim_{x \rightarrow -3^+} \frac{x^3}{x^2 - 9} = \infty$ $\lim_{x \rightarrow -3^-} \frac{x^3}{x^2 - 9} = -\infty$

7. $x = -1, x = 2$ 9. $x = 0$

11. $x = -2, x = 1$ 13. $x = \pm 2$ 15. $x = 0$

17. $x = -2, x = 1$

19. Removable discontinuity at $x = -1$

21. Vertical asymptote at $x = -1$ 23. $-\infty$

25. ∞ 27. $-\infty$ 29. $\frac{1}{2}$ 31. ∞ 33. ∞

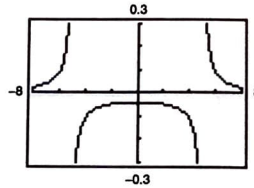
35. ∞ 37. $-\infty$

39. (a) \$14,117.65 (b) \$80,000

(c) \$720,000 (d) ∞

41. (a) $\frac{7}{12}$ ft/sec (b) $\frac{3}{2}$ ft/sec (c) ∞

43. $-\infty$



Section 2.5

1. $\lim_{x \rightarrow 2} (3x + 2) = 8$ Let $\delta = \frac{0.01}{3} \approx 0.0033$.

3. $\lim_{x \rightarrow 2} (x^2 - 3) = 1$

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

5. $\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x - 2} = 1$ Let $\delta = 0.01$.

7. $\lim_{x \rightarrow 2} (x + 3) = 5$ Let $\delta = \epsilon$.

9. $\lim_{x \rightarrow 6} 3 = 3$ Any δ will work.

11. $\lim_{x \rightarrow 0} \sqrt[3]{x} = 0$ Let $\delta = \epsilon^3$.

13. $\lim_{x \rightarrow 0} x^2 = 0$ Let $\delta = \sqrt{\epsilon}$.

15. $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x - 2} = 5$ Let $\delta = \epsilon$.

17. $\lim_{x \rightarrow 2} \frac{1}{x} = \frac{1}{2}$ Let $\delta = 2\epsilon$.

19. $\lim_{x \rightarrow 2} (x^2 - 2) = 2$ Let $\delta = \frac{\epsilon}{5}$.

21. $\lim_{x \rightarrow 0^+} \sqrt{x} = 0$ Let $\delta = \epsilon^2$.

23. $\lim_{x \rightarrow -1^+} \frac{1}{x + 1} = \infty$ Let $\delta = \frac{1}{M}$.

25. $\lim_{x \rightarrow 2} \frac{1}{(x - 2)^2} = \infty$ Let $\delta = \frac{1}{\sqrt{M}}$.

27. $\lim_{x \rightarrow 3} x^2 = f(3) = 9$ 29. 4

Review Exercises for Chapter 2

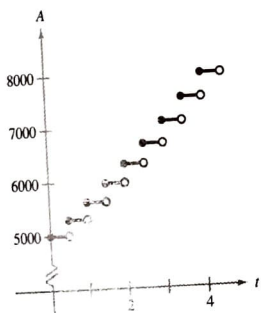
1. 7 3. 77 5. $\frac{10}{3}$ 7. $-\frac{1}{4}$ 9. -1
 11. 3 13. $-\infty$ 15. $-\infty$ 17. $\frac{1}{3}$ 19. 0

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

$$\lim_{x \rightarrow 1^+} \frac{\sqrt{2x+1} - \sqrt{3}}{x-1} \approx 0.577$$

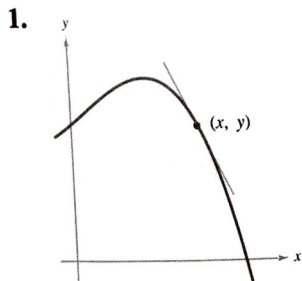
23. $\frac{1}{\sqrt{3}}$ 25. False 27. False 29. True

31. Nonremovable discontinuity at each integer
 33. Removable discontinuity at $x = 1$
 35. Nonremovable discontinuity at $x = 2$
 37. Nonremovable discontinuity at $x = -1$
 39. $c = -\frac{1}{2}$
 41. Nonremovable discontinuity every 6 months



Chapter 3

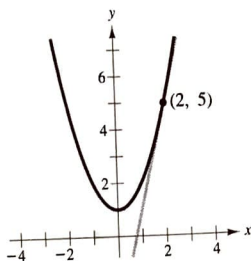
Section 3.1



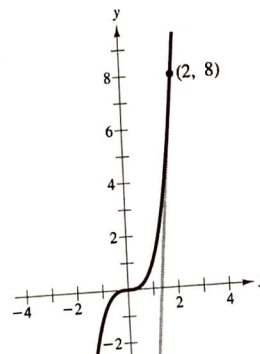
3. (a) $m = 0$
 (b) $m = -3$

5. $f'(x) = 0$ 7. $f'(x) = -5$
 9. $f'(x) = 4x + 1$ 11. $f'(x) = -\frac{1}{(x-1)^2}$
 13. $f'(t) = 3t^2 - 12$

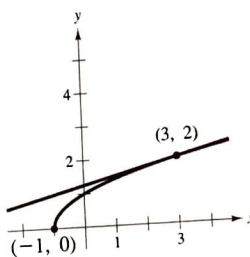
15. $f'(x) = 2x$
 Tangent line:
 $y = 4x - 3$



17. $f'(x) = 3x^2$
 Tangent line:
 $y = 12x - 16$



19. $f'(x) = \frac{1}{2\sqrt{x+1}}$
 Tangent line: $4y = x + 5$



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

$$f'(2) = \lim_{x \rightarrow 2} \frac{f(x) - f(2)}{x - 2}$$

$$= \lim_{x \rightarrow 2} \frac{(x^2 - 1) - 3}{x - 2}$$

$$= \lim_{x \rightarrow 2} (x + 2) = 4$$

23. $f(x) = x^3 + 2x^2 + 1$

$$f'(-2) = \lim_{x \rightarrow -2} \frac{f(x) - f(-2)}{x + 2}$$

$$= \lim_{x \rightarrow -2} \frac{(x^3 + 2x^2 + 1) - 1}{x + 2}$$

$$= \lim_{x \rightarrow -2} x^2 = 4$$

25. $f(x) = (x - 1)^{2/3}$

$$f'(1) = \lim_{x \rightarrow 1} \frac{f(x) - f(1)}{x - 1}$$

$$= \lim_{x \rightarrow 1} \frac{(x - 1)^{2/3} - 0}{x - 1}$$

$$= \lim_{x \rightarrow 1} \frac{1}{(x - 1)^{1/3}}$$

Limit does not exist.

f is not differentiable at $x = 1$.

27. $(-\infty, -3), (-3, \infty)$ 29. $(-\infty, -1), (-1, \infty)$
 31. $(-\infty, 3), (3, \infty)$ 33. $(1, \infty)$
 35. $(-\infty, 0), (0, \infty)$ 37. (a) 3 (b) -3
 39. f is not differentiable at $x = 1$. 41. $f'(1) = 0$

Section 3.4

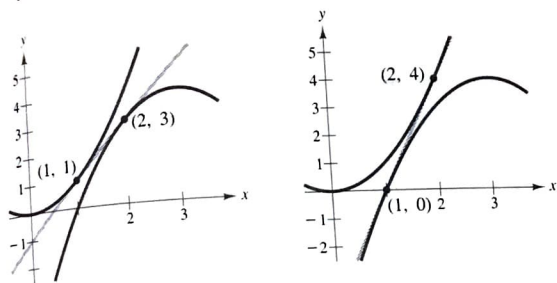
37. $2x + y - 2 = 0$

39. $(0, 2), (\sqrt{\frac{3}{2}}, -\frac{1}{4}), (-\sqrt{\frac{3}{2}}, -\frac{1}{4})$

41. No horizontal tangents

43. $y = 2x - 1$

$y = 4x - 4$



45. 8

47. (a) 10,000 (b) 4000 (c) 0 (d) -8000

49. (a) $\frac{4}{9}$ (b) $\frac{1}{3}$ (c) 0 (d) $-\frac{5}{9}$

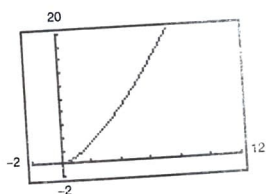
51. -44.1 ft/sec

53. -5.4 ft/sec²

Approximately $\frac{1}{6}$ the acceleration due to gravity on earth.

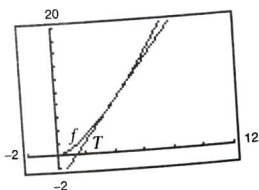
55. True

57. (a)



(b) $T(x) = 3(x - 4) + 8 = 3x - 4$

(c)



It becomes less accurate.

(d)

Δx	-2	-0.5	-0.1
$f(4 + \Delta x)$	2.828	6.458	7.702
$T(4 + \Delta x)$	2	6.5	7.7

Δx	0	0.1	0.5	2
$f(4 + \Delta x)$	8	8.302	9.456	14.697
$T(4 + \Delta x)$	8	8.3	9.5	14

1. $f'(x) = 2x^2, f'(0) = 0$

3. $f'(x) = 5[x^{-2}(1) + (x + 3)(-2x^{-3})]$
 $= -\frac{5(x + 6)}{x^3}$

$f'(1) = -35$

5. $f'(x) = (x^3 - 3x)(4x + 3) + (2x^2 + 3x + 5)(3x^2 - 3)$
 $= 10x^4 + 12x^3 - 3x^2 - 18x - 15$

$f'(0) = -15$

7. $f'(x) = (x^5 - 3x)\left(-\frac{2}{x^3}\right) + \left(\frac{1}{x^2}\right)(5x^4 - 3)$
 $= 3x^2 + \frac{3}{x^2}$

$f'(-1) = 6$
 $\frac{(2x - 3)(3) - (3x - 2)(2)}{(2x - 3)^2} = -\frac{5}{(2x - 3)^2}$

11. $\frac{(x^2 - 1)(-2 - 2x) - (3 - 2x - x^2)(2x)}{(x^2 - 1)^2} = \frac{2}{(x + 1)^2}$

13. $\frac{\sqrt{x}(1) - (x + 1)[1/(2\sqrt{x})]}{x} = \frac{x - 1}{2x^{3/2}}$

15. $\frac{(t^2 + 2t + 2)(1) - (t + 1)(2t + 2)}{(t^2 + 2t + 2)^2} = \frac{-t^2 - 2t}{(t^2 + 2t + 2)^2}$

17. $6s^2(s^3 - 2)$

19. $\left(\frac{x + 1}{x + 2}\right)(2) + (2x - 5)\left[\frac{(x + 2)(1) - (x + 1)(1)}{(x + 2)^2}\right]$
 $= \frac{2x^2 + 8x - 1}{(x + 2)^2}$

21. $15x^4 - 48x^3 - 33x^2 - 32x - 20$

23. $\frac{(c^2 + x^2)(-2x) - (c^2 - x^2)(2x)}{(c^2 + x^2)^2} = -\frac{4xc^2}{(c^2 + x^2)^2}$

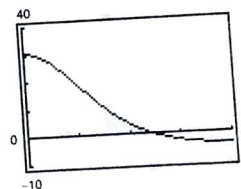
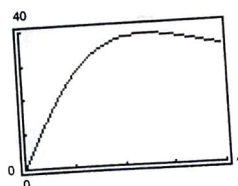
Function	Rewrite	Derivative	Simplify
25. $y = \frac{x^2 + 2x}{x}$	$y = x + 2$	$y' = 1$	$y' = 1$
27. $y = \frac{7}{3x^3}$	$y = \frac{7}{3}x^{-3}$	$y' = -7x^{-4}$	$y' = -\frac{7}{x^4}$
29. $y = \frac{3x^2 - 5}{7}$	$y = \frac{1}{7}(3x^2 - 5)$	$y' = \frac{1}{7}(6x)$	$y' = \frac{6x}{7}$

31. $\frac{3}{\sqrt{x}}$ 33. $\frac{2}{(x - 1)^3}$ 35. $y = -x + 4$

37. $y = -x - 2$ 39. $(0, 0), (2, 4)$

41. (a) -0.48 (b) 0.12 (c) 0.0149 43. 31.55

45. $a(2) = 4.069$



Section 3.5

$$y = f(g(x)) \quad u = g(x) \quad y = f(u)$$

1. $y = (6x - 5)^4$ $u = 6x - 5$ $y = u^4$

3. $y = \sqrt{x^2 - 1}$ $u = x^2 - 1$ $y = \sqrt{u}$

5. $y = (x^2 - 3x + 4)^6$ $u = x^2 - 3x + 4$ $y = u^6$

7. $6(2x - 7)^2$

9. $12(9x - 4)^3(9) = 108(9x - 4)^3$

11. $-\frac{1}{(x-2)^2}$ 13. $-2(t-3)^{-3}(1) = -\frac{2}{(t-3)^3}$

15. $-3(x^3 - 4)^{-2}(3x^2) = -\frac{9x^2}{(x^3 - 4)^2}$

17. $x^2[4(x-2)^3(1)] + (x-2)^4(2x) = 2x(x-2)^3(3x-2)$

19. $\frac{1}{2}(1-t)^{-1/2}(-1) = -\frac{1}{2\sqrt{1-t}}$

21. $\frac{1}{2}(t^2 + 2t - 1)^{-1/2}(2t + 2) = \frac{t + 1}{\sqrt{t^2 + 2t - 1}}$

23. $\frac{1}{3}(9x^2 + 4)^{-2/3}(18x) = \frac{6x}{(9x^2 + 4)^{2/3}}$

25. $(4 - x^2)^{-1/2}(-2x) = -\frac{2x}{\sqrt{4 - x^2}}$

27. $\frac{2}{3}(9 - x^2)^{-1/3}(-2x) = -\frac{4x}{3(9 - x^2)^{1/3}}$

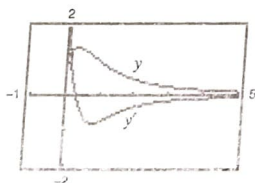
29. $-\frac{1}{2(x+2)^{3/2}}$

31. $x\left(\frac{1}{2}\right)(1-x^2)^{-1/2}(-2x) + (1-x^2)^{1/2}(1) = \frac{1-2x^2}{\sqrt{1-x^2}}$

33. $\frac{(x^2 + 1)^{1/2}(1) - x(1/2)(x^2 + 1)^{-1/2}(2x)}{x^2 + 1} = \frac{1}{(x^2 + 1)^{3/2}}$

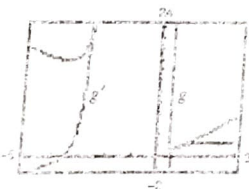
35. $\frac{(t-1)(3) - (3t+2)}{(t-1)^2} = -\frac{5}{(t-1)^2}$

37. $\frac{1 - 3x^2 - 4x^{3/2}}{2\sqrt{x}(x^2 + 1)^2}$



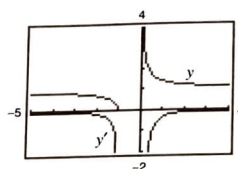
The zero of y' corresponds to the point on the graph of the function where the tangent line is horizontal.

39. $\frac{3t(t^2 + 3t - 2)}{(t^2 + 2t - 1)^{3/2}}$



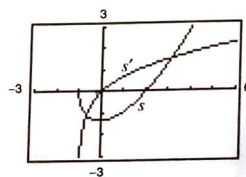
The zero of $g'(x)$ corresponds to the point on the graph of the function where the tangent line is horizontal.

41. $-\frac{\sqrt{x+1}}{2x(x+1)}$



y' has no zeros.

43. $\frac{t}{\sqrt{1+t}}$

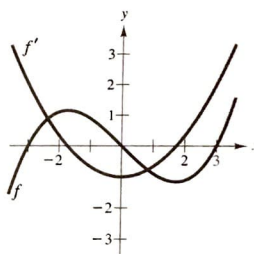


The zero of $s'(t)$ corresponds to the point on the graph of the function where the tangent line is horizontal.

45. $9x - 5y - 2 = 0$ 47. $12(5x^2 - 1)(x^2 - 1)$

49. $\frac{3}{4(x^2 + x + 1)^{3/2}}$ 53. $(3x^2 + 1)\left(\frac{x^3 + x}{|x^3 + x|}\right)$

55.



The zeros of f' correspond to the points where the graph of f has horizontal tangents.

57. (a) 1.461 (b) -1.016

Section 3.6

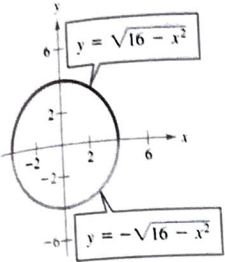
1. $-\frac{x}{y}, -\frac{3\sqrt{7}}{7}$ 3. $-\frac{y}{x}, -\frac{1}{4}$ 5. $-\sqrt{\frac{y}{x}}, -\frac{5}{4}$

7. $\frac{y - 3x^2}{2y - x}, \frac{1}{2}$ 9. $\frac{18x}{(x^2 + 9)^2y}$, undefined

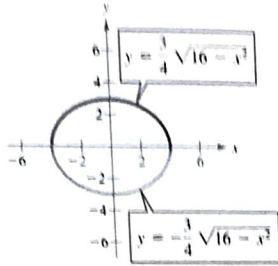
11. $\frac{1 - 3x^2y^3}{3x^3y^2 - 1}, -1$ 13. $-\frac{3\sqrt{y}}{x}, -\frac{1}{2}$

15. $\frac{4xy - 3x^2 - 3y^2}{2x(3y - x)}, -\frac{15}{28}$ 17. $-\frac{1}{2}$ 19. 0

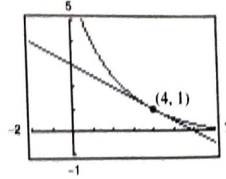
21. $y' = -\frac{x}{y}$



23. $y' = -\frac{9x}{16y}$



41. $x + 2y - 6 = 0$

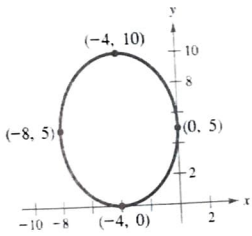


25. $\frac{10}{x^3}$ 27. $-\frac{16}{y^3}$ 29. $\frac{3x}{4y}$

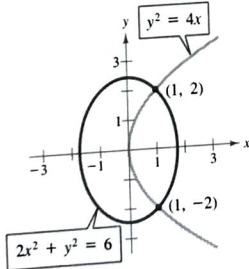
31. (a) At (4, 3):
Tangent line: $4x + 3y - 25 = 0$
Normal line: $3x - 4y = 0$

(b) At (-3, 4):
Tangent line: $3x - 4y + 25 = 0$
Normal line: $4x + 3y = 0$

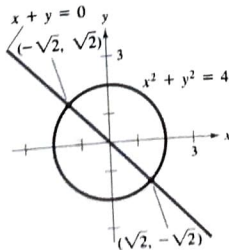
33. Horizontal tangents: (-4, 0), (-4, 10)
Vertical tangents: (0, 5), (-8, 5)



35. At (1, 2):
Slope of ellipse: -1
Slope of parabola: 1
At (1, -2):
Slope of ellipse: 1
Slope of parabola: -1



37. At $(\sqrt{2}, -\sqrt{2})$:
Slope of line: -1
Slope of circle: 1
At $(-\sqrt{2}, \sqrt{2})$:
Slope of line: -1
Slope of circle: 1



39. $(x - 1 - 2\sqrt{2})^2 + (y - 2 + 2\sqrt{2})^2 = 16$
 $(x - 1 + 2\sqrt{2})^2 + (y - 2 - 2\sqrt{2})^2 = 16$

Section 3.7

1. (a) $\frac{3}{4}$ (b) 20 3. (a) $-\frac{5}{8}$ (b) $\frac{3}{2}$
5. (a) 24π in.²/min (b) 96π in.²/min
7. If dr/dt is constant, dA/dt is proportional to r .
9. (a) $\frac{5}{\pi}$ ft/min (b) $\frac{5}{4\pi}$ ft/min
11. $\frac{8}{405\pi}$ ft/min
13. (a) 9 cm³/sec (b) 900 cm³/sec
15. (a) 0 cm/min (b) 12 cm/min
17. (a) $\frac{8}{25}$ cm/min (b) 0 cm/min
 (c) $-\frac{8}{25}$ cm/min (d) -0.0039 cm/min
19. (a) 24.6% (b) $\frac{1}{64}$ ft/min
21. (a) $-\frac{7}{12}$ ft/sec (b) $-\frac{3}{2}$ ft/sec (c) $-\frac{48}{7}$ ft/sec
23. 21.96 ft²/sec
25. (a) -750 mi/hr (b) 20 minutes
27. $-\frac{28}{\sqrt{10}} \approx -8.85$ ft/sec
29. (a) $\frac{25}{3}$ ft/sec (b) $\frac{10}{3}$ ft/sec
33. $v^{0.3} \left(1.3p \frac{dv}{dt} + v \frac{dp}{dt} \right) = 0$

Review Exercises for Chapter 3

1. $3x(x - 2)$ 3. $\frac{x + 1}{2x^{3/2}}$ 5. $-\frac{4}{3t^3}$
7. $\frac{3x^2}{2\sqrt{x^3 + 1}}$ 9. $2(6x^3 - 9x^2 + 16x - 7)$
11. $s(s^2 - 1)^{3/2}(8s^3 - 3s + 25)$ 13. $\frac{2x(2 - x)}{(x - 1)^2}$
15. $-\frac{x^2 + 1}{(x^2 - 1)^2}$ 17. $32x - 128x^3$
19. $\frac{6x}{(4 - 3x^2)^2}$ 21. $\frac{x + 2}{(x + 1)^{3/2}}$ 23. $\frac{5}{6(t + 1)^{1/6}}$
25. $\frac{9}{(x^2 + 9)^{3/2}}$ 27. $\frac{2(t + 2)}{(1 - t)^4}$
29. $\frac{2(6x^3 - 15x^2 - 18x + 5)}{(x^2 + 1)^3}$ 31. $-\frac{2x + 3y}{3(x + y^2)}$
33. $\frac{2y\sqrt{x} - y\sqrt{y}}{2x\sqrt{y} - x\sqrt{x}}$ 35. $\frac{x}{y}$