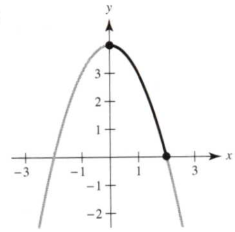
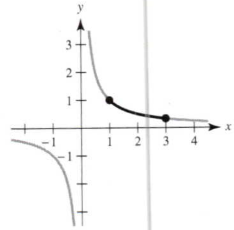
17. (a)



(b) $\int_0^2 \sqrt{1 + 4x^2}\, dx$

(c) About 4.647

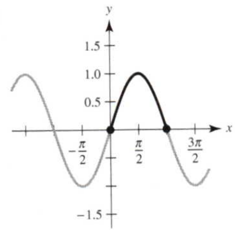
19. (a)



(b) $\int_1^3 \sqrt{1 + \frac{1}{x^4}}\, dx$

(c) About 2.147

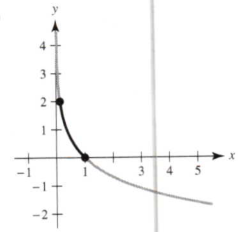
21. (a)



(b) $\int_0^{\pi} \sqrt{1 + \cos^2 x}\, dx$

(c) About 3.820

23. (a)

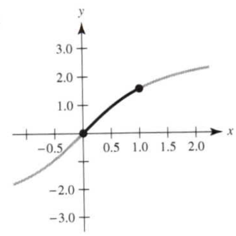


(b) $\int_0^2 \sqrt{1 + e^{-2y}}\, dy$

$= \int_{e^{-2}}^1 \sqrt{1 + \frac{1}{x^2}}\, dx$

(c) About 2.221

25. (a)



(b) $\int_0^1 \sqrt{1 + \left(\frac{2}{1 + x^2}\right)^2}\, dx$

(c) About 1.871

27. b **29.** (a) 64.125 (b) 64.525 (c) 64.666 (d) 64.672

31. $20[\sinh 1 - \sinh(-1)] \approx 47.0$ m **33.** About 1480

35. $3 \arcsin \frac{2}{3} \approx 2.1892$

37. $2\pi \int_0^3 \frac{1}{3}x^3 \sqrt{1 + x^4}\, dx = \frac{\pi}{9}\left(82\sqrt{82} - 1\right) \approx 258.85$

39. $2\pi \int_1^2 \left(\frac{x^3}{6} + \frac{1}{2x}\right)\left(\frac{x^2}{2} + \frac{1}{2x^2}\right) dx = \frac{47\pi}{16} \approx 9.23$

41. $2\pi \int_{-1}^1 2\, dx = 8\pi \approx 25.13$

43. $2\pi \int_1^8 x \sqrt{1 + \frac{1}{9x^{4/3}}}\, dx = \frac{\pi}{27}\left(145\sqrt{145} - 10\sqrt{10}\right) \approx 199.48$

45. $2\pi \int_0^2 x \sqrt{1 + \frac{x^2}{4}}\, dx = \frac{\pi}{3}\left(16\sqrt{2} - 8\right) \approx 15.318$

47. 14.424

49. A rectifiable curve is a curve with a finite arc length.

51. The integral formula for the area of a surface of revolution is derived from the formula for the lateral surface area of the frustum of a right circular cone. The formula is $S = 2\pi rL$, where $r = \frac{1}{2}(r_1 + r_2)$, which is the average radius of the frustum, and L is the length of a line segment on the frustum. The representative element is $2\pi f(d_i)\sqrt{1 + (\Delta y_i/\Delta x_i)^2}\, \Delta x_i$.

Section 7.4 (page 485)

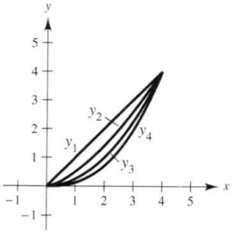
1. (a) and (b) 17 **3.** $\frac{5}{3}$ **5.** $\frac{2}{3}\left(2\sqrt{2} - 1\right) \approx 1.219$

7. $5\sqrt{5} - 2\sqrt{2} \approx 8.352$ **9.** 309.3195

11. $\ln\left[\left(\sqrt{2} + 1\right)/\left(\sqrt{2} - 1\right)\right] \approx 1.763$

13. $\frac{1}{2}(e^2 - 1/e^2) \approx 3.627$ **15.** $\frac{76}{3}$

53. (a)



(b) y_1, y_2, y_3, y_4

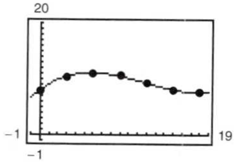
(c) $s_1 \approx 5.657$; $s_2 \approx 5.759$; $s_3 \approx 5.916$; $s_4 \approx 6.063$

55. 20π **57.** $6\pi(3 - \sqrt{5}) \approx 14.40$

59. (a) Answers will vary. Sample answer: 5207.62 in.^{3}

(b) Answers will vary. Sample answer: 1168.64 in.^{2}

(c) $r = 0.0040y^3 - 0.142y^2 + 1.23y + 7.9$



(d) 5279.64 in.^{3}; 1179.5 in.^{2}

61. (a) $\pi(1 - 1/b)$ (b) $2\pi\int_1^b \sqrt{x^4 + 1}/x^3\, dx$

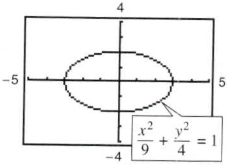
(c) $\lim_{b\to\infty} V = \lim_{b\to\infty} \pi(1 - 1/b) = \pi$

(d) Because $\dfrac{\sqrt{x^4 + 1}}{x^3} > \dfrac{\sqrt{x^4}}{x^3} = \dfrac{1}{x} > 0$ on $[1, b]$,

you have $\displaystyle\int_1^b \frac{\sqrt{x^4 + 1}}{x^3}\, dx > \int_1^b \frac{1}{x}\, dx = \Big[\ln x\Big]_1^b = \ln b$

and $\lim_{b\to\infty} \ln b \to \infty$. So, $\displaystyle\lim_{b\to\infty} 2\pi\int_1^b \frac{\sqrt{x^4 + 1}}{x^3}\, dx = \infty.$

63. (a)



(b) $\displaystyle\int_0^3 \sqrt{1 + \frac{4x^2}{81 - 9x^2}}\, dx$

(c) You cannot evaluate this definite integral because the integrand is not defined at $x = 3$. Simpson's Rule will not work for the same reason.

65. Fleeing object: $\frac{2}{3}$ unit

Pursuer: $\displaystyle\frac{1}{2}\int_0^1 \frac{x + 1}{\sqrt{x}}\, dx = \frac{4}{3} = 2\left(\frac{2}{3}\right)$

67. $384\pi/5$ **69.** Proof **71.** Proof