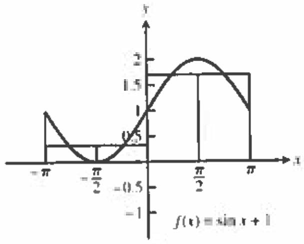
(c)




**38.** 1.1 **40.** $9 + \frac{9}{n}; 9$ **42.** $1 + \frac{3n+1}{2n^2}; 1$

**44.** $\frac{13}{6} + \frac{15n+2}{6n^2}; \frac{13}{6}$ **46.** $\frac{7}{12}$

## Section 5.3, pp. 313–317

**2.** $\int_{-1}^{0} 2x^3 dx$ **4.** $\int_{1}^{4} \frac{1}{x}\, dx$ **6.** $\int_{0}^{1} \sqrt{4 - x^2}dx$

**8.** $\int_{0}^{\pi/4} (\tan x)\, dx$

**10.** (a) 2 (b) 9 (c) −2 (d) 1 (e) −6 (f) 1

**12.** (a) $-\sqrt{2}$ (b) $\sqrt{2}$ (c) $-\sqrt{2}$ (d) 1

**14.** (a) 6 (b) 6 **16.** Area = 2 square units

**18.** Area = $4\pi$ square units **20.** Area = 1 square unit

**22.** Area = $2 + \frac{\pi}{2}$ square units **24.** $2b^2$ **26.** $\frac{3}{2}(b^2 - a^2)$

**28.** (a) $\frac{\pi}{4} - \frac{3}{2}$ (b) $\frac{\pi}{2}$ **30.** 3 **32.** 24 **34.** 0.009

**36.** $\frac{\pi^3}{24}$ **38.** $a^2$ **40.** $9b^3$ **42.** 10 **44.** −1 **46.** 0

**48.** 7 **50.** $\frac{7}{2}$

**52.** Using $n$ subintervals of length $\Delta x = \frac{b}{n}$ and right end-point values: Area = $\int_{0}^{b} \pi x^2 dx = \frac{\pi b^3}{3}$.

**54.** Using $n$ subintervals of length $\Delta x = \frac{b}{n}$ and right end-point values: Area = $\int_{0}^{b} \left(\frac{x}{2} + 1\right) dx = \frac{1}{4}b^2 + b$.

**56.** $\text{av}(f) = -\frac{3}{2}$ **58.** $\text{av}(f) = -2$ **60.** $\text{av}(f) = \frac{3}{2}$

**62.** (a) $\text{av}(h) = -\frac{1}{2}$ (b) $\text{av}(h) = -\frac{1}{2}$ (c) $\text{av}(h) = -\frac{1}{2}$

**64.** 6 **66.** $-\frac{5}{6}$ **68.** 0 **70.** $\frac{5}{4}$

**72.** $a = -\sqrt{2}$ and $b = \sqrt{2}$ minimize the integral.

**74.** $\frac{13}{20} \le \int_{0}^{1} \frac{1}{1+x^2} dx \le \frac{9}{10}$ **78.** $\int_{a}^{b} f(x)dx \le \int_{a}^{b} 0\, dx = 0$

**80.** Lower bound $= \frac{7}{6}$ **82.** All three rules hold.

**84.** (a) $U - L = (f(x_0) - f(x_1))\Delta x + (f(x_1) - f(x_2))\Delta x + \cdots + (f(x_{n-1}) - f(x_n))\Delta x = (f(x_0) - f(x_n))\Delta x = (f(a) - f(b))\Delta x$

**86.** (a) The area of the shaded region is $\sum_{i=1}^{n} \Delta x_i \cdot m_i$ which is equal to $L$.

(b) The area of the shaded region is $\sum_{i=1}^{n} \Delta x_i \cdot M_i$ which is equal to $U$.

(c) The area of the shaded region is the difference in the areas of the shaded regions shown in the second part of the figure and the first part of the figure. Thus this area is $U - L$.

**88.** 37.5

## Section 5.4, pp. 325–328

**2.** $\frac{133}{4}$ **4.** $\frac{20}{3}$ **6.** 12 **8.** $\frac{5}{2}$ **10.** $\pi$ **12.** 4

**14.** $\frac{\pi}{3} - \frac{\sqrt{3}}{4}$ **16.** $2\sqrt{3} - \frac{\pi}{6} - 2$ **18.** $4\sqrt{3} - 3$

**20.** $10\sqrt{3}$ **22.** $\frac{22}{3}$ **24.** $-\frac{137}{20}$ **26.** $\frac{5\pi}{6} + \frac{9\sqrt{3}}{8}$ **28.** 1

**30.** $\ln 2 + \frac{1}{e^2} - \frac{1}{e}$ **32.** $\frac{1}{2}\tan^{-1}\left(\frac{2\sqrt{3}}{3}\right)$

**34.** $\frac{1}{\ln \pi}(\pi^{-1} - \pi^{-2})$

**36.** $\frac{1}{2}(\ln 2)^2$ **38.** $\frac{\sqrt{3}}{8}$ **40.** $3\sin^2 x \cos x$

**42.** (a) $(\sec^2(\tan\theta))\sec^2\theta$ (b) $(\sec^2(\tan\theta))\sec^2\theta$

**44.** (a) $\frac{1}{2}t^{3/2} + \frac{3}{2\sqrt{t - t^2}}$ **46.** $\frac{1}{x}, x > 0$

**48.** $2x^2\sin(x^6) + \int_{2}^{x^2} \sin(t^3)\, dt$

**50.** $3(x^3+1)^{10}\left(\int_{0}^{x}(t^3+1)^{10} dt\right)^2$ **52.** −1 **54.** $-2^{4x/3}\ln 2$

**56.** $\sin^{-1}(x^{1/\pi}) \cdot \frac{1}{\pi}x^{(1/\pi)-1}$ **58.** 12

**60.** $\frac{83}{4}$ **62.** $\sqrt{3} - \frac{\pi}{3}$ **64.** $\frac{1}{3} + \frac{\pi}{2}$

**66.** (c) Since $\frac{dy}{dx} = \sec x$ and $y(-1) = \int_{-1}^{-1} \sec t\, dt + 4 = 4$

**68.** (a) Since $\frac{dy}{dx} = \frac{1}{x}$ and $y(1) = \int_{1}^{1} \frac{1}{t}\, dt - 3 = -3$

**70.** $y = \int_{1}^{x} \sqrt{1 + t^2}\, dt - 2$ **74.** \$4500

**76.** (a) $H(0) = 1$ ft, $H(4) = \sqrt{5} + 5(4)^{1/3} \approx 10.17$ ft, $H(8) = 13$ ft

(b) $\text{av}(H) = 29/3 \approx 9.67$ ft

**78.** 1 **80.** $-2x + 1$ **84.** 2

## Section 5.5, pp. 333–335

**2.** $\frac{2}{3}(7x-1)^{3/2} + C$ **4.** $\frac{-1}{x^4+1} + C$

**6.** $\frac{3}{2}(1 + \sqrt{x})^{4/3} + C$ **8.** $-\frac{1}{4}\cos 2x^2 + C$

**10.** $\frac{2}{3}\left(1 - \cos\frac{t}{2}\right)^3 + C$ **12.** $(y^4 + 4y^2 + 1)^3 + C$

**14.** $-\frac{1}{2x} - \frac{1}{4}\sin\left(\frac{2}{x}\right) + C$

**16.** (a) $\frac{2}{5}u^{1/2} + C = \frac{2}{5}\sqrt{5x+8} + C$ (b) $\frac{2}{5}\sqrt{5x+8} + C$

**18.** $\frac{2}{5}\sqrt{5s+4} + C$ **20.** $-\frac{1}{3}(7-3y^2)^{3/2} + C$

**22.** $\frac{1}{3}\sin(3z+4) + C$ **24.** $\frac{1}{3}\tan^3 x + C$

**26.** $\frac{1}{4}\tan^8\left(\frac{x}{2}\right) + C$ **28.** $-\frac{1}{2}\left(7 - \frac{r^5}{10}\right)^4 + C$

**30.** $-2\csc\left(\frac{v-\pi}{2}\right) + C$ **32.** $2\sqrt{\sec z} + C$

**34.** $2\sin(\sqrt{t}+3) + C$ **36.** $-\frac{2}{\sin\sqrt{\theta}} + C$

**38.** $\frac{2}{3}\left(1 - \frac{1}{x}\right)^{3/2} + C$ **40.** $\frac{1}{3}\left(1 - \frac{1}{x^2}\right)^{3/2} + C$

**42.** $\frac{2}{3}\sqrt{x^3-1} + C$ **44.** $\frac{2}{5}(4-x)^{5/2} - \frac{8}{3}(4-x)^{3/2} + C$

**46.** $\frac{3}{7}(x-5)^{7/3} + \frac{15}{2}(x-5)^{4/3} + C$

**48.** $\frac{2}{5}(x^3+1)^{5/2} - \frac{2}{3}(x^3+1)^{3/2} + C$

**50.** $\frac{-1}{x-4} - \frac{2}{(x-4)^2} + C$ **52.** $e^{\sin^2\theta} + C$

**54.** $-\sec\left(1 + e^{1/x}\right) + C$ **56.** $\frac{1}{4}(\ln t)^2 + C$

**58.** $\frac{1}{2}\sec^{-1}(x^2) + C$ **60.** $\sec^{-1}(e^\theta) + C$

**62.** $-e^{\cos^{-1}x} + C$ **64.** $\frac{2}{3}\sqrt{(\tan^{-1}x)^3} + C$

**66.** $\ln|\sin^{-1}y| + C$

**68.** (a) $\frac{1}{3}(1+\sin^2(x-1))^{3/2} + C$

(b) $\frac{1}{3}(1+\sin^2(x-1))^{3/2} + C$

(c) $\frac{1}{3}(1+\sin^2(x-1))^{3/2} + C$

**70.** $\frac{4}{\sqrt{\cos\sqrt{\theta}}} + C$ **72.** $y = 3(x^2+8)^{2/3} - 12$

**74.** $r = \frac{3}{2}\theta - \frac{3}{4}\cos 2\theta + \frac{\pi}{8} + \frac{3}{4}$ **76.** $y = \frac{1}{2}\tan 2x + 3x - 1$

**78.** 10 m

## Section 5.6, pp. 341–344

**2.** (a) $\frac{1}{3}$ (b) 0 **4.** (a) 2 (b) 2 **6.** (a) $\frac{45}{8}$ (b) $-\frac{45}{8}$

**8.** (a) $\frac{10}{3}$ (b) $\frac{70}{27}$ **10.** (a) $\frac{\sqrt{10}-3}{2}$ (b) $\frac{3-\sqrt{10}}{2}$

**12.** (a) 3 (b) 8 **14.** (a) $-\frac{1}{15}$ (b) $\frac{1}{15}$ **16.** $\frac{1}{6}$ **18.** 12

**20.** $\frac{1}{5}$ **22.** $-\frac{2}{3}$ **24.** $\frac{1}{2} - \frac{1}{4}\sin 2$ **26.** $e$ **28.** $\ln\frac{1}{3}$

**30.** $\ln 2$ **32.** $\sqrt{\ln 2}$ **34.** $\ln\sqrt{2}$ **36.** $\ln 2$ **38.** $\pi/12$

**40.** $4\tan^{-1}(\pi/4)$ **42.** $\pi/8$ **44.** $\frac{\sqrt{3}-1}{2}$ **46.** $-\pi/12$

**48.** 2 **50.** 2 **52.** $\frac{4\pi}{3}$ **54.** $\frac{1}{12}$ **56.** $\frac{22}{15}$ **58.** $\frac{5}{6}$ **60.** 16

**62.** $\frac{19}{4}$ **64.** $\frac{32}{3}$ **66.** $\frac{9}{2}$ **68.** 4 **70.** $\frac{2a^3}{3}$ **72.** $\frac{64}{3}$ **74.** $\frac{9}{2}$

**76.** 4 **78.** $\frac{12}{5}$ **80.** $\frac{37}{12}$ **82.** $\frac{27}{4}$ **84.** 8 **86.** $6\sqrt{3}$

**88.** $\frac{4-\pi}{\pi}$ **90.** $4-\pi$ **92.** $\frac{6\sqrt{3}}{\pi}$ **94.** $\frac{1}{6}$ **96.** $\sqrt{2}-1$

**98.** $\frac{3}{2}\ln 2$ **100.** 1 **102.** $\frac{3}{\ln 2}$ **104.** (a) $\frac{32}{3}$ (b) $\frac{32}{3}$

**106.** $\frac{5}{2}$ **108.** 4

**110.** It is sometimes true. It is true if $f(x) \geq g(x)$ for all $x$ between $a$ and $b$. Otherwise it is false.

**114.** (a) 0 (b) 0

## Practice Exercises, pp. 345–348

**2.** (a) Approximately 26 m **4.** (a) 0 (b) 7 (c) 8 (d) −40

**6.** $\int_1^3 x(x^2-1)^{1/3}dx = 6$ **8.** $\int_0^{\pi/2}(\sin x)(\cos x)\,dx = \frac{1}{2}$

**10.** (a) 1 (b) −1 (c) $-\pi$ (d) $\pi\sqrt{2}$ (e) $1 - 3\pi$

**12.** $\frac{13}{4}$ **14.** 2 **16.** $\frac{7-4\sqrt{2}}{2}$ **18.** $\frac{9}{14}$ **20.** $\frac{32}{3}$ **22.** $\frac{243}{8}$

**24.** $\pi - 2$ **26.** $6\sqrt{3}$ **28.** $\frac{13}{6}$ **30.** $\frac{a^2}{6}$ **32.** $4\sqrt{2} - 2$

**38.** $y = \int_{-1}^{x}\sqrt{2 - \sin^2 t}\,dt + 2$ **40.** $y = \tan^{-1}x - x + 1$

**42.** $y = \tan^{-1}x - 2\sin^{-1}x + 2$ **44.** $\frac{-2}{(\tan x)^{1/2}} + C$

**46.** $(2\theta - \pi)^{1/2} + \tan(2\theta - \pi) + C$ **48.** $-\frac{1}{t} - \frac{1}{t^2} + C$

**50.** $\frac{2}{3}(1 + \sec\theta)^{3/2} + C$ **52.** $-\csc(e^v + 1) + C$

**54.** $-e^{\cot x} + C$ **56.** $\frac{2}{3}$ **58.** $-\ln|\cos(\ln v)| + C$

**60.** $-\cot(1 + \ln r) + C$ **62.** $\frac{2^{\tan x}}{\ln 2} + C$

**64.** $6\sin^{-1}\left(\frac{r+1}{2}\right) + C$ **66.** $\frac{1}{3}\tan^{-1}(3x+1) + C$

**68.** $\frac{1}{5}\sec^{-1}\left|\frac{x+3}{5}\right| + C$ **70.** $\frac{2}{3}(\sin^{-1}x)^{3/2} + C$

**72.** $\frac{1}{3}(\tan^{-1}x)^3 + C$ **74.** 3 **76.** 2 **78.** $\frac{4}{3}(3\sqrt{3} - 2\sqrt{2})$

**80.** $\frac{3}{5}(\sqrt[3]{7} - \sqrt[3]{2})$ **82.** $\frac{1}{90}$ **84.** $\frac{\pi}{8}$ **86.** 2 **88.** $3\sqrt{3} - \pi$

**90.** 0 **92.** −2 **94.** $\frac{3}{7}$ **96.** $\ln 4 - 7$ **98.** $\frac{3}{8}$ **100.** $\frac{32\sqrt{2}}{3}$

**102.** $\frac{7}{3}(\ln 2)^3$ **104.** 4 **106.** $\frac{2\pi}{5}$ **108.** $\frac{\sqrt{3}\pi}{36}$

**110.** $6\sec^{-1}\left|\frac{y}{4}\right| + C$ **112.** $-\sqrt{3}\pi/36$

**114.** (a) 2 (b) $\frac{2}{3}a$ **116.** Yes **118.** $\ln 2$

**120.** 5.43, 396.72°C **122.** $14x\sqrt{2 + \cos^3(7x^2)}$