184. $\int_0^{\pi/4} \sec^2 \theta d\theta$

185. $\int_0^{\pi/4} \sec\theta \tan\theta$

186. $\int_{\pi/3}^{\pi/4} \csc\theta \cot\theta d\theta$

187. $\int_{\pi/4}^{\pi/2} \csc^2 \theta d\theta$

188. $\int_1^2 \left(\frac{1}{t^2} - \frac{1}{t^3}\right) dt$

189. $\int_{-2}^{-1} \left(\frac{1}{t^2} - \frac{1}{t^3}\right) dt$

In the following exercises, use the evaluation theorem to express the integral as a function $F(x)$.

190. $\int_a^x t^2 dt$

191. $\int_1^x e^t dt$

192. $\int_0^x \cos t dt$

193. $\int_{-x}^x \sin t dt$

In the following exercises, identify the roots of the integrand to remove absolute values, then evaluate using the Fundamental Theorem of Calculus, Part 2.

194. $\int_{-2}^3 |x| dx$

195. $\int_{-2}^4 \left|t^2 - 2t - 3\right| dt$

196. $\int_0^{\pi} |\cos t| dt$

197. $\int_{-\pi/2}^{\pi/2} |\sin t| dt$

198. Suppose that the number of hours of daylight on a given day in Seattle is modeled by the function $-3.75 \cos\left(\frac{\pi t}{6}\right) + 12.25,$ with t given in months and $t = 0$ corresponding to the winter solstice.

a. What is the average number of daylight hours in a year?
b. At which times t_1 and t_2, where $0 \le t_1 < t_2 < 12,$ do the number of daylight hours equal the average number?
c. Write an integral that expresses the total number of daylight hours in Seattle between t_1 and t_2.
d. Compute the mean hours of daylight in Seattle between t_1 and t_2, where $0 \le t_1 < t_2 < 12,$ and then between t_2 and t_1, and show that the average of the two is equal to the average day length.

199. Suppose the rate of gasoline consumption in the United States can be modeled by a sinusoidal function of the form $\left(11.21 - \cos\left(\frac{\pi t}{6}\right)\right) \times 10^9$ gal/mo.

a. What is the average monthly consumption, and for which values of t is the rate at time t equal to the average rate?
b. What is the number of gallons of gasoline consumed in the United States in a year?
c. Write an integral that expresses the average monthly U.S. gas consumption during the part of the year between the beginning of April $(t = 3)$ and the end of September $(t = 9)$.

200. Explain why, if f is continuous over $[a, b],$ there is at least one point $c \in [a, b]$ such that $f(c) = \frac{1}{b - a} \int_a^b f(t) dt.$

201. Explain why, if f is continuous over $[a, b]$ and is not equal to a constant, there is at least one point $M \in [a, b]$ such that $f(M) = \frac{1}{b - a} \int_a^b f(t) dt$ and at least one point $m \in [a, b]$ such that $f(m) < \frac{1}{b - a} \int_a^b f(t) dt.$