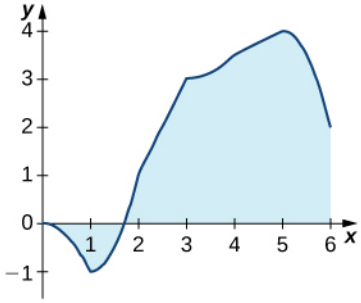
162. The graph of $y = \int_0^x \ell(t)dt$, where ℓ is a piecewise linear function, is shown here.



a. Over which intervals is ℓ positive? Over which intervals is it negative? Over which, if any, is it zero?
b. Over which intervals is ℓ increasing? Over which is it decreasing? Over which, if any, is it constant?
c. What is the average value of ℓ?

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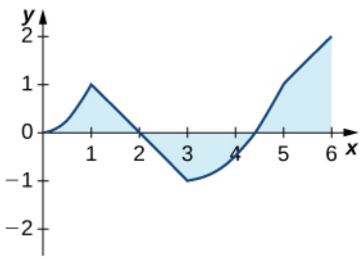

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In the following exercises, use a calculator to estimate the area under the curve by computing T_{10}, the average of the left- and right-endpoint Riemann sums using $N = 10$ rectangles. Then, using the Fundamental Theorem of Calculus, Part 2, determine the exact area.

164. **[T]** $y = x^2$ over $[0, 4]$

165. **[T]** $y = x^3 + 6x^2 + x - 5$ over $[-4, 2]$

166. **[T]** $y = \sqrt{x^3}$ over $[0, 6]$

167. **[T]** $y = \sqrt{x} + x^2$ over $[1, 9]$

168. **[T]** $\int(\cos x - \sin x)dx$ over $[0, \pi]$

169. **[T]** $\int \frac{4}{x^2}dx$ over $[1, 4]$

In the following exercises, evaluate each definite integral using the Fundamental Theorem of Calculus, Part 2.

170. $\int_{-1}^{2}\left(x^2 - 3x\right)dx$

171. $\int_{-2}^{3}\left(x^2 + 3x - 5\right)dx$

172. $\int_{-2}^{3}(t + 2)(t - 3)dt$

173. $\int_{2}^{3}\left(t^2 - 9\right)\left(4 - t^2\right)dt$

174. $\int_{1}^{2} x^9\, dx$

175. $\int_{0}^{1} x^{99}\, dx$

176. $\int_{4}^{8}\left(4t^{5/2} - 3t^{3/2}\right)dt$

177. $\int_{1/4}^{4}\left(x^2 - \frac{1}{x^2}\right)dx$

178. $\int_{1}^{2}\frac{2}{x^3}dx$

179. $\int_{1}^{4}\frac{1}{2\sqrt{x}}dx$

180. $\int_{1}^{4}\frac{2 - \sqrt{t}}{t^2}dt$

181. $\int_{1}^{16}\frac{dt}{t^{1/4}}$

182. $\int_{0}^{2\pi}\cos\theta d\theta$

183. $\int_{0}^{\pi/2}\sin\theta d\theta$