3.5 EXERCISES

For the following exercises, find $\frac{dy}{dx}$ for the given functions.

175. $y = x^2 - \sec x + 1$

176. $y = 3\csc x + \frac{5}{x}$

177. $y = x^2 \cot x$

178. $y = x - x^3 \sin x$

179. $y = \frac{\sec x}{x}$

180. $y = \sin x \tan x$

181. $y = (x + \cos x)(1 - \sin x)$

182. $y = \frac{\tan x}{1 - \sec x}$

183. $y = \frac{1 - \cot x}{1 + \cot x}$

184. $y = \cos x(1 + \csc x)$

For the following exercises, find the equation of the tangent line to each of the given functions at the indicated values of x. Then use a calculator to graph both the function and the tangent line to ensure the equation for the tangent line is correct.

185. **[T]** $f(x) = -\sin x,\ x = 0$

186. **[T]** $f(x) = \csc x,\ x = \frac{\pi}{2}$

187. **[T]** $f(x) = 1 + \cos x,\ x = \frac{3\pi}{2}$

188. **[T]** $f(x) = \sec x,\ x = \frac{\pi}{4}$

189. **[T]** $f(x) = x^2 - \tan x\ x = 0$

190. **[T]** $f(x) = 5\cot x\ x = \frac{\pi}{4}$

For the following exercises, find $\frac{d^2y}{dx^2}$ for the given functions.

191. $y = x \sin x - \cos x$

192. $y = \sin x \cos x$

193. $y = x - \frac{1}{2}\sin x$

194. $y = \frac{1}{x} + \tan x$

195. $y = 2\csc x$

196. $y = \sec^2 x$

197. Find all x values on the graph of $f(x) = -3\sin x \cos x$ where the tangent line is horizontal.

198. Find all x values on the graph of $f(x) = x - 2\cos x$ for $0 < x < 2\pi$ where the tangent line has slope 2.

199. Let $f(x) = \cot x$. Determine the points on the graph of f for $0 < x < 2\pi$ where the tangent line(s) is (are) parallel to the line $y = -2x$.

200. **[T]** A mass on a spring bounces up and down in simple harmonic motion, modeled by the function $s(t) = -6\cos t$ where s is measured in inches and t is measured in seconds. Find the rate at which the spring is oscillating at $t = 5$ s.

201. Let the position of a swinging pendulum in simple harmonic motion be given by $s(t) = a\cos t + b\sin t$. Find the constants a and b such that when the velocity is 3 cm/s, $s = 0$ and $t = 0$.

202. After a diver jumps off a diving board, the edge of the board oscillates with position given by $s(t) = -5\cos t$ cm at t seconds after the jump.

a. Sketch one period of the position function for $t \geq 0$.
b. Find the velocity function.
c. Sketch one period of the velocity function for $t \geq 0$.
d. Determine the times when the velocity is 0 over one period.
e. Find the acceleration function.
f. Sketch one period of the acceleration function for $t \geq 0$.