203. The number of hamburgers sold at a fast-food restaurant in Pasadena, California, is given by $y = 10 + 5\sin x$ where y is the number of hamburgers sold and x represents the number of hours after the restaurant opened at 11 a.m. until 11 p.m., when the store closes. Find y' and determine the intervals where the number of burgers being sold is increasing.

204. **[T]** The amount of rainfall per month in Phoenix, Arizona, can be approximated by $y(t) = 0.5 + 0.3\cos t$, where t is months since January. Find y' and use a calculator to determine the intervals where the amount of rain falling is decreasing.

For the following exercises, use the quotient rule to derive the given equations.

205. $\frac{d}{dx}(\cot x) = -\csc^2 x$

206. $\frac{d}{dx}(\sec x) = \sec x \tan x$

207. $\frac{d}{dx}(\csc x) = -\csc x \cot x$

208. Use the definition of derivative and the identity $\cos(x + h) = \cos x \cos h - \sin x \sin h$ to prove that $\frac{d(\cos x)}{dx} = -\sin x.$

For the following exercises, find the requested higher-order derivative for the given functions.

209. $\frac{d^3 y}{dx^3}$ of $y = 3\cos x$

210. $\frac{d^2 y}{dx^2}$ of $y = 3\sin x + x^2 \cos x$

211. $\frac{d^4 y}{dx^4}$ of $y = 5\cos x$

212. $\frac{d^2 y}{dx^2}$ of $y = \sec x + \cot x$

213. $\frac{d^3 y}{dx^3}$ of $y = x^{10} - \sec x$