104. Absolute maximum at $x = 2$ and absolute minima at $x = \pm 3$

105. Absolute minimum at $x = 1$ and absolute maximum at $x = 2$

106. Absolute maximum at $x = 4,$ absolute minimum at $x = -1,$ local maximum at $x = -2,$ and a critical point that is not a maximum or minimum at $x = 2$

107. Absolute maxima at $x = 2$ and $x = -3,$ local minimum at $x = 1,$ and absolute minimum at $x = 4$

For the following exercises, find the critical points in the domains of the following functions.

108. $y = 4x^3 - 3x$

109. $y = 4\sqrt{x} - x^2$

110. $y = \frac{1}{x - 1}$

111. $y = \ln(x - 2)$

112. $y = \tan(x)$

113. $y = \sqrt{4 - x^2}$

114. $y = x^{3/2} - 3x^{5/2}$

115. $y = \frac{x^2 - 1}{x^2 + 2x - 3}$

116. $y = \sin^2(x)$

117. $y = x + \frac{1}{x}$

For the following exercises, find the local and/or absolute maxima for the functions over the specified domain.

118. $f(x) = x^2 + 3$ over $[-1, 4]$

119. $y = x^2 + \frac{2}{x}$ over $[1, 4]$

120. $y = \left(x - x^2\right)^2$ over $[-1, 1]$

121. $y = \frac{1}{\left(x - x^2\right)}$ over $[0, 1]$

122. $y = \sqrt{9 - x}$ over $[1, 9]$

123. $y = x + \sin(x)$ over $[0, 2\pi]$

124. $y = \frac{x}{1 + x}$ over $[0, 100]$

125. $y = |x + 1| + |x - 1|$ over $[-3, 2]$

126. $y = \sqrt{x} - \sqrt{x^3}$ over $[0, 4]$

127. $y = \sin x + \cos x$ over $[0, 2\pi]$

128. $y = 4\sin\theta - 3\cos\theta$ over $[0, 2\pi]$

For the following exercises, find the local and absolute minima and maxima for the functions over $(-\infty, \infty)$.

129. $y = x^2 + 4x + 5$

130. $y = x^3 - 12x$

131. $y = 3x^4 + 8x^3 - 18x^2$

132. $y = x^3(1 - x)^6$

133. $y = \frac{x^2 + x + 6}{x - 1}$

134. $y = \frac{x^2 - 1}{x - 1}$

For the following functions, use a calculator to graph the function and to estimate the absolute and local maxima and minima. Then, solve for them explicitly.

135. **[T]** $y = 3x\sqrt{1 - x^2}$

136. **[T]** $y = x + \sin(x)$

137. **[T]** $y = 12x^5 + 45x^4 + 20x^3 - 90x^2 - 120x + 3$

138. **[T]** $y = \frac{x^3 + 6x^2 - x - 30}{x - 2}$

139. **[T]** $y = \frac{\sqrt{4 - x^2}}{\sqrt{4 + x^2}}$

140. A company that produces cell phones has a cost function of $C = x^2 - 1200x + 36{,}400,$ where C is cost in dollars and x is number of cell phones produced (in thousands). How many units of cell phone (in thousands) minimizes this cost function?