1. Find the slope-intercept form of the line that is tangent to the function at the indicated point $P$.

(a) $f(x) = \cos^2(3x)$, $P\left(\frac{\pi}{6}, f\left(\frac{\pi}{6}\right)\right)$

(b) $g(x) = \sqrt{\sec(x)}$, $P\left(\frac{\pi}{3}, g\left(\frac{\pi}{3}\right)\right)$

(c) $h(x) = x \tan(2x)$, $P\left(\frac{\pi}{6}, h\left(\frac{\pi}{6}\right)\right)$

2. Determine the sign chart for the first derivative of the function.

(a) $f(x) = \sqrt{x}(4 - \sqrt{x})^2$

(b) $f(x) = \sin(x) - \cos(x)$ where $0 < x < \pi$

(c) $f(x) = \frac{x^2}{x^2 - 9}$

(d) $f(x) = 64x^{1/3} - \frac{4}{3}x^{5/3}$

3. Determine the sign chart for the second derivative of the function.

(a) $f(x) = 9x^{5/3} - \frac{3}{11}x^{8/3}$

(b) $f(x) = \sqrt{3}\sin(x) - \cos(x)$ where $0 < x < \pi$

(c) $f(x) = 2\sin(x) + \cos(2x)$ where $0 < x < \pi$

4. Apply the First Derivative Test in finding the relative extrema of the function.

(a) $f(x) = 2x^3 - 3x^2 - 36x - 2$.

(b) $f(x) = \frac{2x}{x^2 + 1}$

5. Apply the Second Derivative Test in finding the relative extrema of the function.

(a) $f(x) = 2x^3 - 3x^2 - 36x - 2$.

(b) $f(x) = \frac{2x}{x^2 + 1}$

6. Determine the open intervals where the function is concave upward or concave downward.

Then find the points of inflection of the function.

(a) $f(x) = 9x^{2/3} + \frac{9}{40}x^{5/3}$

(b) $f(x) = \sqrt{3}\cos(x) - \sin(x)$ where $0 < x < \pi$

(c) $f(x) = 2\sin(x) + \cos(2x)$ where $0 < x < \pi$

7. The product of two positive numbers is $\sqrt{2}$. Write a function that describes the sum of two such numbers.

Then find the sign chart for the derivative of the function. What is the minimum sum of two such numbers?

8. A right triangle lies in the first quadrant. Two sides of the triangle lie in the coordinates axes, and the hypotenuse contains the point $(4, 8)$. Write a function that describes the area of such a triangle. Determine the sign chart for the derivative of the function. Then find the minimum area of such a triangle.

9. Evaluate and simplify the expression

$$\sum_{i=1}^{n} f\left(a + \frac{i(b-a)}{n}\right) \frac{b-a}{n}$$

for the indicated function $f(x)$, and given values $a$ and $b$.

(a) $f(x) = 2x$, $a = 0$, $b = 4$

(b) $f(x) = x + 4$, $a = 1$, $b = 3$