Exercise 1. Let \( n \) be an arbitrary positive integer. Give an example of a function with exactly \( n \) vertical asymptotes. Give an example of a function with infinitely many vertical asymptotes.

Exercise 2. Let \( f \) be a function which is differentiable everywhere. Suppose that \( f'(x) > 1 \) for all \( x \). Show that \( \lim_{x \to \infty} f(x) = \infty \).

Exercise 3. Graph the function \( f(x) = x^3 + 6x^2 + 9x \).

Indicate domain, critical points, inflection points, regions where the graph is increasing/decreasing, \( x \)-intercepts and \( y \)-intercepts, regions of concavity (up or down), local maxima and minima, any asymptotes and behavior at infinity.

Exercise 4. Find

\[
\lim_{t \to 16} \frac{\sqrt{t} - 4}{t - 16}
\]

in three ways: (i) using methods learned up to and including the first midterm; (ii) by realizing the limit as \( f'(c) \) for some function \( f(t) \) and some value \( c \); (iii) using L’Hospital’s Rule.

Exercise 5 (Section 4.7, #19). Find the point on the line \( y = 2x + 3 \) that is closest to the origin.

Exercise 6 (Section 4.7, #21). Find the points on the ellipse \( 4x^2 + y^2 = 4 \) that are farthest away from the point \((1, 0)\).

Exercise 7 (Section 4.7, #24). Find the area of the largest rectangle that can be inscribed in the ellipse \( x^2/a^2 + y^2/b^2 = 1 \).

Exercise 8 (Section 4.7, #54). At which points on the curve \( y = 1 + 40x^3 - 3x^5 \) does the tangent line have the largest slope?