1. (15%) Analyze and sketch the graph of $f(x) = \frac{2(x^2-9)}{x^2-4}$. Your answer should include extremum, point of inflection, intervals of increase and decrease, concavity and asymptote.

2. (15%) Find the relative extrema and the absolute extrema of $f(x) = 2x - 3x^{2/3}$ on the interval $[-1, 3]$.

3. (15%) Given $x^2 + y^2 = 25$, use implicit differentiation to find $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$. Find the tangent line at $(3, 4)$.

4. (15%) Find the derivative of the function $g(x) = \sec(\frac{1}{3}x)\tan(\frac{1}{3}x)$.

5. (10%) Use differentials to approximate the value of $(2.99)^3$.

6. (10%) Find the relative extrema and points of inflection for $f(x) = -3x^5 + 5x^3$.

7. (10%) Let $0 < a < b$. Use the Mean Value Theorem to show that

$$\sqrt{b} - \sqrt{a} < \frac{b - a}{2\sqrt{a}}.$$

8. (10%) Use squeeze theorem to find the limit of $h(x) = x\sin\frac{1}{x}$ as $x \to 0$.