1. (36 pt) Evaluate the following limits.
   
   a) \( \lim_{x \to 0} \frac{\sin(x^2)}{\tan(x) + 2} \)
   
   b) \( \lim_{t \to 3} \frac{t^3 - 27}{t^2 - 5t + 6} \)
   
   c) \( \lim_{x \to \infty} (\sqrt{x^2 + ax + b} - \sqrt{x^2 + cx + d}) \)
   
   d) \( \lim_{t \to -\infty} \frac{t}{\sqrt{t^2 + 1}} \)
   
   e) \( \lim_{h \to 0} \frac{h}{\sqrt{2a + 2h} - \sqrt{2a}} \)
   
   f) \( \lim_{x \to \infty} \frac{x \sin(x)}{x + 1} \)

2. (24 pt) Find the derivative of each of the following functions.
   
   a) \( f(x) = \frac{ae^{2x} + 1}{be^x + 1} \)
   
   b) \( g(x) = (x^4 + 1)(x^2 + 1)(e^x + 2) \)
   
   c) \( h(x) = \frac{F(x)G(x)H(x)}{\sin^2(x) + \cos^2(x) + 1} \)
   
   d) \( k(x) = \frac{e^x \sqrt{x}}{x^3 + x^2 + \frac{1}{x}} \)

3. (10 pt) Let \( f \) be a differentiable function. Find the derivative of the function \( g(x) = \sqrt[3]{f(x)} \).

4. (12 pt) Use the definition of the derivative to compute the derivative of the following functions.
   
   a) \( f(x) = x|x| \)
   
   b) \( g(x) = F(ax) \), where \( F \) is a differentiable function.

5. (10 pt) Consider the functions pictured below.

   ![Graphs of f(x) and g(x)]

   a) For what values of \( x \) is the function \( f(g(x)) \) continuous (and justify your answer)?
   
   b) For what values of \( x \) is the function \( g(f(x)) \) continuous (and justify your answer)?

6. (10 pt) Consider the function
   
   \[ f(x) = \begin{cases} 
   x^2 \sin\left(\frac{1}{x}\right) & \text{if } x \neq 0; \\
   0 & \text{if } x = 0. 
   \end{cases} \]

   a) Explain why \( f(x) \) is continuous everywhere.
   
   b) Explain why \( f(x) \) is differentiable at 0.

7. (8 pt) Find all (horizontal and vertical) asymptotes of the function \( f(x) = e^{-\frac{1}{x^2}} \).