1. Two curves intersect orthogonally when their tangent lines at each point of intersection are perpendicular. Suppose $C$ is a positive number. The curves $y = Cx^2$ and $y = \frac{1}{x^2}$ intersect twice. Find $C$ so that the curves intersect orthogonally. For that value of $C$, sketch both curves when $-2 \leq x \leq 2$ and $0 \leq y \leq 4$.

2. The graph of $f(x)$ is shown to the right.
   a) At which points is the function not continuous?
   b) At which points is the function not differentiable?
   c) Sketch a graph of $f'(x)$, the derivative of $f(x)$, as well as you can.

   ![Graph of $f(x)$]

   This is essentially problem 76 in section 3.2 of the textbook.

3. Suppose that $f(x)$ and $g(x)$ are differentiable functions, and the following information is known about them:
   
   $f(2) = -3 \quad f'(2) = 5 \quad g(2) = 1 \quad g'(2) = 2 \quad g(0) = 2 \quad g'(0) = 4$

   a) If $F(x) = \frac{f(x)}{g(x)}$, compute $F(2)$ and $F'(2)$.
   b) If $G(x) = x^3f(x) - 7g(x)$, compute $G(2)$ and $G'(2)$.
   c) If $H(x) = \frac{3 + e^x}{g(x)}$, compute $H(0)$ and $H'(0)$.

4. Suppose $f(x) = \frac{5x^2 - 10x}{e^x}$.
   a) Graph $y = f(x)$ in the window $0 \leq x \leq 5$ and $-3 \leq y \leq 1$. Locate the apparent highest and lowest points on the curve.
   b) Calculate $f'(x)$ and use it to locate (algebraically) all those values of $x$ at which the graph has a horizontal tangent line. Check your answer against a).
   c) Use $f'(x)$ to find an equation for the line that is tangent to the curve $y = f(x)$ at $x = 1$. Draw the line on the graph in a) to check the result.
   d) Use the graph in a) to guess the values of $x$ where $f'(x)$ is largest and where $f'(x)$ is smallest. Then graph the equation $y = f'(x)$ on your calculator to check your guesses.

One problem will be selected for a writeup to be handed in at the next recitation meeting. Please see Professor Greenfield’s Math 153 webpage to learn which problem to hand in.

The content of every one of these problems is a possible question on the first exam.