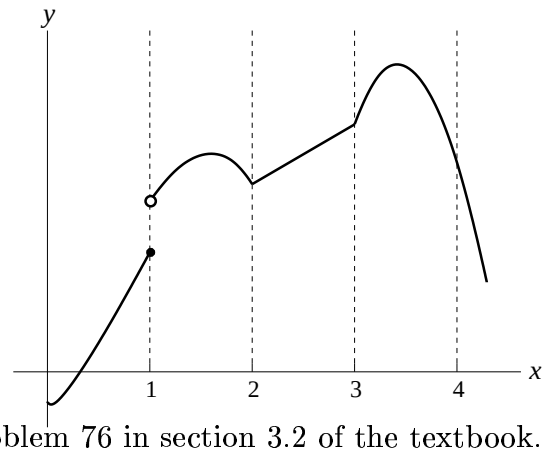
1. Two curves intersect orthogonally when their tangent lines at each point of intersection are perpendicular. Suppose C is a positive number. The curves $y = Cx^2$ and $y = \frac{1}{x^2}$ intersect twice. Find C so that the curves intersect orthogonally. For that value of C, sketch both curves when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

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.



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:

$$f(2) = -3 \qquad f'(2) = 5 \qquad g(2) = 1 \qquad g'(2) = 2 \qquad g(0) = 2 \qquad g'(0) = 4$$

a) If $F(x) = \dfrac{f(x)}{g(x)}$, compute $F(2)$ and $F'(2)$.

b) If $G(x) = x^3 f(x) - 7g(x)$, compute $G(2)$ and $G'(2)$.

c) If $H(x) = \dfrac{3 + e^x}{g(x)}$, compute $H(0)$ and $H'(0)$.

4. Suppose $f(x) = \dfrac{5x^2 - 10x}{e^x}$.

a) Graph $y = f(x)$ in the window $0 \le x \le 5$ and $-3 \le y \le 1$. 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 <u>every one</u> of these problems is a possible question on the first exam.