Math 251

PR and QR Problems Name:_____

Show all relevant work!

You may use a calculator to verify solutions, but not to provide them.

1. Find the derivatives below. Make a good faith effort to simplify your answers.

   (a) $\dfrac{\mathrm{d}}{\mathrm{d}x}\left(\dfrac{4x^2-1}{\sqrt{x}}\right)$

   (b) $\dfrac{\mathrm{d}}{\mathrm{d}x}\left(\dfrac{x-1}{x+1}\right)$

2. Use calculus to determine where $g(x) = xe^{-x}$

   (a) Has any horizontal tangents.

   (b) Is concave down and decreasing.

3. Consider the function $g(x) = \dfrac{x}{x^2+1}$ defined for all $x \in \mathbb{R}$.

   (a) Determine where $g(x)$ has any horizontal tangents.

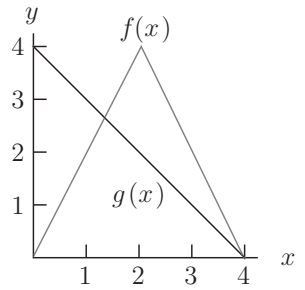
   (b) Explain why $g(x)$ must be increasing on $[-1, 1]$

4. Let $k(x) = (f(x))/(g(x))$. Find:

(a) $k'(1)$ _____

(b) $k'(2)$ _____

(c) $k'(3)$ _____



5. Suppose f and g are differentiable functions with the values shown in the following table. For each of the following functions, h, find $h'(2)$.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
2	3	4	5	-2

(a) $h(x) = f(x) + g(x)$

(b) $h(x) = f(x)g(x)$

(c) $h(x) = \dfrac{f(x)}{g(x)}$

6. Let $f(v)$ be the gas consumption (in liters/km) of a car going at velocity v (in km/hr). In other words, $f(v)$ tells you how many liters of gas the car uses to go one kilometer, if it is going at velocity v. You are told that $f(80) = 0.05$ and $f'(80) = 0.0005$.

(a) Let $g(v)$ be the distance the same car goes on one liter of gas at velocity v. What is the relationship between $f(v)$ and $g(v)$? Find $g(80)$ and $g'(80)$.

(b) Let $h(v)$ be the gas consumption in liters per hour. In other words, $h(v)$ tells you how many liters of gas the car uses in one hour if it is going at velocity v. What is the relationship between $h(v)$ and $f(v)$? Find $h(80)$ and $h'(80)$.

(c) How would you explain the practical meaning of the values of these functions and their derivatives to a driver who knows no calculus?