RECO 250 Homework #6 review for Exam #2 due 10/26 Fall 2009

Re-cap from lectures: How to 'curve sketch' WITHOUT using excel or a graphing calculator.
Always follow these four steps:

1) how many wiggles does the function have? answer: the highest power – 1

2) find the vertical axis *intercept* : evaluate the function at 0; and label it (0, #). If it's not too hard evaluate the *intercept*(s) on the horizontal axis and label them (#,0).

3) identify the *critical point(s) :* take the first derivative, *f'*, set it = 0, and solve for the domain variable. **Also check if *x* = 0* when your function has more than one wiggle**. Next, evaluate the function at the *critical point*(s).By convention, label *critical points* with asterisks, e.g., (*x*, y**).

4) check for (local) *concavity* or *convexity*: take the second derivative, *f'',* and evaluate it at the critical points (found above). If $f''(x^*) \geq 0$, its "going up" around x*, so the function is *convex* at that critical point. That critical point is a local or global ***minimum***.

If $f''(x^*) \leq 0$, it is "going down" around x*, so the function is *concave* at that critical point. That critical point is a local or global **maximum**.

If $f''' = 0$, the function is either a linear function (you might have recognized that when you counted "zero wiggles," but it could also have a flat spot) OR *x** is an ***inflection*** point. Evaluate *f''* two more times: (i) at *x*-1* (on the left side of the critical point), and (ii) at *x*+1* (on the right side of the critical point).

(i) if $f''(x^*-1) \leq 0$, the function's *concave* to the LEFT of the critical point; if $f''(x^*-1) \geq 0$, its *convex* to the left of the critical point.

(ii) if $f''(x^*+1) \leq 0$, the function's *concave* to the RIGHT of the critical point; if $f''(x^*+1) \geq 0$, its *convex* to the right of the critical point.

NOTE: If x* isn't a nice round number to begin with, just round down to a nice round number for the left side (i), and round up to a nice round number on the right side(ii) when you re-evaluate *f''*.

1. Define each concept in *English* and provide an example (an equation or a graph).
   a) the *Quotient Rule*
   b) the *Chain Rule*
   c) *critical value*
   d) *local maximum*
   e) *First-Order Necessary Condition*
   f) *Second-Order Sufficient Condition*
   g) *Marginal Revenue*

2. derivate: $y = \frac{x^2 + 1}{5}$

3. derivate: $y = \frac{3x}{2x + 1}$

4. derivate: $y = \sqrt[3]{4x - 1}$

5. derivate: $y = 8x^3(1-7x)^4$

6. If *average cost* = $2q + \frac{10{,}000}{q^2}$

(a) express *total cost* $C(q)$

(b) Draw the total cost function $C(q)$ without using excel or a graphing calculator.
(Follow steps 1-2-3-4 on the top of the first page.)

(c) express *marginal cost*

(d) Draw the marginal cost function without using excel or a graphing calculator.
(Follow steps 1-2-3-4 on the top of the first page.)

7. Given *inverse demand* $p = 1{,}200 - q^2$ express:
(a) total *revenue*

(b) *marginal revenue*

(c) Draw the demand curve (**hint:** draw the 'graphing version')
(Follow steps 1-2-3-4 on the top of the first page.)

(d) draw the *marginal revenue* function
(Follow steps 1-2-3-4 on the top of the first page.)

(e) find the level of q that maximizes total revenue (& don't forget to check the SOC.'s) AND EVALUATE $R(q^*)$

8. Draw the function $y = 5x^3 - 30x^2 + 300$ without using excel or a graphing calculator.
(Follow steps 1-2-3-4 on the top of the first page.)

NOT REQUIRED: *CHECK all your "curve sketches" using excel (or a graphing calculator). If you did them all correctly by hand,* ***CONGRATULATIONS!***

If you did <u>not</u> get the same graphs in excel,
either (i) your excel work is wrong, or
(ii) your drawing(s) is/are wrong, OR your calculations were incorrect

(i) In excel: "add a trend line" with "show the equation" and "show the R^2".
-If you chose the correct polynomial for the trend line (the highest power – as in step 1), the trend line should be the equation you thought you were graphing.
-If you entered the equation incorrectly, the trend line will be different.
→FIX your equation.

(ii) When you are sure that your excel work is correct:
look again at your calculations to find out where you went wrong 'by hand.' If you are still totally mystified, come see Prof K.

(Try to have drawn your graphs correctly before you turn in your homework.)