Math 165 **Special Assignment #2** **Lowman** **Fall 2010**
due on Thursday in discussion before Exam 1 on Friday Oct 15

1. For some $f(x)$, $f'(x) = x^2+2x-8$. Find where $f(x)$ is increasing and where it is decreasing.

2. For some $f(x)$, $f'(x) = x^2 + 2x - 8$. Find where $f(x)$ is concave up and and where it is concave down.

3. For some $f(x)$, $f'(x) = -10x^2 + 60x - 50$. Find the x coordinates of all first order critical points and use the first derivative test to determine what kind of critical point at each x.

4. For some $f(x)$, $f'(x) = -10x^2 + 60x - 50$. Find the x coordinates of all first order critical points and use the second derivative test to determine what kind of critical point at each x.

5. Given $f(x) = (x^2 + 7x + 1) \cdot \sqrt{5x^2 + x}$ find $\frac{df}{dx}$ at $x = 1$.

6. Find the slope of the tangent line to the graph of $3xy^2 + 4y = 10$ at the point $(2, 1)$.

7. Find $\frac{df}{dx}$ by using the limit definition of the derivative. $f(x) = x^2$

8. Find the following limits:
   (a) $\lim_{x\to\infty} \frac{x-3}{2x^2+2x+3}$
   (b) $\lim_{x\to 3} \frac{9-x^2}{3-x}$

   Find $\frac{df}{dx}$ for the following functions, **Please Do Not Simplify** answers:

9. $f(x) = (x^3 + x + 1)/(x^3 + 1)$

10. $f(x) = (x^3 + x + 1) \cdot (x^3 + 1)$

11. $f(x) = (x^2 + x)^{1/3}$

12. $f(x) = \ln(x^2 + x)$

13. $f(x) = e^{x^2+x}$

14. Use implicit differentiation to find $\frac{dy}{dx}$ when $y^2 + x = x^2 + x^3y^4$

15. Use the chain rule to find $\frac{dy}{dx}$ if $y = u^3 - 3u^2 + 1$ and $u = x^2 + 2$

16. Given $f(x) = e^{2x} + ln(3x) + \sqrt{(4x + 1)}$ find the differential of $f(x)$.

17. For $f(x) = x^3 - 9x^2$ find the locations of any inflection points. Use $f''(x)$ to show that the points you found actually are inflection points.

18. $f(x) = (x - 1)^3 + 1$ Find the location of any critical points and use the first derivative test to determine what kind of critical point.

19. $f(x) = \frac{x}{(x+1)^2}$ Use the second derivative test to determine what kind of critical point it has.

20. For $f(x) = x^4 - 6x^2 + 10$, use f'' determine where the graph of $f(x)$ is concave up and where it is concave down.

21. For some $f(x)$, $f'(x) = \frac{(2x-x^2)}{(x-3)}$ use f' determine where the graph of $f(x)$ is increasing, and where it is decreasing.

22. Write the geneneral form of the Power Rule, Exponential Rule and Log Rule for *differentiation*.

23. $f(x)$ is a function with first derivative $f'(x) = (x-1)(x-2)(x-3)(x-4)/x$. $f(x)$ obviously has a critical number at $x = 2$. Use the first derivative test to determine what kind of critical point is at $x = 2$.

24. The function in the previous problem has a critical number $x_c = 2$ and a second derivative $f''(x) = \frac{3x^4-20x^3+35x^2-24}{x^2}$. Use the second derivative test to determine what kind of critical point is at $x_c = 2$.

25. Given the cost to produce one unit is **\$1.00** and the demand relation is given by $p = 10 - .1q$. Find the following and **Box Your Answers**:

    - profit function $P(q)$
    - marginal profit $MP = \frac{dP}{dq}$
    - find the production level that maximizes the profit by setting the slope of the profit function to zero and solving for q_{max}.
    - find the price that should charged to maximize the profit p_{max}.
    - find the maximum profit P_{max}

26. A store has been selling skateboards at the price of **\$46** per board, and at this price, skaters have been buying **66** boards a month. The owner of the store wants to raise the price and estimates that for each **\$2** increase in price, **4** fewer boards will be sold each month. Each board costs the store **\$24**.
    (a) Find the linear demand function that gives p as a function of q, the quantity sold.
    (b) Find the profit function as a function of q.
    (c) At what price p should the store sell the boards in order to maximize profit?

27. A company estimates that the cost in dollars of producing x units of a certain product is $C(x) = \frac{x^2}{5} + 6x + 1000$. Find the production level that minimizes average cost. Hint: find average cost, find all critical numbers for average cost, use the first or 2nd derivative test to determine that the CNs correspond to a minimum. Average cost is defined as $C_{avg} = \frac{C(x)}{x}$