Exam 2 Review Assignment
Due Wednesday, October 29^{th} (30 points)

1. Calculate derivatives of the following functions.

(a) $f(x) = \ln\left[\left(\dfrac{e^{2x}\tan(x)}{x^2+1}\right)^{2/3}\right]$

(b) $g(x) = \sec(x)^{\sin(x^3-1)}$

2. Find the second derivative of $f(x) = ln(ln(x+1))$.

3. (a) Find the linearization of $f(x) = \sqrt[5]{2+x}$ near $x = 30$.

(b) Use (a) to estimate $\sqrt[5]{31}$.

4. (a) Compute the differential of the function $y = e^{x^2-\ 4}\cos(\pi x)$.

(b) Evaluate the differential found in (a) if $x = 2$ and $dx = .2$.

5. Suppose $d(x) = x^4 - 4x^2 + 2$. Find the absolute maximum and minimum values of $d(x)$ on $[-3, 1]$.

6. Find all numbers c which satisfy the conclusion of the Mean Value Theorem for $f(x) = 5x^{2/3} - x^{5/3}$ in $[0, 5]$.

7. Suppose that $f(1) = 10$ and that for every $1 \leq t \leq 4$, $f'(t) \geq 2$. What is the minimum value of $f(4)$?

8. Let $p(x) = e^{\frac{1}{x}}$, $x \neq 0$.

(a) On what interval(s) is $p(x)$ increasing? decreasing?

(b) On what interval(s) is the graph of $p(x)$ concave up? concave down?

(c) Find all inflection points of the graph of $p(x)$.

9. Classify all critical points of $r(t) = \frac{2}{5}t^5 + \frac{1}{4}t^4 - 5t^3$.

10. Find an equation of the line tangent to the given curve at the given point.

(a) $g(x) = \dfrac{\ln(x)+2}{x^2}$, $(1, 2)$

(b)$x^y = y^x$, $(2, 4)$

11. A sample of Trinitonium-2008 decayed to 80% of its original size after 5 years.

(a) Find the half-life of Trinitonium-2008.

(b) How long will it take until there is 8% of the original sample left?

12. A population of bacteria, $P(t)$, initially contains 500 cells and grows at a rate proportional to its size. When the population is 2000 it is growing at a rate of 6000 cell per hour.

(a) How many cells are there after 6 hours?

(b) How long will it take for the population to contain 100,000 cells?

13. Pablo likes to brew up a big pot of chili late on Sunday evenings so that he has plenty of chili to eat all week long. Pablo has also realized that he cannot put his chili into the fridge unless it has first cooled down to 20° C, but by leaving it on the counter the chili takes forever to cool to this temperature. Thus, Pablo discovered that by cooling the chili in a sink full of cold water, (kept running, so that its temperature was roughly constant at 5° C) and stirring occasionally, he could bring the temperature of the chili to 60° C in ten minutes. If the chili is taken off the stove when it is 100° C and placed immediately into the sink of cold water, how long will it be until Pablo can put it in the fridge?

14. Do problem 36 on page 247.

15. A person 6 feet tall walks at 5 feet per second along one edge of a road 30 feet wide. On the other edge of the road is a light pole that is 18 feet tall. How fast is the length of the person's shadow (on the ground) increasing when the person is 40 feet from the point directly across the street from the pole?