Mathematics 209
Midterm test, October 21, 2012 1h30min

Only authorized calculators permitted

[75 pts=100%]

1. [10pts] Find the limits

(a) $\lim_{x\to 0} \frac{\sqrt{36+x}-6}{x}$,

(b) $\lim_{x\to+\infty} \frac{4-x^3}{x^2+5}$, (c) $\lim_{x\to 1^-} \frac{c^2}{x-3}$ where c is a real number.

2. [15pts](3+4+4+4) Without simplifying find the derivatives $f'(x)$ of the following

(a) $f(x) = \frac{1}{5}x^{-3} + 8\sqrt{x} + 4$, (b) $f(x) = 4(x^2-6)^5$, (c) $f(x) = \frac{2+x^2}{x^5-3}$, (d) $f(x) = e^{3x^4+2x}$.

3. [10pts] Find the derivative of the function $3x^2$ from first principles. i.e. using the four-step method.

4. [5pts] Suppose that interest is compounded continuously and that 8000 current dollars have a future value of 12,000 dollars after five years. What is the effective rate of interest that is being charged?

5. [10pts] The function $t(x)$ is given implicitly by the equation $e^t+3t-x = 3$. Calculate the slope of the tangent line at the point $(e, 1)$

6. [15pts] Market studies for a new product show that the demand as a function of price p, is $x = 500,000 - 1000p$.

(a) Find the average revenue as a function of p.

(b) Find the marginal average revenue when $p = 50$

7. [10pts] A point is moving along the graph of $2y^2 - e^x = x + 1$. When the point is at $(x, y) = (0, -1)$ its x coordinate has velocity zero. How fast is the y coordinate changing at that moment?