Mathematics 209
Midterm test, February 18, 2012   1h30min

Only authorized calculators permitted

[100 pts=100%]

1. [15pts] Find the limits

(a) $\lim_{x \to 2}(3x^4 - 6x - 5)$,   (b) $\lim_{x \to 1}\frac{x^2-3x+2}{x-1}$,   (c) $\lim_{x \to 1^+}\frac{3}{x-2}$

2. [30pts](7+7+8+8) Without simplifying find the derivatives $f'(x)$ of the following

(a) $f(x) = \frac{1}{5}x^{-3} + 3\sqrt{x} + 4\pi$,   (b) $f(x) = 5(x^2 + 7)^4$,
(c) $f(x) = \frac{-x}{x^3+1}$,   (d) $f(x) = \ln(2x^4 + 1)$.

3. [15pts] The function $t(x)$ is given implicitly by the equation $e^t + t - x = 1$. Calculate the slope of the tangent line at $(x, t) = (e, 1)$.

4. [10pts] If interest is compounded continuously at the rate $r = 0.05$ (5% annually), how many whole years are needed for principal of $P = 10,000$ dollars to become the future value of $A = 16,000$ dollars?

5. [15pts] Market studies for a new camera show that the demand as a function of price p, is $x = 1,000,000 - 2,000p$.

(a) Find the marginal revenue depending on p at $p = \$100$.

(b) For what p does the revenue reach its *maximum*?

(c) Find the elasticity of demand when $p = \$100$. Will an increase in price increase revenue or decrease revenue?

6. [10pts] A point is moving along the graph of $2y^2 - e^x = 1$. When the point is at $(x, y) = (0, 1)$ its x coordinate is increasing at the rate of 0.8 units per second. How fast is the y coordinate changing at that moment?

7. [5pts] Prove from the definition of the derivative: if the function $f(x)$ is differentiable at $x = 7$ then the function $g(x) = 5f(x)$ is differentiable at $x = 7$.