

Math 211

Final Exam

FALL 2009

Name (print): _____

Signature: _____

Z-number: _____

Section: _____

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Page 1	/ 20	TOTAL / 200
Page 2	/ 20	
Page 3	/ 30	
Page 4	/ 35	
Page 5	/ 35	
Page 6	/ 20	
Page 7	/ 20	
Page 8	/ 20	
Page 9	/ 35	

1. **[20 pts.]** Find the derivative of each of the following functions. (Do not simplify).

$$(a) f(x) = \left(\frac{2}{x^2} + 5\sqrt{x} + e^{5x} \right)^2$$

$$(b) f(x) = \ln \left(\frac{1-x^2}{1+2x^2} \right)^5$$

$$(c) f(x) = 5e^{\sqrt{x}-2}$$

$$(d) f(x) = \frac{x^3 + 3x}{3x^2 - 4}$$

$$(e) f(x) = x^2 \ln(2x^2 + 5)$$

2. **[10 pts.]**

(a) Let the function $f(x)$ be defined by

$$f(x) = \begin{cases} \frac{x^2 - 4}{x - 2} & x \neq 2 \\ 4 & x = 2 \end{cases}$$

Is this function $f(x)$ continuous at $x = 2$?

Justify your answers.

(b) **[5 pts.]** $\lim_{x \rightarrow 1} (x^2 + 2x)^5$

(c) **[5 pts.]** $\lim_{x \rightarrow \infty} \frac{x^2 - 3x + 2}{-2x^2 + 5}$

3. **[15 pts.]** Let $f(x) = x^4 - 2x^2 + 1$. Find absolute maximum and minimum values of $f(x)$ on the interval $[-2, 2]$.

4. **[15 pts.]** Suppose 1000gm of Strontium-90 becomes 500gm after 10 days. After how many days will 1000gm be 30gms?

5. **[20 pts.]** Given $f(x) = x^3 - 3x^2 + 1$

(i) Find all the critical points.

(ii) Find the relative maxima/minima of the function using a derivative test.

(iii) Use the 2nd derivative test to determine where the graph of $f(x)$ is concave upward and concave downward. Find all the inflection point(s).

(iv) Draw a rough sketch of the graph of $f(x)$ using the information in (i)-(iii).

6. **[15 pts.]** Suppose \$1000.00 is invested in a savings account in which interest is compounded continuously at 7.2% per year.

(a) What is the balance after 3 years?

(b) When will \$1000.00 be \$2000.00?

7. **[20 pts.]** A small furniture manufacturer estimates that the cost (in dollars) of producing x units of a particular chair is given by

$$C(x) = 10,000 + 4x + 0.01x^2$$

and the revenue for the production of x chairs is

$$R(x) = 48x - 0.012x^2.$$

- (a) Find the profit function $P(x)$.

- (b) Find the number of chairs, that will maximize the profit.

8. **[20 pts.]** Evaluate

$$(a) \int_1^2 \left(3x^2 - \frac{1}{x^2} + 2 \right) dx$$

$$(b) \int_1^2 \left(\frac{2}{x} - 5e^x \right) dx$$

9. **[20 pts.]** Compute the following integrals:

$$(a) \int \frac{(x+1)}{(x^2+2x)^{10}} dx$$

$$(b) \int 2xe^{x^2+2} dx$$

$$(c) \int \left(x^3 + 3x - \frac{2}{x} \right) dx$$

$$(d) \int \left(\sqrt{x} + \frac{3}{x^2} - 4x^3 + 2 \right) dx$$

10. **[20 pts.]** Find the area of the region bounded by the curves $y = 2x^2 - 2x + 1$ and $y = x^2 + 1$.

11. **[15 pts.]** Find $f(x)$ where $f'(x) = 4x^3 + 2x + e^x$ and $f(0) = 2$.