

Math 211

Final Exam

Fall 05

Name (print): _____

Signature: _____

Z-number: _____

Section: _____

Show all work for credit!
NO calculators are allowed to be used
in conjunction with this exam.

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

(a) $f(x) = (x^2 + 2x + 2)^5 + \ln(x + 1) + e^{x^3+3}$

(b) $f(x) = \left(2x^2 + \frac{2}{x}\right)^6 \cdot e^{x^3+3x+2}$

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

(d) $f(x) = \sqrt{\left(\frac{x+1}{x-1}\right)}$

2. **[15 pts.]** Find the equation of the tangent line to the curve $y = \left(\frac{x+2}{x-1}\right)^2$ at $x = 2$.

3. **[15 pts.]** Find the following limits (if exists):

(a) $\lim_{x \rightarrow 3} \frac{(x^2 - 9)}{(x^2 - 5x + 6)}$

(b) $\lim_{x \rightarrow 1} \left(5x^3 + \frac{3}{e^x} + 6x^{2/3}\right)^5$

(c) $\lim_{x \rightarrow \infty} \frac{6x^4 + 2x + 1}{2x^4 + 3x^2 + 1}$

4. **[20 pts.]** Using the limit definition of the derivative of a function, find $f'(x)$ where

$$f(x) = \frac{1}{2x}$$

5. **[15 pts.]** An appliance firm is marketing a new washing machine. It determined that in order to sell x washing machines, the price per washing machine must be $p = 150 - .02x$. It also determines the cost of producing x washing machines is given by $C(x) = 10x + 300$. What price per washing machine must be charged in order to make a maximum profit.

6. **[20 pts.]** Let $f(x) = x^3 - 3x - 2$

(a) Determine $f'(x)$ and $f''(x)$

(b) Find the critical point(s) of $f(x)$.

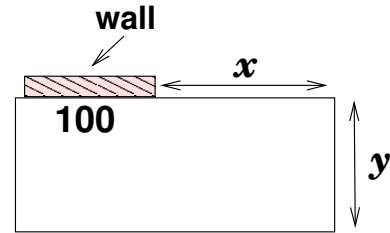
(c) Find the relative extrema of $f(x)$ using the first derivative or the second derivative test.

(d) Find the point(s) of inflection of $f(x)$. Justify your answer.

(e) Using the results of 5(a)-5(d), sketch the graph of $f(x)$.

7. **[15 pts.]** A rancher would like to enclose a rectangular area which has a **100ft** long stone wall in one side as shown below. There are **400ft** of fencing available. Find the values of x and y that result in greatest area possible.

(Note that no fencing is used along the wall).



8. **[20 pts.]** The population of a colony of bacteria doubles every 7 hrs. Suppose the initial size of the colony of bacteria was 100.

(a) How large will the colony be after 51 hours?

(b) How fast will the colony be growing at that time?

(c) At what time will the colony of bacteria contain 1000 bacteria?

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

(a) $\int (\sqrt{x} + 3x^5 - e^{-5x}) dx$

(b) $\int_1^5 \left(3x^2 + \frac{3}{x} + 1 \right) dx$

(c) $\int \frac{2x}{x^2 + 2} dx$

(d) $\int x^2 e^{(x^3+3)} dx$

10. **[20 pts.]** Find the area bounded by the curves $y = x^2 + 2x + 3$ and $y = 2x + 4$.

11. **[20 pts.]** Let $P(t)$ be the number of mowers produced in time t hours by a company. Suppose the rate of production by the assembly line is

$$P'(t) = 20 - 2t \quad \text{mowers per hour.}$$

How many mowers are produced during the time $t = 2$ to $t = 5$ hours?