NAME _____

STUDENT ID _____

RECITATION INSTRUCTOR _____

RECITATION TIME _____

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DIRECTIONS

1. Write your name, student ID number, recitation instructor's name and recitation time in the space provided above. Also write your name at the top of pages 2, 3 and 4.
2. The test has four (4) pages, including this one.
3. Write your answers in the boxes provided.
4. You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
5. Credit for each problem is given in parentheses in the left hand margin.
6. No books, notes or calculators may be used on this exam.

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(10) 1. Find the absolute maximum and absolute minimum values of $f(x) = x^3 - 3x + 1$ on the interval $[0, 3]$.

abs. max. $f(\ ) =$

abs. min. $f(\ ) =$

(8) 2. Suppose that f is continuous on $[1, 4]$ and differentiable on $(1, 4)$.

(a) The Mean Value Theorem asserts that there is a number c in (a, b) such that

$f(4) - f(1) =$

(b) If $f(1) = 2$ and $f'(x) \geq 4$ for all x in $(1, 4)$, find the smallest possible value for $f(4)$.

$f(4) \geq$

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(20) 3. Find each of the following as a real number, $+\infty$, $-\infty$ or write DNE (does not exist).

(a) $\lim_{x \to \frac{\pi}{4}} \dfrac{\tan x}{x}$

(b) $\lim_{x \to 0} (\csc x - \cot x)$

(c) $\lim_{x \to -\infty} x^2 e^x$

(d) $\lim_{x \to 0} (\cos x)^{1/x}$

(12) 4. The numbers 1 and 3 are the only critical numbers of the function $f(x) = x^3 - 6x^2 + 9x$. Showing all necessary work, decide whether f has a local maximum or a local minimum,

(a) at $x = 1$, using the first derivative test,

loc.

(b) at $x = 3$, using the second derivative test.

loc.

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(18) 5. Let $f(x) = \dfrac{x+1}{x-1}$. Give all the requested information and sketch the graph of the function on the axes below. Give both coordinates of the intercepts, local extrema and points of inflection, and give an equation for each asymptote. Write NONE where appropriate.

domain	
intercepts	
symmetry	
horizontal asymptotes	
vertical asymptotes	
intervals of increase	
intervals of decrease	
local maxima	
local minima	
intervals of concave down	
intervals of concave up	
points of inflection	

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(8) 6. Find two positive numbers x and y whose product is 188 and [illegible]
You must use Calculus.

$x =$, $y =$

(12) 7. A box with square base and open top must have a volume of $4\ m^3$. Find the dimensions of the box that minimize the amount of material used.

edge of base =
height =

(12) 8. Find f if $f''(x) = 3e^{-x} + 5\cos x$, $f(0) = 1$ and $f'(0) = 2$.

$f(x) =$