

NAME \_\_\_\_\_

STUDENT ID \_\_\_\_\_

RECITATION INSTRUCTOR \_\_\_\_\_

RECITATION TIME \_\_\_\_\_

Page 1	/20
Page 2	/30
Page 3	/20
Page 4	/30
TOTAL	/100

## 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.

- 
- (12) 1. Find the absolute maximum and absolute minimum values of  $f(x) = xe^{-x}$  on the interval  $[0, 2]$ .

abs. max. 

$f( ) =$
----------

abs. min. 

$f( ) =$
----------

- (8) 2. If  $f(1) = 10$  and  $f'(x) \geq 2$  for  $1 \leq x \leq 4$ , use the Mean Value Theorem to show that  $f(4) \geq 16$ .

Name: \_\_\_\_\_

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

(a)  $\lim_{x \rightarrow 0} \frac{\cos x - 1}{\sin x}$

(b)  $\lim_{x \rightarrow \infty} \frac{e^x}{x^2}$

(c)  $\lim_{x \rightarrow \infty} \left(1 + \frac{2}{x}\right)^x$

(12) 4. The number 0 is the only critical number of  $f(x) = \ln(1 + x^2)$ . Decide whether  $f(0) = 0$  is a local maximum or a local minimum using

(a) the first derivative test.

(b) the second derivative test.

Name: \_\_\_\_\_

- (20) 5. Let  $f(x) = \frac{x}{x-1}$ . 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	

- (15) 6. A right circular cylinder is inscribed in a sphere of radius 10. Find the height of the cylinder with largest possible volume. (Let  $h$  denote the height and  $r$  denote the radius of the cylinder).

- (5) 7. Find the most general antiderivative of  $f(x) = \sec^2 x + 5 \cos x$ .

- (10) 8. A particle is moving with acceleration  $a(t) = \cos t + \sin t$ . Its initial position is  $s(0) = -5$  and its initial velocity is  $v(0) = 3$ . Find the position function  $s(t)$ .