MAT131 Calculus I Fall, 2000

Final Exam, Dec. 20, 2000, 2:00-4:30 P.M.

Name: _____ **ID:** _____

Section: _____ **Section Teacher:** _____.

If you are not sure of your section, consult the table below.

Section	Instructor	Time
1	Mieczkowski	Tu Th 2:20
2	Mieczkowski	Tu Th 3:50
3	Kim	M W 5:30
4	Krol	M W 2:15
5	Lundberg	M W 8:20
6	Coffee	M W 10:30
7	Kim	M W 8:30
9	Buse	Tu Th 8:20
10	Yau	M W 3:20
11	Friedman	Tu Th 9:50
12	Friedman	Tu Th 12:50
13	Sporn	Tu Th 8:20
14	Yau	M W 2:15
15	Behrstock	Tu Th 11:20
16	Behrstock	Tu Th 3:50
17	Rasdeaconu	Tu Th 7:00
18	Buse	Tu Th 8:20

Problem	Points	Grade
1	8	
2	9	
3	10	
4	9	
5	10	
6	13	
7	9	
8	9	
9	10	
Total	87	

WORK all problems on these pages. SHOW all work you want graded. WRITE CAREFULLY: points may be taken off for meaningless statements.

1. a) Evaluate:

$$\lim_{h\to 0} \frac{(2+h)^2 - 4}{h}$$

b) Find a function $f(x)$ and a number x_0 such that the expression in part a) is the derivative of $f(x)$ at x_0.

2. Suppose a ball is dropped from the top of a building whose height is 80 feet. Assuming that its distance from the top is $s(t) = 16t^2$ after t seconds, how fast is it descending when $t = 3$ seconds? How fast is it descending when it hits the ground? How long does it take the ball to hit the ground?

3. Let $\lfloor x \rfloor$ denote the largest integer that is less than or equal to x.
a) Find

$$\lim_{x \to 2^+} \lfloor x \rfloor.$$

b) Find

$$\lim_{x \to 2^-} \lfloor x \rfloor.$$

c) For what values of x is $\lfloor x \rfloor$ continuous?

4. Find the number at which the function $f(x) = x^2 + 3x$ has a minimum and find the value of $f(x)$ at that number.

Draw the graph of $f(x)$ for $-2 \leq x \leq 2$

5. a) Draw the graph of $g(x) = x^3 - x$ for $-2 \leq x \leq 2$.

b)Find all local minima, local maxima and inflexion points of $g(x)$ and mark them on the graph.

6. Let the function $f(x)$ be given by

$$f(x) = \begin{cases} 0, & x \leq 0 \\ x, & 0 \leq x \leq 2, \\ 2, & x \geq 2. \end{cases}$$

a) Find the value of the function

$$\Phi(x) = \int_0^x f(t)\, dt$$

for each $x \leq 0$, for each x between 0 and 2, and then for each $x \geq 2$.

b) Draw the graph of $\Phi(x)$ for $-1 \leq x \leq 3$

c) Compute the derivative of $\Phi(x)$.

Find the difference bewteen $f(x)$ and $\Phi(x)$

7. Let $f(x) = x^{1/4}$.

a) Find $f'(x)$.

b) Find the equation of the tangent line to the graph of f at $x = 16$.

c) Use a linear approximation to f to find an approximate value for $17^{1/4}$.

8) Compute the following anti-derivatives (or indefinite integrals):

a) $\int (3x^3 - 3x + 3)dx$

b) $\int (1/x - 1/x^2)dx$

c) $\int (e^x - \sin x)dx$

9) Assume that a 10-foot ladder is leaning against a vertical wall with its base 2 feet from the wall. The base starts to slip and when it is 6 feet from the wall, it is moving away form the wall at 8 feet per second. How fast is the top of the ladder descending at this time? Show clearly what you did to get your answer.