Read and sign after completing this exam:
I have neither given nor received help, in any form, on this final exam. Signed ______________________

Department of Mathematics
Math 111 Fall 2006
Final Exam

NAME(print): ________________________________

Instructor: ______________________________

Instructions:

- The exam is divided into two parts. Part I consists of problems in which no partial credit will be given. Part II consists of problems in which partial credit is possible.
- Using a TI-89 or a TI-92 on any part of this exam is not permitted.

Page:	Score:
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Total	
Total possible: 130 points	

Part I: No partial credit. (2 points each, unless otherwise stated)

1) Fill in the blank. Circle the answer choice which best completes each statement.

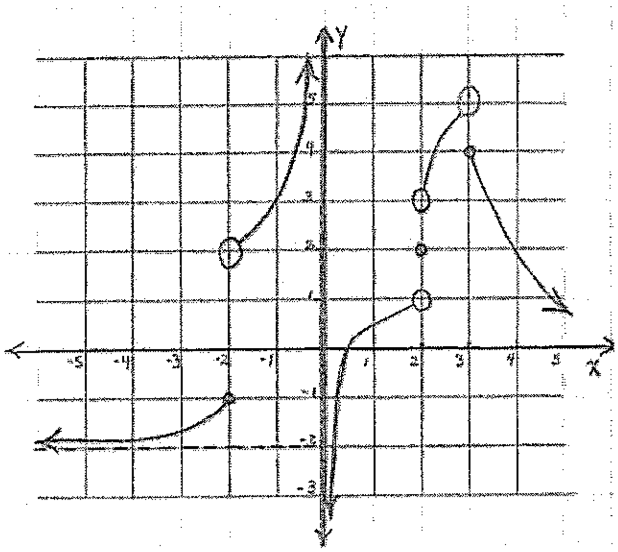
(a) If $f(x)$ is increasing on the interval [a, b], then using a Riemann sum with left endpoints as sample points will yield an estimate for $\int_a^b f(x)\,dx$ that is ________ the actual value. (hint: make a sketch)

(i) above (ii) below (iii) the same as

(b) Let $f(x)$ be a continuous function such that $f(-x)=-f(x)$. If $\int_0^a f(x)dx=10$, then $\int_{-a}^a f(x)dx=$ ______.

(i) 0 (ii) 10 (iii) 20 (iv) cannot be determined

2) Use the graph of f below to find each limit or explain why it does not exist (1 point each)



(a) $\lim\limits_{x\to -2^+} f(x) =$

(b) $\lim\limits_{x\to 0^+} f(x) =$

(c) $\lim\limits_{x\to 2} f(x) =$

(d) $\lim\limits_{x\to -\infty} f(x) =$

3) If the given statement is always true, then circle TRUE; otherwise circle FALSE. Do not explain your answer choice.

(a) If f is continuous at x=2, then f is differentiable at x=2. TRUE FALSE

(b) If $\int f(x)\,dx = F(x)$, then $F'(x)=f(x)$. TRUE FALSE

(c) If f' is positive, then f is increasing. TRUE FALSE

(d) If f'' is concave up, then f''' is increasing. TRUE FALSE

(e) $\lim\limits_{x\to 0}\left(\dfrac{f(x)}{g(x)}\right)=\lim\limits_{x\to 0}\left(\dfrac{f'(x)}{g'(x)}\right)$ TRUE FALSE

4) Find the derivative of $f(x)=2x^4\sin x$ (do not simplify)

(5-9) No partial credit. (2 points each) Circle your final answer. Show all supporting work.

5) Suppose $f(7)=1$, $g(7)=3$, $f'(7)=5$, and $g'(7)=2$. Find $\frac{d}{dx}[(fg+g)(7)]$

6) Find the limit: $\lim_{x\to\infty}\frac{3x^3+2x^2-x}{2x^3-x+1}$.

7) Find the equation of the tangent line to the cubic parabola $y=x^3-2x+2$ at the point $(1,1)$.

8) If $g(x)=\int_x^4\cos(t^3)dt$, find $g'(x)$.

9) Evaluate the integral: $\int_0^1 2x^3-x\,dx$

Part II: All problems require work supporting your final answer. (points vary)

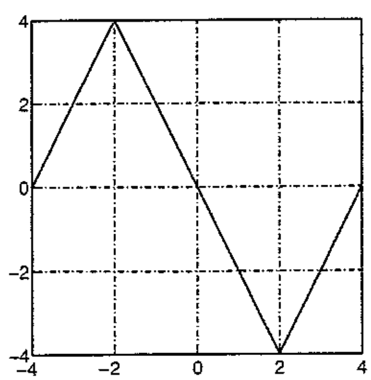
- Show all your steps clearly to receive full credit. Use principles of calculus to support all answers. For example: definite integral solutions must include steps of evaluation.
- If you need more space for your solutions, use the back of one of the pages. Indicate clearly where your extra work can be found.
- Make sure to cross out all work you do not want to be considered. Otherwise it will be graded accordingly and could reduce your score.
- Circle your final answer.

1) (4 points) Use the definition of continuity to find a real number r such that the function

$$f(x)=\begin{cases}\dfrac{x^2-4}{x+2}, & x\neq -2\\ r, & x=-2\end{cases}$$ is continuous on $(-\infty,\infty)$.

2) (4 points) Use an analytic method to find the limit. $\lim\limits_{x\to 2}\dfrac{\sqrt{x+2}-\sqrt{2x}}{x^2-2x}$.

3) (4 points) Given the graph of f below, sketch the graph of f' on the same coordinate plane.



4) (5 points)
(a) State the limit definition of the derivative of the function f.

(b) Use the definition of the derivative to find $f'(x)$ if $f(x)=5x^2$

5) (16 points) Find the derivative of each function.
(a) $g(t)=\ln\sqrt{5t+6}$

(b) $f(x)=\left(\tan\left(\sqrt[3]{x}\right)\right)^4$

(c) $g(x)=(x)^{\sqrt{x}}$

(d) $2xy-y^3=16$

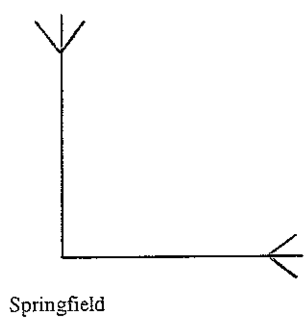
6) (7 points) Use the function $f(x) = \frac{1}{\sqrt{1+x}}$ for each of the following:

(a) Find the linear approximation (linearization) of $f(x)$ at $a = 0$.

(b) Use calculus methods to find the equation(s) of any vertical asymptotes graph of $f(x)$.

(c) Use calculus methods to find the equation(s) of any horizontal asymptotes on the graph of $f(x)$.

7) (6 points) Two cars are traveling toward the town of Springfield. One is directly to the north and the other directly to the east. The car to the north is heading toward the town at 60 miles per hour, while the one to the east is heading toward the town at 30 miles per hour. Find the rate at which the distance between the cars changes at the moment that both cars are 100 miles from the town.



8) (8 points) Find each limit.

(a) $\lim_{x \to 0} \frac{x + \tan x}{\sin x}$

(b) $\lim_{x \to 0} (1 - 2x)^{1/x}$

9) (6 points) A farmer with 890 ft of fencing wants to enclose a rectangular area and then divide it into four pens with fencing parallel to one side of the rectangle. What is the largest possible total area of the four pens?

10) (10 points) For the function $f(x)=9x^{10}-10x^{9}$, use principles of calculus to find each feature below. Be sure to identify each feature clearly.

(a) Find all critical numbers.

(b) Find the interval(s) of increase.

(c) Find the coordinate pair(s) of any local minimum(s).

(d) Find the interval(s) where f is concave down.

(e) Find the coordinate pair(s) of any inflection point(s).

11) (4 points) A particle travels with velocity $v(t)$, where t is in seconds and $v(t)$ is in inches per second. Suppose $v(t)$ is given by the following table of values:

t	1.0	1.1	1.2	1.3	1.4	1.5
$v(t)$	25	24	21	17	10	1

Estimate the distance traveled by the particle between $t = 1.0$ seconds and $t = 1.5$ seconds.

12) (6 points) A ball is thrown upward from the top of a building at an initial velocity of 64 feet per second. The ball then hits the ground 5 seconds later. (Note: the ball hits the *ground*, not the roof of the building.) Assume that the acceleration due to gravity is constant at $-32\ ft/\sec^2$. (Note: the acceleration is chosen to be negative since gravitational force is directed downward.)

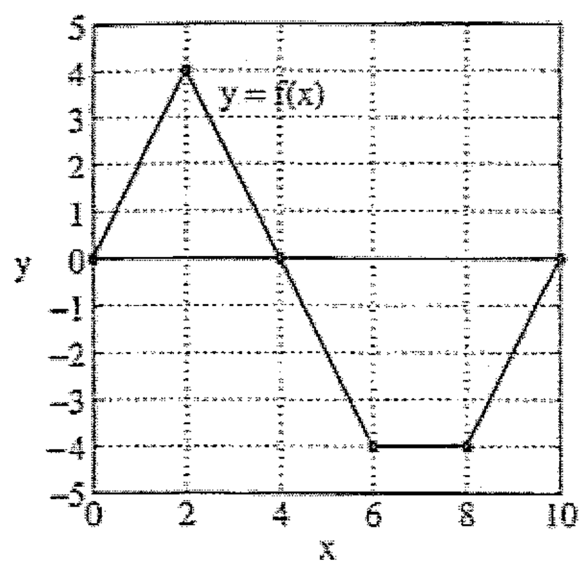
(a)Determine the velocity at which the ball hits the ground.

(b) When does the ball reach its greatest height?

(c) Determine the height of the building.

13) (4 points) The graph of $f(x)$ on [0, 10] is shown.

Let $g(x) = \int_0^x f(t)\,dt$.



(a) Find $g(0)$

(b) Find $g(10)$

(c) Find the absolute maximum value of $g(x)$ on [0, 10].

(d) Where does the graph of $g(x)$ have an inflection point?

14) (16 points) Evaluate each integral.

(a) $\int e^x \sin e^x \, dx$

(b) $\int \frac{1+\ln x}{x} \, dx$

(c) $\int_{-1}^{2} (2-3x)^5 \, dx$

(d) $\int_0^1 \frac{1}{1+x^2} \, dx$