

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

Instructor: \_\_\_\_\_

**Math 125, Exam I**  
**September 26, 2006**

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 9 pages of the test.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!					
1.	(a)	(b)	(c)	(d)	(e)
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Multiple Choice	_____
11.	_____
12.	_____
13.	_____
Total	_____

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Multiple Choice

1.(7 pts.) If  $f(2) = 5$ ,  $f(3) = 2$ ,  $f(4) = 5$ ,  $g(2) = 6$ ,  $g(3) = 2$  and  $g(4) = 0$ , find  $(fg)(2) + (f \circ g)(3)$ .

(a) 25

(b) 15

(c) 35

(d) 30

(e) 20

2.(7 pts.) Evaluate the following limit

$$\lim_{x \rightarrow -3} \frac{9 - x^2}{3 + x}.$$

(a) 0

(b) does not exist

(c) -3

(d) 6

(e) 3

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3.(7 pts.) For which value of the constant  $c$  is the function  $f(x)$  continuous on  $(-\infty, \infty)$ ?

$$f(x) = \begin{cases} c^2x - c & x \leq 1 \\ cx - x & x > 1. \end{cases}$$

- (a) 1            (b) 0            (c) 2            (d) -2            (e) -1

4.(7 pts.) For  $f(x) = \sqrt[3]{x^5} + \frac{6}{\sqrt[5]{x^3}}$ , find  $f'(x)$ .

(a)  $\frac{5\sqrt[3]{x^2}}{3} + \frac{5}{18\sqrt[5]{x^8}}$

(b)  $\frac{5\sqrt[3]{x^2}}{3} - \frac{18}{5\sqrt[5]{x^8}}$

(c)  $\frac{3\sqrt[3]{x^2}}{5} - \frac{5}{18\sqrt[5]{x^8}}$

(d)  $\frac{3\sqrt[3]{x^2}}{5} - \frac{18}{5\sqrt[5]{x^8}}$

(e)  $\frac{3\sqrt[3]{x^2}}{5} + \frac{18}{5\sqrt[5]{x^8}}$

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5.(7 pts.) Find the equation of the tangent line to  $y = \sqrt{x^2 - 1}$  at the point  $(2, \sqrt{3})$ .

(a)  $y = \frac{1}{\sqrt{3}}x + \frac{1}{\sqrt{3}}$

(b)  $y = \frac{2}{\sqrt{3}}x - \frac{4}{\sqrt{3}}$

(c)  $y = \frac{2}{\sqrt{3}}x - \frac{2}{\sqrt{3}}$

(d)  $y = \frac{1}{\sqrt{3}}x + \frac{2}{\sqrt{3}}$

(e)  $y = \frac{2}{\sqrt{3}}x - \frac{1}{\sqrt{3}}$

6.(7 pts.) If  $\sin(\pi xy) = \pi(x + y)$  find  $\frac{dy}{dx}$  at  $(1, -1)$  by implicit differentiation.

(a)  $-1$

(b)  $0$

(c)  $1$

(d)  $\pi$

(e)  $\frac{\pi}{2}$

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7.(7 pts.) Find the derivative of

$$f(x) = x^2 \cos(\sqrt{x^3 - 1} + 2).$$

(a)  $\frac{dy}{dx} = 4x \cos(\sqrt{x^3 - 1} + 2) - \frac{3x^4}{2\sqrt{x^3 - 1}} \sin(\sqrt{x^3 - 1} + 2)$

(b)  $\frac{dy}{dx} = 2x \cos(\sqrt{x^3 - 1} + 2) - \frac{x^4}{2\sqrt{x^3 + 1}} \sin(\sqrt{x^3 - 1} + 2)$

(c)  $\frac{dy}{dx} = 2x \cos(\sqrt{x^3 - 1} + 2) - \frac{4x^4}{3\sqrt{x^3 - 1}} \sin(\sqrt{x^3 - 1} + 2)$

(d)  $\frac{dy}{dx} = x \cos(\sqrt{x^3 - 1} + 2) - \frac{x^4}{2\sqrt{x^3 - 1}} \sin(\sqrt{x^3 - 1} + 2)$

(e)  $\frac{dy}{dx} = 2x \cos(\sqrt{x^3 - 1} + 2) - \frac{3x^4}{2\sqrt{x^3 - 1}} \sin(\sqrt{x^3 - 1} + 2)$

8.(7 pts.) If  $f(x) = x^2 \cos x + \sin x$ , find  $f''(x)$ .

(a)  $f''(x) = 2 \cos x - 4x \sin x + x^2 \cos x - \sin x$

(b)  $f''(x) = 2 \cos x + 2sx \sin x - x^2 \cos x - \sin x$

(c)  $f''(x) = 4 \cos x + 4x \sin x - 2x^2 \cos x - \sin x$

(d)  $f''(x) = 2 \cos x - 4x \sin x - x^2 \cos x - \sin x$

(e)  $f''(x) = 4 \cos x - 4x \sin x + x^2 \cos x - \sin x$

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9.(7 pts.) A ball is thrown straight upward from the ground with the initial velocity  $v_0 = 96\text{ft/s}$ . Find the highest point reached by the ball. Hint: The height of the ball at time  $t$  is given by  $y(t) = -16t^2 + 96t$ .

- (a) 128ft                      (b) 120ft                      (c) 144ft  
(d) 288ft                      (e) 80ft

10.(7 pts.) Find the limit

$$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x \tan x}.$$

- (a) 0                      (b) 2                      (c)  $\frac{1}{2}$                       (d) 1                      (e)  $\infty$

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Partial Credit

You must show your work on the partial credit problems to receive credit!

**11.**(10 pts.) Find the equation of the tangent line to the curve  $y = \frac{x^3}{3} - x^2 + 1$  which is parallel to the line  $y + x = 2$ .

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**12.**(10 pts.) Show that there are at least *two* roots of the equation

$$x^4 + 2x - 1 = 0.$$

Justify your answer and identify the theorem you use.

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**13.**(10 pts.) Find the derivative of

$$y = \frac{1}{x^2 + 1}$$

using the definition of the derivative.

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