

## Midterm 2

Instructor: Abhijit Champanerkar  
Calculus IA, MA 125 Section 107, Fall 2004

Date: Nov 9th 2004

Points: 80

Time: 1hr 40 min

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

To receive full credit, you must explain your answers.

No calculators of any type are allowed.

<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>6</b>	
<b>7</b>	
<b>8</b>	
<b>Total</b>	

1. (10 points) Calculate  $\frac{dy}{dx}$ .

(a)  $y = \sqrt[3]{x} \sin x$  (Do not simplify your answer)

(b)  $y = \sin(\cos x)$

(c)  $y = \ln(x^2 + x - 1)$ .

(d)  $y = \frac{x}{x+1}$  (Do not simplify your answer)

2. (a) (6 points) Find the derivative of  $f(x) = \frac{3}{x-2}$  using the definition of the derivative. (No points will be given if you do not use the definition).

- (b) (4 points) Let  $f(1) = 2$ ,  $f'(1) = 4$ ,  $g(1) = 1$ ,  $g'(1) = 3$ . Find  $(fg)'(1)$  and  $(f \circ g)'(1)$

**3.** (10 points) Calculate  $\frac{dy}{dx}$ .

(a) (2 points)  $y = (x^3 + 3x^2 + 1)^8$

(b) (4 points)  $y = x^{\sin x}$

(c) (4 points)  $y \cos x + x \sin y = x + y$

4. (10 points) Find the equation of tangent to the given curves at the given points.

(a) (4 points)  $y = 2x \sin(x + \frac{\pi}{6})$  at  $(0, 0)$ .

(b) (6 points)  $\frac{x^2}{16} + \frac{y^2}{9} = 2$  at  $(4, 3)$ .

5. (a) (6 points) Find the linearization of  $f(x) = \sqrt[4]{1 + 2x}$  at  $a = 0$ .

(b) (4 points) Use the above linearization to estimate  $\sqrt[4]{1.006}$ .

**6.** (10 points) The displacement function of a car traveling on a straight road is  $s(t) = 10 + 30t^2 - 10t^3$  miles where  $t$  is in hours.

(a) (2 points) Find the velocity and acceleration.

(b) (2 points) When is the car at rest ?

(c) (3 points) When is the car speeding up ? When is it slowing down ?

(d) (3 points) Find the distance traveled by the car in the first 3 hours.

7. (a) (5 points) Let  $f(x) = ax^2 + bx + c$ . Find  $a$ ,  $b$  and  $c$  if  $f(0) = 4$ ,  $f'(0) = 3$  and  $f''(0) = 2$ .

(b) (3 points) Find the limit  $\lim_{x \rightarrow 3} \frac{2^x - 8}{x - 3}$  by identifying it as a derivative.

(c) (2 points) Find  $f^{(6)}(x)$  for  $f(x) = \sin 2x$ .

8. (a) (5 points) Find the points on the curve  $y = x^3 - x + 1$  where the tangent is parallel to the line  $2x - y = 3$ .

- (b) (5 points) Find the  $x$ -coordinate of all the points on the curve  $y = 2x - 4 \sin x$  where the tangent is horizontal.