

SECTION NUMBER: E.....

CALCULUS  
**Math 21A, Fall 2015**  
**Sample Midterm 2**

NAME.....

SIGNATURE.....

I.D. NUMBER.....

*No books, notes, or calculators.*  
*Unless stated otherwise, show all your work and explain your answers.*

Question	Points	Score
1	20	
2	15	
3	20	
4	15	
5	10	
6	20	
Total	100	

1. [20%] Compute the derivatives of the following functions. You do not need to simplify your answer.

(a)  $3\sqrt{1 + \tan x} - 2\sqrt{\cos x}$ .

(b)  $\frac{xe^{2x}}{\ln x}$ .

(c)  $\tan^{-1}(x^2) \sin^2 x$ .

(d)  $(\tan^{-1} x)^2 \sin(x^2)$ .

- 2.** [15%] (a) State the definition of the derivative  $f'(c)$  of a function  $f(x)$  at  $x = c$ .
- (b) Suppose that  $f(x) = 1/\sqrt{x}$ . Compute  $f'(9)$  from the definition of the derivative. (No credit for using differentiation rules.)

3. [20%] At what point does the tangent line to the curve

$$2x^2 + y^3 = x^3 + y^2$$

at  $(x, y) = (2, 1)$  intersect the  $x$ -axis?

4. [15%] Suppose that a particle moves a distance  $s$  after time  $t$  where

$$s = t - 2t^2 + t^3.$$

- (a) At what times is the velocity of the particle equal to zero?
- (b) How far has the particle moved when its acceleration is zero?

5. [10%] Suppose that a function  $f(x)$  has derivative  $f'(x) = e^{x^2}$  and

$$g(x) = f(\sqrt{\sin x}).$$

Compute  $g'(x)$ .

**6.** [20%] A conical tank of height 3 m and radius 5 m at its top is filled with water at a rate of  $0.2 \text{ m}^3 \text{ s}^{-1}$ . Find the rate at which the height of the water is increasing when the height is 1 m.

HINT. The volume  $V$  of a cone with height  $h$  and radius  $r$  is  $V = \frac{1}{3}\pi r^2 h$ .