

CALCULUS AND ANALYTIC GEOMETRY I - MAT 250

FALL 2008 - EXAM 2

Name :.....

TO RECEIVE FULL CREDIT YOU MUST SHOW YOUR WORK. No notes or books allowed.

**No. 1. (10 points)** State whether each statement is **True** or **False** as stated. Provide a clear reason for your answer.

i) The derivative of the product is the product of derivatives.

ii) 
$$\frac{d}{dx} \left( \frac{f(x)}{g(x)} \right) \Big|_{x=4} = \frac{f(4)g'(4) + g(4)f'(4)}{(g(4))^2}$$

iii) The units *meters per atmosphere* might be used to measure the ROC of Pressure (in atmospheres) in a water tank with respect to the depth.

iv) Suppose that  $f(2) = 4$  and the average ROC of  $f$  between 2 and 5 is 3. Then we have enough information to compute  $f(5)$ .

v) The third derivative of position with respect to time is zero for an object falling to earth under the influence of gravity.

**No. 2. (8 points)** Given that  $f(x) = 4x - 3$ , compute  $f'(x)$  using the limit definition.

**No. 3. (6 points)** Find the equation of the tangent line to  $y = 4e^x$  at  $x = 2$ .

**No. 4. (10 points)** Match the functions in graphs (A)-(C), Figure 1 with their derivatives (I)-(III) in Figure 2.

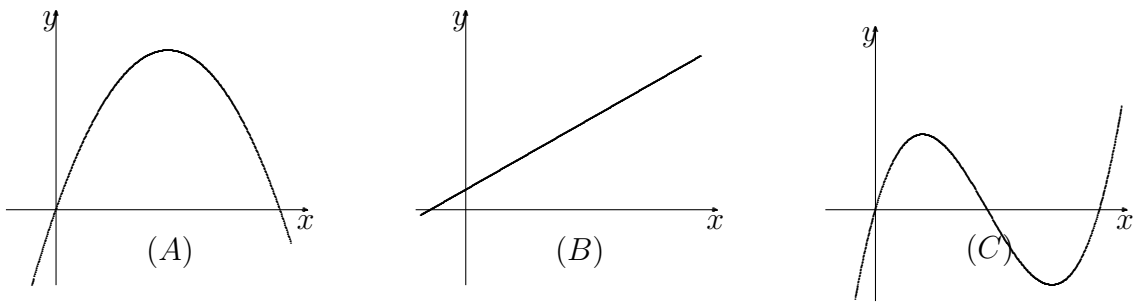


Figure 1:

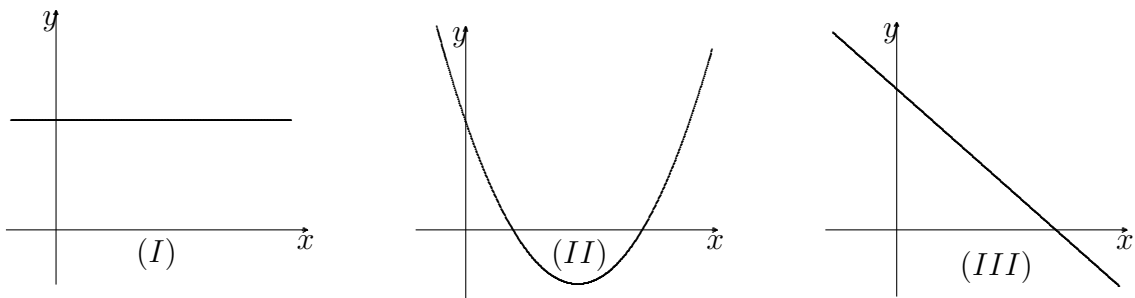


Figure 2:

**A** \_\_\_\_\_

**B** \_\_\_\_\_

**C** \_\_\_\_\_

**No. 5. (6 points)** Suppose that  $f(1) = 0$  and  $f'(1) = 2$ . Find  $g(1)$ , assuming that  $(fg)'(1) = 10$ .

**No. 6. (20 points)** Calculate the derivatives of the given functions:

i)  $f(x) = 2x^3 - 10x^{-1}$

ii)  $f(s) = \sqrt[4]{s} + \sqrt[3]{s}$

iii)  $f(x) = (x^2 + 9)(2 - e^x)$

iv)  $f(x) = \pi^2(x - 1)$

v)  $f(x) = \frac{x^4 + e^x}{x + 1}$

**No. 7. (20 points)** Find the derivative of each function

i)  $f(x) = x^2 \cos x$

ii)  $f(\theta) = \frac{\theta}{\tan \theta}$

iii)  $y = (x^2 + 9)^4$

iv)  $y = \cot(4t^2 + 9)$

v)  $y = \cos^3(e^{4\theta})$

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

**No. 8. (6 points)** Given that  $f(x) = \tan x$ , calculate the second derivative of  $f$ , that is,  $f''(x)$ .

**No. 9. (14 points)** A stone is tossed vertically upward with an initial velocity of  $25ft/s$  from the top of a  $30 ft$  building. [ $s(t) = s_0 + v_0t - \frac{1}{2}gt^2$ , acceleration due to gravity on the surface of the earth is  $32 ft/s^2$ .]

- a) What is the height of the stone after  $0.25 s$ ?
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
- b) Find the velocity of the stone after  $1 s$ .
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
- c) When does the stone hit the ground?