



Instructor: Sal Barone

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

GT username: \_\_\_\_\_

1. No books or notes are allowed.
2. You may use ONLY NON-GRAPHING and NON-PROGRAMABLE scientific calculators. All other electronic devices are not allowed.
3. Show all work and fully justify your answer to receive full credit.
4. Please  BOX your answers.
5. Good luck!

Page	Max. Possible	Points
1	30	
2	30	
3	20	
4	20	
Total	100	

1. Consider the function

$$f(x) = x^3 - x^4.$$

(10 pts. each)

(a) Find the intervals where  $f(x)$  is increasing and where  $f(x)$  is decreasing.

(b) Find and classify any local maximum/minimum of  $f(x)$ .

(c) Find the absolute maximum/minimum of  $f(x)$  on the interval  $[-1, 1]$ .

2. Find  $f''(x)$  where

(15 pts.)

$$f(x) = \ln\left(\frac{1}{x}\right).$$

3. Use the linearization of the function  $f(x) = \sqrt{x}$  at  $x = 9$  to estimate  $\sqrt{11}$ .

(15 pts.)

4. Find the indefinite integral, do not forget to add an arbitrary constant  $C$ . (5 pts. each)

(a)  $\int (x^3 - 2x + 1) dx$

(b)  $\int \frac{2}{x^2} dx$

5. Calculate the definite integral. Simplify your answer for full credit. (5 pts. each)

(a)  $\int_0^{\pi/2} \sin(x) dx$

(b)  $\int_1^e \frac{1}{x} dx$

6. A rectangle has its base on the  $x$ -axis and its upper two vertices on the parabola  $y = 12 - x^2$ . What is the largest area the rectangle can have, and what are its dimensions? (10 pts.)

7. Assume that  $2x^2 + 3y = 12$  and  $dy/dt = -2$  when  $x = -1$ . Find  $dx/dt$ . (10 pts.)