

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

Student ID: \_\_\_\_\_

Section: \_\_\_\_\_

Instructor: Paul Gustafson

# Math 131 (Principles of Calculus)

## Exam 3A

# RED

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### Instructions:

- For questions which require a written answer, show all your work. Full credit will be given only if the necessary work is shown justifying your answer.
- Simplify your answers.
- Calculators are allowed.
- Should you have need for more space than is allocated to answer a question, use the back of the exam.
- Please do not talk about the test with other students until exams are handed back.
- **Honor Code:**

An Aggie does not lie, cheat, or steal or tolerate those who do.

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Signature

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### For Instructor use only.

#	Possible	Earned
MC	40	
9	10	
10	12	
Sub	62	

#	Possible	Earned
11	20	
12	10	
Sub	30	
Total	92	

**Part I: Multiple Choice (5 points each)** *Mark the correct answer on the bubble sheet.*

1. Find the absolute maximum and minimum values for the function  $f(x) = 3x^2 - 6x + 4$  on the interval  $[-1, 3]$ 
  - a) maximum value = 1, minimum value =  $-1$
  - b) maximum value = 10, minimum value =  $-1$
  - c) maximum value = 13, minimum value = 1
  - d) maximum value = 10, minimum value = 1
  - e) maximum value = 13, minimum value =  $-1$
2. If  $f'(x) = \frac{1}{\sqrt{x}} + 3x^2$  and  $f(4) = 38$ 
  - a)  $f(x) = \sqrt{x} + 3x^3 - 30$
  - b)  $f(x) = 2\sqrt{x} + x^3 - 30$
  - c)  $f(x) = 2\sqrt{x} + x^3 + 30$
  - d)  $f(x) = \frac{2}{3}x^{3/2} + x^3 + 38$
  - e)  $f(x) = \frac{2}{3}x^{3/2} + x^3 - 30$
3. A particle moves along a wire with velocity  $v(t) = \sin(t) + 3$ . Find the net change in position between times  $t = 0$  and  $t = \pi$ 
  - a)  $1 + 3\pi$
  - b)  $-2 + 3\pi$
  - c)  $2 + 3\pi$
  - d) 0
  - e)  $3\pi$
4. Calculate the indefinite integral  $\int \frac{4}{x} + \sec^2(3x) dx$ 
  - a)  $\frac{2}{x^2} + \frac{1}{3} \tan(3x) + C$
  - b)  $4 + 3 \tan(3x) + C$
  - c)  $4 \ln|x| + \tan(3x) + C$
  - d)  $4 + \frac{1}{3} \tan(3x) + C$
  - e)  $4 \ln|x| + \frac{1}{3} \tan(3x) + C$

5. Use the fundamental theorem of calculus to find the derivative of  $f(x) = \int_1^x \frac{t^3 - e^t}{\cos^2(t)} dt$

a)  $\frac{2x^2 - e^x}{2 \cos(x) \sin(x)}$

b)  $\frac{(2x^2 - e^x) \cos^2(x) - 2 \cos(x) \sin(x)(x^3 - e^x)}{\cos^4(x)}$

c)  $\frac{t^4 - e^t}{\cos^2(t)}$

d)  $\frac{x^3 - e^x}{\cos^2(x)}$

e)  $\frac{3t^2 - e^t}{\cos^4(t)}$

6. Use the geometric shape of the graph to find the integral  $\int_{-3}^3 f(x)$  where

$$f(x) = \begin{cases} 3 - x, & x \leq 0 \\ \sqrt{9 - x^2}, & x > 0 \end{cases}$$

a)  $\frac{9}{2} + \frac{9}{4}\pi$

b)  $\frac{27}{2} + \frac{3}{4}\pi$

c)  $\frac{9}{2} + 3\pi$

d)  $\frac{27}{2} + \frac{9}{4}\pi$

e)  $\frac{27}{2} + 9\pi$

7. The acceleration of a particle is given by  $a(t) = 6t - 2$ . The position of the particle at times  $t = 0$  and  $t = 1$  are  $s(0) = 2$  and  $s(1) = 5$ , respectively. The position function for the particle is

a)  $s(t) = 3t^2 - 2t + 2$

b)  $s(t) = 3t^2 - 2t + 4$

c)  $s(t) = t^3 - t^2 + 5t + 2$

d)  $s(t) = t^3 - t^2 + 3t + 2$

e)  $s(t) = t^3 - 2t + 4$

8. Calculate  $\int_1^{e^2} \frac{\ln(x)}{x} dx$ .

a)  $e^{-4} - 1$

b)  $2e^{-4} - 1$

c)  $2e^{-4}$

d)  $e^{-2}$

e)  $2$

**Part II: Free Response** *Show all work*

9. (10 points) Use four approximating rectangles with **left endpoints** to estimate the definite integral

$$\int_2^{10} \frac{1}{\sqrt{x} + 1} dx$$

Leave your solution as an exact answer.

10. (12 points) A glassblower wants to make a cylindrical vase with one end covered and one end open. He has enough molten glass to cover a surface area of 30 square centimeters. Determine the dimensions of the vase that will maximize its volume.

11. (20 points) Let  $f(x) = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 6x + 1$ .

a.) (5 points) Find the intervals on which  $f(x)$  is **increasing** and the intervals where it is **decreasing**.

b.) (5 points) Find the  $x$ -coordinates where  $f(x)$  has a **local max or min**. Make sure to specify which are maxes and which are mins.

c.) (5 points) Find the  $x$ -coordinates of the **inflection points** of  $f(x)$ .

d.) (5 points) Find the intervals where  $f(x)$  is **concave up** and where it is **concave down**.

12. (10 points) Find the exact value of the definite integral. Show all your work.

$$\int_0^1 3x \sin(x^2 - 1) dx$$

**END OF EXAM**