Math 142: Calculus II

Midterm 1

October 12, 2017

NAME (please print legibly): _____

Your University ID Number: _____

Indicate your instructor with a check in the appropriate box:

Crossen	MW 9-10:15	
Zhong	MW 3:25-4:40	

- You have 75 minutes to work on this exam.
- You are responsible for checking that this exam has all 9 pages.
- No calculators, phones, electronic devices, books, notes are allowed during the exam.
- Show all work and justify all answers.
- Please sign the pledge below.

Pledge of Honesty

I affirm that I will not give or receive any unauthorized help on this exam, and that all work will be my own.

Signature: _____

QUESTION	VALUE	SCORE
1	15	
2	10	
3	10	
4	15	
5	10	
6	15	
TOTAL	75	

1. (15 points) Consider the following function

$$f(x) = \frac{x^2+1}{x^2-9}, \quad f'(x) = -\frac{20x}{(x^2-9)^2}, \quad f''(x) = \frac{60x^2+180}{(x^2-9)^3}.$$

(a) Find the domain of f.

(b) List all x and y intercepts of f.

(c) Final all horizontal and vertical asymptotes of f or explain why none exist.

(d) Find all critical points and where the function is increasing and where it is decreasing.

(e) Find where the function is concave up, and where it is concave down, and all x values at points of inflection.

(f) Use the information you found in parts (a)-(e) to sketch the graph of $y = f(x)$.

2. (10 points) A manufacturer needs to make a box whose base length is twice the base width. The material used to build the top and bottom costs \$10/ft^2 and the material used to build the sides costs \$6/ft^2. If the box must have a volume of 960 ft^3, determine the dimensions that will minimize the cost to build the box.

3. (10 points) A particle is moving with the given acceleration

$$a(t) = 10\sin(t) + 3\cos(t),$$

and two positions

$$s(0) = 0, \quad s(2\pi) = 12.$$

Find the position function $s(t)$ of the particle.

4. (15 points) Estimate the area between the graph of $y = (x+1)^2$ and x-axis from $x = 0$ to $x = 2$ using a right-endpoint Riemann sum with:

(a) 4 rectangles

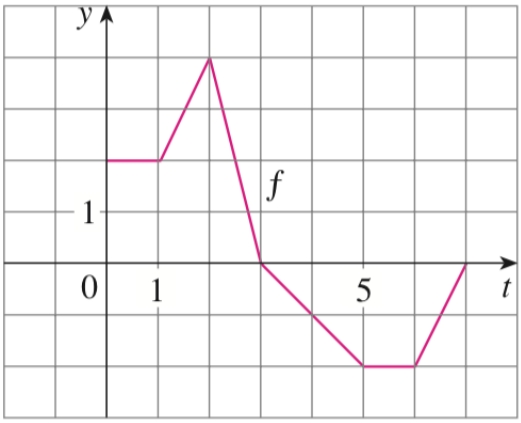
(b) n rectangles (express your answer in terms of n)

(c) Write the area as a define integral and use your answer in part (b) to determine the exact value of the area. (**No partial credit if you use other methods.**)

5. (10 points) Let

$$g(x) = \int_0^x f(t)\,dt, \quad x \in [0, 7].$$

where f is the function whose graph is shown.



(a) Evaluate $g(1)$, $g(2)$, and $g(6)$.

(b) On what intervals is g increasing?

(c) Where does g have a maximum value? What is the maximum value?

6. (15 points)

(a) Evaluate $\displaystyle\int_1^{64} \frac{\sqrt{x}+\sqrt[3]{x}}{\sqrt[6]{x}}\,dx.$

(b) Suppose that

$$f(x)=\int_{\arctan x}^{\sin(2\pi x)} \sqrt{1+t^2}\,dt \quad \text{and} \quad g(y)=\int_3^{2y} f(x)\,dx.$$

Find $g'(y)$, $g''(y)$ and $g''(0)$.

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