# Math 103-001 Rimmer Final Exam Spring 2019



First and Last Name		(PRINT)	Penn ID
Recitation (circle one):	W 8	W 9	
	203	204	

This exam has 14 questions. Each question is worth 10 points for a total of 140 points. Partial credit will be given for the entire exam so be sure to show all work. Circle the correct answer and give supporting work, a correct answer with little or no supporting work will receive little or no credit. Use the space provided to show all work. A sheet of scrap paper is provided at the end of the exam, do not rip it off. If you write on this scrap page or the back of any page and expect that to be graded, you must indicate this in some strong way.

You have **120 minutes** to complete the exam. You are not allowed the use of a calculator or any other electronic device. You are allowed to use the front and back of a standard 8.5"X5" sheet of paper for handwritten notes. Please silence and put away all cell phones and other electronic devices. When you finish, please stay seated until the entire 120 minutes has elapsed. When time is up, continue to stay seated until someone comes by to collect your exam and announces that you may leave.

Do **NOT** write in the grid below. It is for grading purposes only.

Problem	Points	Problem	Points
1		8	
2		9	
3		10	
4		11	
5		12	
6		13	
7		14	
Total			

My signature below certifies that I have complied with the University of				
Pennsylvania's Code of Academic Integrity in completing this examination paper.				
Name (printed)				

$$\frac{2}{\log_3(27)} - e^{2\ln\left(\frac{\sqrt{3}}{2}\right)} + \sec^2\left(\arcsin\left(\frac{1}{2}\right)\right)$$

B) 
$$2/3$$

F) 
$$1/3$$

c) 
$$3/4$$

b) Solve for x.

$$9x^4 - 10x^2 = -1$$

2. Evaluate the limit

$$\lim_{x \to 2} \frac{\sqrt{x^2 + 5} - (x+1)}{(x-1)(x-2)}$$

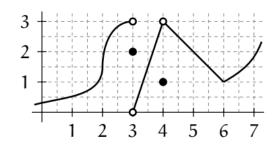
**Hint**: Use algebra

- a) 0

- c)  $\frac{1}{2}$  e)  $\frac{7}{2}$  g) Does Not Exist

- b) e d) 1 f) 3 h)  $-\frac{1}{3}$

3. Use the graph of the function g(x) below to answer the following questions



a) List all discontinuities for g(x) where 0 < x < 7. Classify each discontinuity as removable, jump, or infinite.

b) At what **other** value(s) of x is g(x) not differentiable.

c) What is g'(2)? Explain.

d) What is g'(5)? Explain.

$$f\left(x\right) = \frac{3}{2}x^2 + 5x$$

Find f'(x) using the definition of the derivative.

$$f(x) = e^{1/x} + \arctan(\sqrt{x}) + 4^x - x^6 - \pi^{\sqrt{2}} + \ln(\sqrt{x})$$

Find f'(x).

6. Find the coordinates of all the points on the graph of

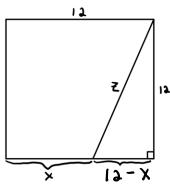
$$10x^2 - 2xy + y^2 = 360$$

at which the tangent line has slope 0.

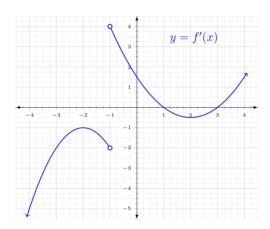
7. It is a sunny day, and you decide to go for a walk to get ice cream. The ice cream store is at the opposite corner of a small square park that measures 12 meters by 12 meters. You do not want to cut through the park, because it is occupied by some very aggressive Canadian geese, so instead you walk around the outside. How fast is the distance between you and the ice cream store changing when you are 5 meters away from turning the corner if at that point in time you are going at a leisurely pace of 0.5 meters/second?

- a)  $\frac{-1}{2}$  c)  $\frac{-1}{5}$  e)  $\frac{-3}{4}$  g)  $\frac{-7}{8}$

- b) -2 d)  $\frac{-5}{26}$  f)  $\frac{-5}{13}$  h) None of these



8. The graph below shows the derivative f'(x) of a continuous function f(x) defined for all x. Answer the following questions about f(x). Provide **complete explanations** for your answers.



Find the open interval(s) where f(x) is increasing and the intervals where f(x) is decreasing.

Find and classify the critical point(s).

Find the interval(s) where the f(x) is concave up and where the f(x) is concave down.

$$y = \frac{1}{8} \left( x^3 + 3x^2 - 9x - 3 \right)$$

Find the interval(s) where the function is increasing and the intervals where the function is decreasing. Find and classify the critical point(s).

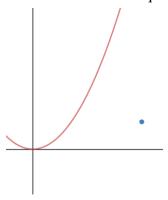
$$y = \frac{1}{8} \left( x^3 + 3x^2 - 9x - 3 \right)$$

Find the interval(s) where the function is concave up and interval(s) where the function is concave down. Identify the x – value of any inflection point(s).

11. Find the point on the graph of the function

$$y = x^2$$
 that is closest to  $\left(2, \frac{1}{2}\right)$ 

**Hint**: Minimize the square of the distance



## 12. Evaluate the limit

$$\lim_{x \to 0} \frac{\sin(3x) - 3x + 3x^2}{xe^x - \tan x}$$

- a) 0 c)  $\frac{1}{2}$  e)  $\frac{7}{2}$  g) Does Not Exist

- b) e d) 1 f) 3 h)  $-\frac{11}{2}$

$$f'(x) = 5 \cdot \sqrt[3]{x^2} - 8x^3 + \pi + 2\sec^2 x + \frac{1}{x^2} + 12\sin(4x)$$

Find f(x).

14. Evaluate

$$\int_{1}^{4} \left( 9\sqrt{x} + \frac{2}{\sqrt{x}} \right) dx$$

A) 10

E) 44

B) 20

F) 46

c) 30

G) 56

D) 40

H) None of these

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