## Math 201 Test 1 Review 2

October 23, 2019

Name:	
Note that both sides of each page may have printed material.	

## **Instructions:**

- 1. Read the instructions.
- 2. Panic!!! Kidding, don't panic! I repeat, do NOT panic! Don't look down, while you're at it.
- 3. Complete all problems in the actual test. Bonus problems are, of course, optional. And they will only be counted if all other problems are attempted.
- 4. You have 50 minutes to complete the test.
- 5. Show ALL your work to receive full credit. You will get 0 credit for simply writing down the answers.
- 6. Write neatly so that I am able to follow your sequence of steps and box your answers.
- 7. Read through the exam and complete the problems that are easy (for you) first!
- 8. Scientific calculators are allowed, but you are NOT allowed to use notes, graphing calculators, or other aids—including, but not limited to, divine intervention/inspiration, the internet, telepathy, knowledge osmosis, the smart kid that may be sitting beside you or that friend you might be thinking of texting.
- 9. In fact, cell phones should be out of sight! If you are caught with a cellphone you will be asked to leave the exam and you'll be given a zero.
- 10. Use the correct notation and write what you mean!  $x^2$  and  $x^2$  are not the same thing, for example, and I will grade accordingly.
- 11. Other than that, have fun and good luck!

1.	(a) (15 points) Let $f(x) = x - x^2$ . Use the limit definition of the derivative to find $f'(x)$ . No credit will be given for any other method!
	(b) (5 points) Using your answer to part (a), compute the equation of the tangent line to $f(x)$ at the point where $x=3$ . Write your line in $y=mx+b$ form.

- 2. (a) (5 points) Using an equation, define what it means for a function f(x) to be continuous at a point (a, f(a)).
  - (b) (10 points) Consider the function

$$f(x) = \begin{cases} cx^2 + 2x & , x < 2 \\ x^3 - cx & , x \ge 2 \end{cases}$$

Find the value(s) of c that will make the function continuous everywhere.

(c) (5 points) Using interval notation, state where the following function is continuous. Justify your claim!

$$g(x) = \frac{\sin x}{\sqrt{x^2 - 1}}$$

3. (5 points each) Compute the following limits. Show your work! Note that  $\infty$ ,  $-\infty$ , and DNE are valid answers.

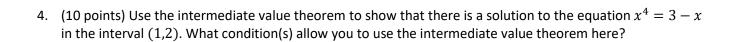
(i) 
$$\lim_{x \to 0} x^4 \sin \frac{1}{x}$$

(ii) 
$$\lim_{x \to 0} \frac{\sin x + 4x}{\tan 3x}$$

(iii) 
$$\lim_{x \to 1^{-}} \frac{x^2 + 3x + 2}{x^2 + x - 2}$$

(iv) 
$$\lim_{x \to -\infty} \frac{\pi + 2x - 3x^7}{2x^7 + x^3 + 3x^4}$$

(v) 
$$\lim_{x \to -1} \frac{2x^2 + 3x + 1}{x^2 - 2x - 3}$$



5. (5 points each) Compute and simplify  $y' = \frac{dy}{dx}$  for the following:

(a) 
$$y = x^2 e^x + \frac{2}{\sqrt{x}}$$

(b) 
$$y = \log_4(x^2 + 1)$$

(c) 
$$y = \frac{(x+1)^3}{(2x+1)^5}$$

(d) 
$$y = \ln \left[ \frac{x^2 e^x}{(x+1)^3} \right]$$

(d) 
$$e^{y^2} = 8x^2y - 3\pi$$

Bonus Problems: You must attempt all problems in the actual test to be eligible.

1. (2 points) Use the definition of the derivative to find the derivative of  $c(x) = \cos x$ 

2. (4 points each) Compute the derivative:

(a) 
$$y = x^3 + (\cos x)^x$$

(b) 
$$y = \frac{2^x \sqrt{x-1}}{x^3 \sin x}$$

3. (5 points) On what interval(s) is the function  $f(x) = \frac{x^2}{x^2 - 1}$  is concave up? Concave down? Find the x-value of its inflection point, if it has one. State that it doesn't have one if that's the case. You may assume (and need not verify) that  $f'(x) = -\frac{2x}{(x^2 - 1)^2}$  and  $f''(x) = \frac{2(3x^2 + 1)}{(x^2 - 1)^3}$ .

4. (5 points) The length of a rectangle is increasing at a rate of 8 cm/s and its width is increasing at a rate of 3 cm/s. When the length is 20 cm and the width is 10 cm, how fast is the area of the rectangle increasing?