Midterm 1 Math 241 Spring 2019

Name:
Section Number:

Read all of the following information before starting the exam:

- **CALCULATORS ARE NOT ALLOWED**.
- Show all work, clearly and in order using proper notations, if you want to get full credit. We reserve the right to take off points if we cannot see how you arrived at your answer (even if your final answer is correct).
- Box or otherwise indicate your final answers.
- Please keep your written answers brief; be clear and to the point. We will take points off for rambling and for incorrect or irrelevant statements.
- This test has 7 pages total including this cover sheet and the scrap page and is worth 65 points. It is your responsibility to make sure that you have all of the pages!
- Good luck!

Question 1	20	
Question 2	5	
Question 3	5	
Question 4	20	
Question 5	10	
Question 6	5	
Total	65	

1. 20 pts Calculate the following limits. State clearly any theorems that you use.

a.

$$\lim_{x \to 4^+} \frac{|x-4|}{(8-2x)}$$

b.

$$\lim_{t \to 0} \frac{\sin(\pi t)}{t}$$

c.

$$\lim_{h \to 3} \frac{\sqrt{h+1}-2}{h-3}$$

d.

$$\lim_{x \to 0} x \sin\left(\frac{3}{x}\right) + 4$$

2. 5 pts. **Use the definition of derivative** to show that the derivative of $f(x) = x^2 - 2$ at $x = -3$ is -6, i.e. $f'(-3) = -6$.

3. 5 pts. Find an equation for the tangent line to $f(x) = x^2 - 2$ at $x = -3$.

4. 20 pts. Calculate the following derivatives (Note: y' is the same as dy/dx):

a.

$$y = \frac{x+1}{x^2+2}, \qquad \frac{dy}{dx} =$$

b.

$$h(t) = \sin^2(3t), \qquad h'(t) =$$

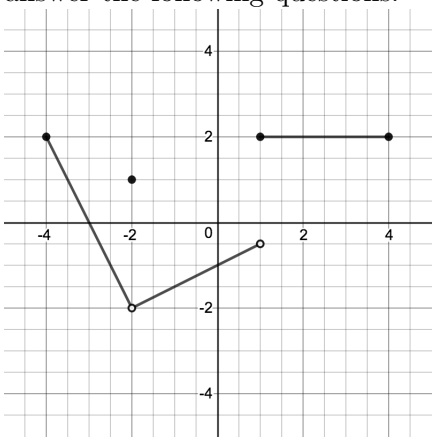
c.

$$f(x) = \sqrt{x}\cos(x) + 3, \qquad f'(x) =$$

d.

$$y^3 + 4x^2 + y = 2, \qquad y' \text{ at } (0,1)$$

5. 10pts. The function $f(x)$ is defined for $-4 \leq x \leq 4$ and is graphed below. Use the graph to answer the following questions:



a. What is $\lim_{x \to -2} f(x)$?

b. What is $\lim_{x \to 1} f(x)$?

c. Give the intervals where $f(x)$ is continuous, be careful to include the endpoints if necessary.

d. Does the function appear to be differentiable at $x = -2$? Explain why or why not.

6. 5 pts. Let $f(x) = x^5 - 4x + 1$. Use the intermediate value theorem to show that there is at least one point where $f(x) = 0$.