

DO NOT WRITE ABOVE THIS LINE!!

MATH 180 Exam 1 September 27, 2016

Directions. Fill in each of the lines below. Circle your instructor's name and write your TA's name. Then read the directions that follow before beginning the exam. YOU MAY NOT OPEN THE EXAM UNTIL TOLD TO DO SO BY YOUR INSTRUCTOR. Good luck!

Print Name: _____

University Email: _____

UIN: _____

Circle your instructor's name: Boester Dumas Embers Riedl Shulman

TA's Name: _____

- VERY IMPORTANT!!! CHECK THAT THE NUMBER AT THE TOP OF EACH PAGE OF YOUR EXAM IS THE SAME. IT IS THE NUMBER PRECEDED BY A POUND (#) SIGN. IF THEY ARE NOT ALL THE SAME, NOTIFY YOUR INSTRUCTOR OR TA RIGHT AWAY.
- All of your work must fit within the boxes on each page for each question. Nothing outside of the box will be graded! If you write outside of the box, there is a good chance that your exam will not be read and therefore not graded.
- A solution for one problem may not go on another page.
- Make clear to the grader what your final answer is.
- Have your student ID ready to be checked when submitting your exam.

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1. (18 points) Find the following derivatives. DO NOT SIMPLIFY YOUR ANSWERS.

(a) $\frac{d}{dx}(e^x \sin x)$

(b) $\frac{d}{dx} \left(\frac{\tan x}{1 + x^2} \right)$

(c) $\frac{d}{dx} (e^{x^2+7})$

2. (6 points) Suppose the height of a ball at time t is given by $h(t) = -16t^2 + 7t + 20$ where t is in seconds and $h(t)$ is in feet. At what time is the ball traveling with an instantaneous velocity of -89 feet per second?

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3. (8 points) Suppose the DERIVATIVE of a function f is given by $f'(x) = \frac{x^2 + 1}{x + 3}$. Suppose also that $f(2) = 3$. What is the equation of the tangent line to $y = f(x)$ at $x = 2$?

4. (10 points) Calculate the following limits.

(a) $\lim_{x \rightarrow -3} (2x^2 + 5x - 4)$

(b) $\lim_{x \rightarrow 2} \frac{\sqrt{2} - \sqrt{x}}{2 - x}$

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5. (10 points) For the following limit, write either its numerical value, $+\infty$, $-\infty$, or D.N.E. Make sure to show all your work.

$$\lim_{x \rightarrow -\infty} \frac{2x^3 + x^2 - 7}{5x^2 - 3x + 6}$$

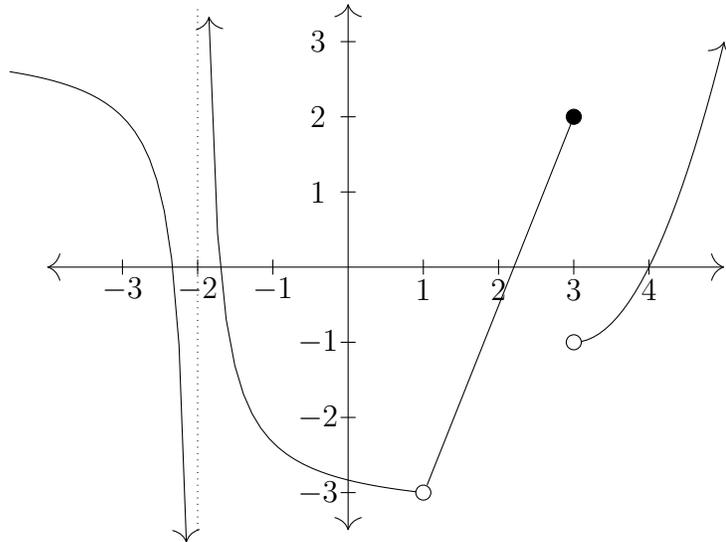
6. (8 points) Find a value for q so that the limit

$$\lim_{x \rightarrow -1} \frac{x^2 + 8x + q}{x + 1}$$

exists. For the value of q that you found, find the limit.

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7. (10 points)



Use the graph above. For each limit below, write either its numerical value, $+\infty$, $-\infty$, or D.N.E.

(a) $\lim_{x \rightarrow -2^-} f(x)$

(b) $\lim_{x \rightarrow -2^+} f(x)$

(c) $\lim_{x \rightarrow -2} f(x)$

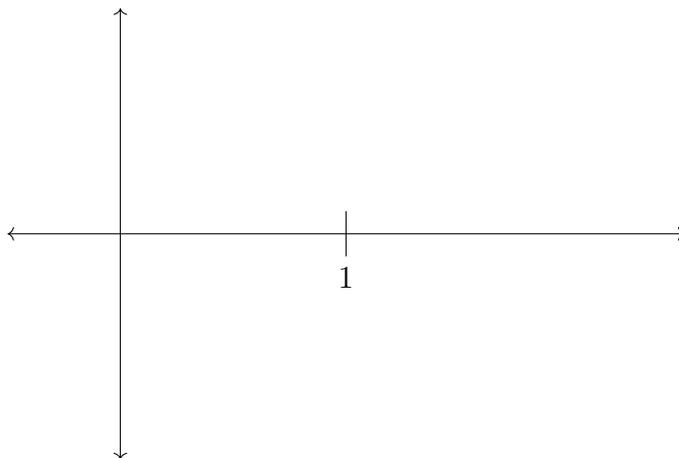
(d) $\lim_{x \rightarrow 1} f(x)$

(e) $\lim_{x \rightarrow 3} f(x)$

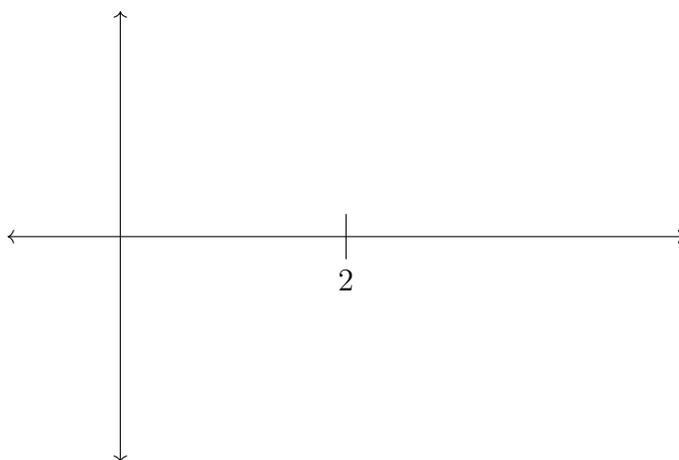
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8. (10 points)

- (a) On the axes below, draw a **function** that is defined at $x = 1$, has a limit as x approaches 1, but is not continuous at $x = 1$.



- (b) On the axes below, draw a **function** that is continuous at $x = 2$, but is not differentiable at $x = 2$.



9. (10 points) Fill in the blanks to show that $f(x) = x^4 - 9x + 7 = 0$ has a solution.

The function $f(x) = x^4 - 9x + 7$ is a function that is _____ everywhere it is defined. We wish to show that there is some value c with $f(c) = L =$ _____. We see that L is between $f(\text{_____}) =$ _____ and $f(\text{_____}) =$ _____, so by the _____ Theorem, there must be some c in the interval $(\text{_____, } \text{_____})$ with $f(c) =$ _____.

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10. (10 points) Using the **definition of the derivative**, find $f'(x)$ if $f(x) = x^2 - 5x + 6$.

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THIS PAGE WAS LEFT BLANK INTENTIONALLY. YOU CAN USE IT FOR SCRATCH PAPER, BUT NOTHING ON THIS PAGE WILL BE GRADED.