Math 26A   Name (Print): _____
Fall 2020
DUE BY 11:59PM ON DEC 18

Instructions:

- The exam is open book and open notes. You may not receive assistance from other people, including through forums or Q&A sites.

- You may use any kind of calculator you like, but you must show each step of your work. *You will receive a zero for correct solutions with no work shown.*

- For incorrect solutions, partial credit will be awarded for work shown.

- You may submit your exam in the same manner as your homework.

- You are welcome to print this exam and write on it directly or to work on a separate piece of paper.

- Round any numeric results to 3 decimal places.

1. A math professor's average number of daily caffeinated beverages B can be modeled by $B = 1.71 + 0.29t$ where t is the week in the semester $(0 \leq t \leq 15)$.

   (a) Describe what the slope and intercept mean in this setting.

   (b) What is the professor's average number of daily caffeinated beverages during Week 6?

2. Use the limit definition to find the derivative of $h(x) = 2x^2 + x$. Then find the slope of the tangent line at the point $(1, 3)$.

3. Find $f'(x)$, $f''(x)$, and $f'''(x)$. For each derivative, state which differentiation rule(s) you used.

$$f(x) = \frac{(x+2)^2}{x-2}$$

4. Determine the open intervals on which the function is concave upward or concave downward:

$$g(x) = \frac{(x^3+4)^2}{3}$$

5. Find all of the relative extrema of $g(x) = 2x^3 - 5x^2 - 4x + 11$. State which test(s) you used.

6. Consider the function

$$f(x) = \frac{(2e^x)^2}{e^5} + 7x^2.$$

(a) Use the rules of exponents to simplify $f(x)$.

(b) Find $f'(x)$. Simplify your result.

7. Consider the function

$$g(x) = \ln\left(\frac{4x+2}{x^2}\right)$$

(a) Use the properties of logarithms to fully expand the expression. (Hint: there should be three logs.)

(b) Find $g'(x)$. Simplify your result.

8. Find the indefinite integral $\int (2x^3 - x^2 + 7x + 2)dx$. Confirm your result by differentiating.

9. Find the indefinite integral

$$\int \frac{3x^2 - 2}{\sqrt{2x^3 - 4x + 3}}dx$$

10. What mathematical ideas are you curious to know more about as a result of taking this class? Give an example of a question about the material that you'd like to explore further, and describe why this is an interesting question to you. (Remember that this is applied calculus, so this can be an applied question!)

Extra Credit: Use the exponential rule to find

$$\int (3x^2 + 1)e^{\frac{x^3+x}{2}}\,dx.$$