Math 1231 Fall 2025
Single-Variable Calculus I Section 11
Mastery Quiz 8
Due Monday, October 20

This week's mastery quiz has three topics. Everyone should submit M3. If you have a 2/2 on S5 or S6 you don't need to submit it again.

Don't worry if you make a minor error, but try to demonstrate your mastery of the underlying material.

Feel free to consult your notes, but please **don't discuss the actual quiz questions with other students in the course**.

Remember that you are trying to demonstrate that you understand the concepts involved. For all these problems, justify your answers and explain how you reached them. Do not just write "yes" or "no" or give a single number.

Topics on This Quiz

- Major Topic 3: Optimization
- Secondary Topic 5: Implicit Differentiation
- Secondary Topic 6: Related Rates

Name:

Recitation Section:

Major Topic 3: Optimization

(a) The function $f(x) = 3x^4 - 2x^3 - 3x^2 + 5$ has absolute extrema either on the interval $(-1, 2)$, or on the interval $[-1, 2]$. Pick one of those intervals, explain why g has extrema on that interval, and find the absolute extrema.

(b) Find all the critical points of $g(x) = \frac{x^2-3x-4}{x+5}$

Secondary Topic 5: Implicit Differentiation

(a) Find a formula for y' in terms of x and y if $\sqrt{x+y} = x^3y^2$.

(b) Write a tangent line to the curve $x^2y^2 = 5 + x + y$ at the point $(1, 3)$.

Secondary Topic 6: Related Rates

A spot light is on the ground 36 ft away from a wall and a 5 ft tall person is walking towards the wall at a rate of 4 ft/sec. How fast is the height of the shadow changing when the person is 24 feet from the wall? Is the shadow increasing or decreasing in height at this time?

(a) Choose an equation to use for this problem, and explain why you chose that equation.

(b) Use calculus to answer the question. Make sure you answer with a complete sentence that clearly and directly answers the question.