Math 1231 Fall 2024
Single-Variable Calculus I Section 11
Mastery Quiz 8
Due Wednesday, October 23

This week's mastery quiz has three topics. Everyone should submit on M3. If you have a 2/2 on S5 or S6, you don't need to submit them. If you're unsure about your current grade, please check Blackboard.

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.

Please turn this quiz in class on Wednesday. You may print this document out and write on it, or you may submit your work on separate paper; in either case make sure your name and recitation section are clearly on it. If you absolutely cannot turn it in in person, you can submit it electronically but this should be a last resort.

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) Classify the critical points and relative extrema of $g(x) = \dfrac{2x-1}{x^2+2}$.

(b) The function $g(x) = 3x^4 - 2x^3 - 3x^2 + 5$ 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.

Secondary Topic 5: Implicit Differentiation

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

(b) Find a tangent line to the curve given by $x^4 - 2x^2y^2 + y^4 = 16$ at the point $(\sqrt{5}, 1)$.

Secondary Topic 6: Related Rates

A rocket is taking off with a perfectly vertical path, and is being tracked by a radar station on the ground four miles from the launch pad. We want to know how fast the rocket is rising when it is three miles high and its distance from the radar station is increasing at a rate of 3000 miles per hour.

(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.