Math 1231 Fall 2024
Single-Variable Calculus I Section 11
Mastery Quiz 9
Due Wednesday, October 30

This week's mastery quiz has three topics. Everyone should submit on all three.

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 7: Curve Sketching

- Secondary Topic 8: Physical Optimization

Name:

Recitation Section:

Major Topic 3: Optimization

(a) Find and classify the critical points of $f(x) = \sqrt[3]{x^3 - 3x}$.

(b) The function $g(x) = x^3 - 3x^2 - 9x + 3$ has absolute extrema either on the interval $(-2, 4)$ or on the interval $[-2, 4]$. Pick one of those intervals, explain why g has extrema on that interval, and find the absolute extrema.

Secondary Topic 7: Curve Sketching

Let $f(x) = \dfrac{(x-2)^2}{x-1}$. We can compute that

$$f'(x) = \frac{x(x-2)}{(x-1)^2}$$
$$f''(x) = \frac{2}{(x-1)^3}.$$

Sketch a graph of f. Your answer should discuss the domain, roots, asymptotes, limits at infinity, critical points and values, intervals of increase and decrease, and concavity and points of inflection.

Secondary Topic 8: Physical Optimization

To check a bag on a certain airplane, the length plus width plus height must be less than or equal to 63in. Assuming the suitcase should be twice as long as it is wide, what height maximizes the volume of the suitcase? Justify your claim that this is a maximum.