Math 1231 Section 16 Fall 2021
Single-Variable Calculus I Mastery Quiz 9
Due Monday, November 15

This week's mastery quiz has three topics. You may submit all three.

Feel free to consult your notes or speak to me privately, but please don't talk about the actual quiz questions with other students in the course or post about it publicly.

You shouldn't spend more than about 20-30 minutes on this quiz. Don't worry if you make a minor error, but try to demonstrate that you understand the concepts involved and have mastered the underlying material. 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 Monday. 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 through Blackboard but this should be a last resort.

Topics on This Quiz

- Major Topic 4: Optimization
- Secondary Topic 6: Curve Sketching
- Secondary Topic 7: Approximation

Name:

Recitation Section:

Major Topic 4: Optimization

(a) Find the absolute extrema of $f(x) = x^3 + x^2 - 5x$ on $[-1, 2]$.

(b) Classify the critical points and relative extrema of $g(x) = \cos^2(x) - 2\sin(x)$ on $[0, 2\pi]$

Secondary Topic 6: Curve Sketching

Let $g(x) = \dfrac{x^2 - 7}{x^2 - 4}$.

We can compute that $g'(x) = \dfrac{6x}{(x+2)^2(x-2)^2}$ and $g''(x) = \dfrac{-6(3x^2+4)}{(x^2-4)^3}$.

Sketch a graph of the function $g(x)$. Your answer should discuss the domain, asymptotes, roots, limits at infinity, critical points and values, intervals of increase and decrease, points of inflection, and concavity.

Secondary Topic 7: Approximation

(a) Find a formula for the quadratic approximation of $f(x) = \sin(x^2 + x)$ near the point $a = 0$, and use it to estimate $f(.1)$.

(b) Use two steps of Newton's method to estimate a solution to $x^3 + x = 1$ starting from $x_0 = 1$. (You should compute x_2.)