Math 1231 Fall 2024
Single-Variable Calculus I Section 11
Mastery Quiz 5
Due Monday, October 6

This week's mastery quiz has three topics. Everyone should submit on S4. If you have a 4/4 on M2 in Blackboard, you don't need to submit it again, and if you have a 2/2 on S3 you don't need to submit that again.

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 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 but this should be a last resort.

Topics on This Quiz

- Major Topic 2: Computing Derivatives
- Secondary Topic 3: Linear Approximation
- Secondary Topic 4: Rates of Change

Name:

Recitation Section:

Major Topic 2: Computing Derivatives

(a) Compute $\dfrac{d}{dx}\csc^{7/3}\left(\dfrac{x^2+\sin(x)}{\sqrt{x}-\cot(x)}\right)$.

(b) Compute $\dfrac{d}{dx}\sec\left(\dfrac{x^3-x}{\sqrt[5]{x}+1}\right) =$

Secondary Topic 3: Linear Approximation

(a) Give a formula for a linear approximation of $f(x) = \sqrt{x^3+1}$ near the point $a = 2$. Use your answer to estimate $f(2.1)$.

(b) Write the equation for the tangent line to $g(x) = 2x - \tan(x)$ at the point $a = \pi$.

Secondary Topic 4: Rates of Change

(a) Suppose the distance between two particles in centimeters is given as a function of time in seconds by the formula $d(t) = t^3 + 4t^2 + 5t + 4$.

(i) When is the velocity zero?

(ii) When is the acceleration zero?

(b) Suppose that a factory produces widgets, and if p people work at the factory then they will produce a total of $W(p) = 30\sqrt{p}$ widgets.

(i) What are the units of $W'(p)$? What does it represent physically? What does it mean if W' is big?

(ii) Calculate $W'(9)$. What does this tell you physically? What physical observation could you make to check your calculation?