Math 1231 Fall 2025
Single-Variable Calculus I Section 11
Mastery Quiz 6
Due Monday, October 6

This week's mastery quiz has three topics. Everyone should submit S4. If you have a 4/4 on M2 you don't need to submit it again. If you have a 2/2 on S3 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 2: Computing Derivatives
- Secondary Topic 3: Linear Approximation
- Secondary Topic 4: Rates of Change

Name:

Recitation Section:

Major Topic 2: Computing Derivatives

(a) Compute $\dfrac{d}{dx}\cos^2\left(\tan^2\left(\sec^2(\sqrt{x}+x)\right)\right)$.

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

Secondary Topic 3: Linear Approximation

(a) Find a linear approximation to the function $f(x) = \frac{x^3}{1+x}$ near the point $a = 1$ and use it to approximate $f(1.3)$.

(b) Find a line tangent to the graph of $g(x) = \tan(x)\sec(x)$ at the point $x = \pi/6$.

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 $d(t) = t + \frac{1}{t}$.

(i) When is the velocity zero?

(ii) When is the acceleration zero?

(b) Suppose you are running a factory that makes industrial equipment, and if you manufacture m machines in a day you make a profit of $P(m) = 1000m - m^3$ dollars.

(a) What are the units of $P'(m)$? What does it mean if $P'(m)$ is positive?

(b) Calculate $P'(10)$. What does this calculation tell you physically? What observation could you make to check this calculation?