Math 1231 Fall 2025
Single-Variable Calculus I Section 12
Mastery Quiz 5
Due Wednesday, October 1

This week's mastery quiz has four topics. Everyone should submit topics M2, S3, and S4. If you have a 4/4 on M1 you don't need to submit it this week. (Check Blackboard for your current scores!) This quiz is the last quiz for M1.

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

Name:

Recitation Section:

Major Topic 1: Computing Limits

(a) $\lim_{x\to 1} \dfrac{\sqrt{x+3}-2}{x-1} =$

(b) $\lim_{x\to+\infty} \dfrac{3x^2+2x+1}{\sqrt{x^4-x^2+x}} =$

(c) $\lim_{x\to 4^+} \dfrac{x+1}{x-4} =$

Major Topic 2: Computing Derivatives

(a) Compute $\dfrac{d}{dx}\tan^{3/5}\left(\sec\left(x^3-4\right)\right)$

(b) Compute $\dfrac{d}{dt}\sqrt[5]{\dfrac{\tan^2(t^2+1)+2}{\sin(2t)-2t}}$.

Secondary Topic 3: Linear Approximation

(a) Estimate $\sqrt[4]{15}$ using a linear approximation of the function $\sqrt[4]{x}$ at the point 16.

(b) Give a formula for a linear approximation to $g(x) = 2x - \tan(x)$ near the point $a = \pi$.

Secondary Topic 4: Rates of Change

(a) 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?

(b) Suppose the height of a particle in centimeters is given as a function of time in seconds $p(t) = t^3 - 3t$.

  (i) When is the velocity zero?

  (ii) When is the acceleration zero?