Math 1231 Fall 2025
Single-Variable Calculus I Section 11
Mastery Quiz 3
Due Monday, September 15

This week's mastery quiz has one topic. Everyone should submit it, even if you got it right last time; on major topics, your two best scores count.

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 1: Computing Limits

Name:

Recitation Section:

Major Topic 1: Computing Limits

(a) $\lim_{x\to 0} \dfrac{\sin(5x^2)+\tan^2(3x)}{x^2} =$

Solution:

$$\begin{aligned}\lim_{x\to 0} \frac{\sin(5x^2)+\tan^2(3x)}{x^2} &= \lim_{x\to 0} \frac{\frac{\sin(5x^2)}{5x^2}5x^2 + \frac{\sin(3x)}{3x}\cdot(3x)\cdot\frac{\sin(3x)}{3x}\cdot(3x)\cdot\frac{1}{\cos^2(3x)}}{x^2} \\ &= \lim_{x\to 0} \frac{5x^2 + \frac{9x^2}{\cos^2(3x)}}{x^2} \\ &= \lim_{x\to 0} 5 + \frac{9}{\cos^2(3x)} = 5+9 = 14.\end{aligned}$$

by the Small Angle Approximation.

(b) Compute $\lim_{x\to 25} \dfrac{\sqrt{x}-5}{x-25}$

Solution:

$$\lim_{x\to 25} \frac{\sqrt{x}-5}{x-25} = \lim_{x\to 25} \frac{x-25}{(x-25)(\sqrt{x}+5)} = \lim_{x\to 25} \frac{1}{\sqrt{x}+5} = \frac{1}{10}.$$

(c) $\lim_{x\to -2} \dfrac{x-2}{(x+2)^2} =$

Solution: The top approaches -4 and the bottom approaches 0, so

$$\lim_{x\to -2} \frac{x-2}{(x+2)^2} = \pm\infty.$$

Further, we see that the top is negative and the bottom is always positive, so in fact the limit is $-\infty$.