Math 1231 Fall 2026
Single-Variable Calculus I Section 12
Mastery Quiz Worksheet 2
Due Friday, September 4

This week's mastery quiz has two topics. It is the last quiz that will cover topic S1.

Remember that you are trying to demonstrate that you understand the concepts involved. For all these problems, you should justify your answers and show your work. Do not just write "yes" or "no" or give a single number.

On Friday, we will end class with a short quiz, containing questions drawn from this worksheet, plus one "easy" question on topic M1. You may not use or consult any materials or notes during Wednesday's quiz; make sure you work through these problems carefully, and understand them well enough that you can replicate that work in class.

Topics on This Quiz

- Major Topic 1: Computing Limits
- Secondary Topic 1: Estimation

Name:

Recitation Section:

Major Topic 1: Computing Limits

(a) Compute $\lim_{x\to 2} \dfrac{x^2+x-5}{3-x} =$

Solution:

$$\lim_{x\to 2} \frac{x^2+x-5}{3-x} = \frac{1}{1} = 1.$$

(b) Compute $\lim_{x\to 3} \dfrac{x^2-5x+6}{x^2-x-6} =$

Solution:

$$\begin{aligned}\lim_{x\to 3} \frac{x^2-5x+6}{x^2-x-6} &= \lim_{x\to 3} \frac{(x-3)(x-2)}{(x-3)(x+2)} \\ &= \lim_{x\to 3} \frac{x-2}{x+2} = 1/5.\end{aligned}$$

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

Solution:

$$\begin{aligned}\lim_{x\to 1} \frac{\sqrt{x+3}-2}{x-1} &= \lim_{x\to 1} \frac{x+3-4}{(x-1)(\sqrt{x+3}+2)} \\ &= \lim_{x\to 1} \frac{1}{\sqrt{x+3}+2} = \frac{1}{4}.\end{aligned}$$

Secondary Topic 1: Estimation

(a) Suppose $f(x) = 5x + 4$, and we want an output of approximately 9. What input a should we aim for? Find a δ so that if our input is $a \pm \delta$ then our output will be 9 ± 2. Explain how you found this δ and why it should give us what we want.

Solution: We want an input of about $a = 1$. We want

$$\begin{aligned}|5x+4-9| &< 2 \\ |5x-5| &< 2 \\ |x-1| &< 2/5.\end{aligned}$$

So we take $\delta = 2/5$.

(b) We can make a pound of charcoal from nine pounds of wood, and we want to produce about 8 pounds of charcoal. Find a formula for δ in terms of ϵ, so that if the error in the amount of *wood* is less than δ then the error in the amount of charcoal is less than ϵ. Make sure your formula gives the **largest δ possible**, and justify your answer.

Solution: The amount of charcoal we produce is $W/9$, so our output error is $|W/9 - 8| = \frac{1}{9}|W - 72|$, which we want to be less than ε. So we get

$$|W/9 - 8| = \frac{1}{9}|W - 72| < \varepsilon$$
$$|W - 72| < 9\varepsilon.$$

So if we take $\delta = 9\varepsilon$, then whenever the error in the amount of wood we use, $|W - 72|$, is less than δ, then the error in our amount of charcoal should be less than ε.