Math 1231 Fall 2026
Single-Variable Calculus I Section 11
Mastery Quiz Worksheet 1
Due Friday, August 28

This week's mastery quiz has one topic.

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. 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

- Secondary Topic 1: Estimation

Name:

Recitation Section:

Secondary Topic 1: Estimation

(a) Suppose $f(x) = x^2 + 4x$, and we want an output of approximately 12. What input a should we aim for, if we want a positive input? Find a δ so that if our input is $a \pm \delta$ then our output will be 12 ± 1. Justify your answer.

Solution: We want an input of about $a = 2$. Our output error will be $|x^2+4x-12| = |x+6| \cdot |x-2|$. We know that $x + 6 \approx 8 < 9$, so we have

$$|x^2 + 4x - 12| = |x + 6| \cdot |x - 2| < 9|x - 2| < 1$$

so we need $|x - 2| < 1/9$. So we can take $\delta = 1/9$.

(b) We want to amplify an electrical signal. Our amplifier will multiply the voltage by a factor of six, and we want an output signal of $24 \pm \varepsilon$ volts. Find a formula for δ in terms of ε, so that if the input error is less than δ then the error in the output is less than ε. Make sure your formula gives the **largest δ possible**, and justify your answer.

Solution: Our output error is $|6x - 24| = 6|x - 4|$, and we want this to be less than ε. So we get

$$|6x - 24| = 6|x - 4| < \varepsilon$$
$$|x - 4| < \varepsilon/6.$$

So if we take $\delta = \varepsilon/6$, then whenever the error in our input voltage $|x - 4| < \delta$ then the error in our output voltage should be less than ε.