Math 1231 Fall 2026
Single-Variable Calculus I Section 11
Mastery Quiz Worksheet 6
Due Friday, October 2

This week's mastery quiz has three topics. It is the first time we have seen topic S3 or S4.

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 Friday'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 2: Computing Derivatives
- Secondary Topic 3: Linear Approximation
- Secondary Topic 4: Rates of Change

Major Topic 2: Computing Derivatives

(a) Explicitly justifying each step and naming each derivative rule you use, compute $\frac{d}{dx}\frac{\sin(x)+1}{2x^2-5}$.

(b) $\dfrac{d}{dx}\sec(\tan(\cos((x+1)^2))) =$

(c) $\dfrac{d}{dx}\sec\left(\dfrac{x^2+1}{\sqrt{x^3-2}}\right) =$

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) Write the equation for the tangent line to $g(x) = 2x - \tan(x)$ at 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?