

Math 1231 Spring 2024  
Single-Variable Calculus I Section 11  
Mastery Quiz 6  
Due Tuesday, February 27

This week's mastery quiz has three topics. Everyone should submit topics S4. If you already have a 4/4 on M2 or a 2/2 on S3 (check Blackboard!) you don't need to submit them again.

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.

Please turn this quiz in class on Thursday. You may print this document out and write on it, or you may submit your work on separate paper; in either case make sure your name and recitation section are clearly on it. If you absolutely cannot turn it in in person, you can submit it electronically but this should be a last resort.

**Topics on This Quiz**

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

**Name:**

**Recitation Section:**

## Major Topic 2: Computing Derivatives

- (a) Compute  $\frac{d}{dx} \frac{\sin(\csc(x^2 + 1))}{x^4 + \cos(x)} =$
- (b) Compute  $\frac{d}{dx} \cos^2(\tan^2(\sec^2(\sqrt{x} + x)))$ .

## Secondary Topic 3: Linear Approximation

- (a) Use linear approximation to estimate  $\sqrt[4]{14}$ .
- (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) Let  $F(x) = \frac{1}{x} + 1$  be the amount of pressure exerted on a beam in pounds per square inch at a point  $x$  inches to the right of its left end.
- (i) What are the units of  $F'(x)$ ? What does  $F'(x)$  represent physically? What would it mean if  $F'(x)$  is big?
- (ii) Compute  $F'(5)$ . What does this tell you physically? What physical observation could you make to check your calculation?
- (b) Suppose the vertical position of a weight on a spring in inches is given as a function of time in seconds by the formula  $h(t) = \cos(2t)$ .
- (i) When is the velocity zero?
- (ii) When is the acceleration zero?