

Math 1231 Section 10 Fall 2021  
Single-Variable Calculus I Mastery Quiz 8  
Due Thursday, November 11

This week's mastery quiz has four topics. **You may submit up to three.** This is the last week for topics M3 and S6.

Feel free to consult your notes or speak to me privately, but please don't talk about the actual quiz questions with other students in the course or post about it publicly.

You shouldn't spend more than about 20-30 minutes on this quiz. Don't worry if you make a minor error, but try to demonstrate that you understand the concepts involved and have mastered the underlying material. 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 Monday. 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 through Blackboard but this should be a last resort.

**Topics on This Quiz**

- Major Topic 3: Linear Approximation
- Major Topic 4: Extrema and Optimization
- Secondary Topic 6: Curve Sketching
- Secondary Topic 7: Approximation

**Name:**

**Recitation Section:**

**Major Topic 3: Linear Approximation**

- (a) Use linear approximation to estimate  $f(9.1)$  if  $f(x) = 3\sqrt{x} + 2x$ .
- (b) Find a line tangent to the graph of  $g(x) = \tan(x)\sec(x)$  at the point  $x = \pi/6$ .

**M4: Extrema and Optimization**

- (a) Suppose that a company that produces and sells  $x$  units of a product makes a revenue of  $R(x) = 260x - 9x^2/10$  and has costs given by  $C(x) = 1000 + 100x + x^2/10$ . What is the maximum profit that can be made (where profit is revenues minus costs)?
- (b) Classify the critical points and relative extrema of  $h(x) = \sin(x) + \cos(x)$  on  $[0, 2\pi]$ .

## S6: Curve Sketching

Sketch the graph of  $g(x) = 3x^4 - 4x^3 - 36x^2 + 64 = (x + 2)^2(3x - 4)(x - 4)$  have  $g'(x) = 12x^3 - 12x^2 - 72x = 12x(x - 3)(x + 2)$  and  $g''(x) = 36x^2 - 24x - 72 = 12(3x^2 - 2x - 6)$ .

You should discuss the domain, limits, critical points, intervals of increase and decrease, concavity, and possible points of inflection.

**S7: Approximation**

- (a) Find a formula for the quadratic approximation of  $f(x) = \sqrt{3x+1}$  near the point  $a = 1$ , and use it to estimate  $f(1.01)$ .
- (b) Use two steps of Newton's method to estimate  $\sqrt{8}$  starting from  $x_0 = 3$ . (You should compute  $x_2$ .)