Math 105, Benedetto

What you need to know for Exam 3

You should know Sections 2.7 (falling body problems) and 2.8, plus most of Chapter 3; specifically, Sections 3.1, 3.3, 3.4, 3.5. The test will not explicitly cover material from Chapter 1 (or from Sections 2.1–2.6), but of course it will be assumed that you understand that material. (For example, you still need to know how to work with limits and derivatives.) The following is a list of most of the topics covered. **THIS IS NOT A COMPREHENSIVE LIST, BUT MERELY AN AID.** Remember, no calculators in any exams.

- 2.7: Physics Motion Problems. Know that the derivative of the position is the velocity function, and the derivative of the velocity function is the acceleration function. Know how to compute falling body problems. Know techniques on how to compute the initial position or initial velocity of an object. Know how to compute max height, know how to compute the velocity at impact.

- 2.8: Related rates. Know the method (either the steps listed in the book, or the steps I listed in class and on the tips handout!).

- 3.1: Extreme Values. Understand the definitions (critical numbers (also known as critical points), absolute extrema, and local extrema), the Extreme Value Theorem. Most of all, know when to use, when not to use, and how to execute the Closed Interval Method.

  We studied three questions:

  (1) When is a function guaranteed Absolute Extreme Values? (Answer: Use EVT)

  (2) Where do those Absolute Extreme Values occur? (Answer: examine critical numbers, and endpoints of closed interval)

  (3) What are the extreme values? (Answer: Use Closed Interval Method)

- 3.3: Derivatives and graphs. Definitions of increasing, decreasing, and inflection points. Intuitive definition of concavity. The Increasing/Decreasing Test, the Concavity Test, and the First Derivative Test.

- 3.4: Limits at $\pm\infty$; Horizontal Asymptotes. Know the (non-epsilon) definitions and how to compute them.

- 3.5: Summary of Curve Sketching. Be able to combine all the information (incr/decr, concavity, local extrema, inflection points, asymptotes) from Sections 3.3 and 3.4 to draw accurate pictures of the graph of a curve.

Some Things You Don't Need to Know

- Most of Section 2.7 (but you DO need to know the motion problems).
- Geometric formulae (for related rates problems). I will give you any possibly relevant geometric formulae (like the volume of a cone), so don't worry about memorizing those.
- Linear Approximation and Differentials (Section 2.9).
- Precise definitions (i.e., ε and all that) for limits at ∞ (end of Section 3.4).
- Slant asymptotes (end of Section 3.5).

Tips

- For related rates problems, follow the outlined method carefully. Besides curve sketching, this is probably the hardest topic on this exam, so study it well. Please be neat and clear. Presentation is key here.
- The closed interval method is only for closed intervals. (And, less obviously, only for continuous functions.)
- Don't forget that there are **two** kinds of critical points; the oft-forgotten type is when $f(c)$ is defined but $f'(c)$ isn't.
- Practice sketching graphs. It's easy to make a mistake computing all those derivatives and second derivatives. Even if you get the derivatives right, it's all too easy to make a mistake finding the critical points or deciding the derivatives are positive and negative. The asymptotes can also be a little tricky sometimes. One little mistake on a sign can multiply to a whole huge mess of horror. So be careful and check your work as you go.
- For curve sketching, be sure to state clearly the intervals of increase/decrease, as well as concavity. Be sure to state whether there are local extreme values or inflection points. Indeed, presentation is also key here.
- Most importantly, be clear and neat on your answer work. Students usually score higher when the work is easy to see and grade. Don't leave any guessing, mind-reading, or searching to the grader.
- Any time you can double check your work, please do that!