Math 11, Benedetto

What you need to know for Exam 2

You should know all of Chapter 3 (excluding Section 3.9), plus most of Chapter 4; specifically, Sections 4.1, 4.3, 4.4, 4.5. The test will not explicitly cover material from Chapters 1 and 2 (or from Sections 3.1–3.2), but of course it will be assumed that you understand that material. (For example, there will be no ε-δ proofs or computations of derivatives from the definition of the derivative, but 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.

- 3.3: Differentiation Rules: Sum, Difference, Constant Multiple, Product, Quotient, Power. Know how to use them.
- 3.4: Know the derivatives of the trigonometric functions. Know $\lim_{x\to 0}(\sin x)/x = 1$, and how to use it to compute other limits involving trig functions.
- 3.5: Chain rule. Know it well!! Be able to compute derivatives involving both chain rule and quotient/product rules, paying attention to the order. Place parentheses carefully!
- 3.6: Implicit differentiation. To find the tangent line to a curve described by some equation involving x and y, we think of y as a function of x, without knowing the actual formula for $y = f(x)$ (hence, an implicit, rather than explicit, function). So if we differentiate with respect to x, we must remember that y is a function of x and use the chain rule (or product rule, or quotient rule) when appropriate.
- 3.7: Of this section, the only part you should know for this test is the physics of motion (like our class worksheet: position, velocity, acceleration, and so on).
- 3.8: Related rates. Know the method (either the steps listed in the book, or the steps I listed in class and on the tips handout!).
- 4.1: Extreme Values. Understand the definitions (critical numbers (also known as critical points), absolute extrema, and local extrema), the Extreme Value Theorem, and Fermat's Theorem. Most of all, know when to use, when not to use, and how to execute the Closed Interval Method.
- 4.3: Derivatives and graphs. Definitions of increasing, decreasing, and inflection points. Intuitive definition of concavity. The Increasing/Decreasing Test, the Concavity Test, the First Derivative Test, and the Second Derivative Test.
- 4.4: Limits at $\pm\infty$; Horizontal Asymptotes. Know the (non-epsilon) definitions and how to compute them.
- 4.5: Summary of Curve Sketching. Be able to combine all the information (incr/decr, concavity, local extrema, inflection points, asymptotes) from Sections 4.3 and 4.4 to draw accurate pictures of the graph of a curve.

Some Things You Don't Need to Know

- The limit definition of the derivative (Sections 3.1 and 3.2).
- Most of Section 3.7 (but you DO need to know the motion problems).
- y'' in implicit differentiation (end of Section 3.6) or $\dfrac{dx}{dy}$ computations.
- 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 3.9).
- Official definition of concavity (middle of Section 4.3), although you DO need to know what concavity means intuitively.
- Precise definitions (i.e., ε and all that) for limits at ∞ (end of Section 4.4).
- Slant asymptotes (end of Section 4.5).

Tips

- If any of the problems in Sections 3.3, 3.4, or 3.5 gave you trouble, make sure you have them cleared up; those problems will be the *easy* ones on the exam.
- 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.
- Implicit differentiation can also be tricky. Besides the fact that it comes up in related rates problems, you also need to be able to recognize when you need to use it.
- 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.
- Most importantly, be clear and neat on you answer work. People 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!