Final exam study guide

The final exam will be the same format as the midterms: one 5x8 notecard and a scientific calculator will be allowed.

If you need a formula for the volume of a sphere/cone/etc., I will provide it. Otherwise, only formulas specifically noted in the bullet points below will be provided. Things like basic trig, how to use similar triangles, the Pythagorean Theorem, and areas of circles, rectangles, triangles, volumes of rectangular prisms, will NOT be provided but may be necessary. You may want to write derivative/antiderivative formulas, formulas for washer/shell method, arc length, and surface area of revolution on your notecard since they will NOT be provided.

The test is scheduled from on **Thursday, April 28 1pm-3pm** in our usual classroom.

New topics not on previous midterms:

- ❑ Set up an integral to find the arc length of a curve given as a parametric equation. **P300**, **Problem Set 5.4, 1-5, 13-16, just set it up.**
- ❑ Set up an integral to find the surface area of a surface of revolution. **P300, Problem Set 5.4, 23-27 just set it up.**
- ❑ Find the work needed to pump a liquid out of a tank. I will provide the density of the liquid for you. **P303, Examples 2, 3, Lab 13.**
    - ❑ I will try to make the numbers come out nicer than the examples in the book, or I will just ask you to set it up.
- ❑ **Skip "force against the side of a tank".**
- ❑ Know the idea behind the various methods of numerical integration (**p262**). Find a bound on the error for different methods of numerical integration, or given an acceptable error, figure out how many subintervals you need. I will give you the error formulas that you need on the exam. You will not need to actually compute any integrals using these methods. **P267, Example 5-6, p269 Problem Set 4.6 #11-16 just do the error analysis.**

Stuff from previous midterms (the final exam is comprehensive!):

- ❑ Find limits by looking at the graph of a function. Figure 10, p59.
- ❑ Evaluate limits like "Sample Test Problems" **p91, #1-11, 14-22; #3 in Lab 4.**
    - ❑ You may need to "plug in" values to a continuous function, manipulate (expand, rationalize the denominator, or find a common denominator) and then cancel.

- ❑ Determine limits as the variable approaches infinity of rational functions by analyzing the leading terms. **Problem Set 1.5, p81, #1-9.**
- ❑ **Skip the special trig limits.**
- ❑ If a limit does not exist, but does approach positive infinity or negative infinity, say which. **Problem Set 1.5, p81, #29, 31, 33, 35.**

- ❑ Analyze the limit behavior and continuity of a piecewise function. **"Sample Test Problems" p91, #24-25; #2 on Lab 4.**
- ❑ Recognize any of the notations for derivatives we have used, including higher order derivatives. Table on p126.
- ❑ **We will not compute derivatives using the limit definition.**
- ❑ **Skip the Squeeze Theorem.**
- ❑ Compute derivatives of given functions using linearity, the power rule, product rule, chain rule, and quotient rule, and the trigonometric derivative formulas, including problems where you have to use multiple rules. **"Sample Test Problems" p148, #5-29.**
- ❑ Use the rules above to compute derivatives in terms of other named functions and/or using given values. **"Sample Test Problems" p148, #30-33, 45.**
- ❑ Answer questions about the motion (position, velocity, acceleration) of an object. **Examples 2,3,4, p126. "Sample Test Problems" p148, #38-39.**
- ❑ Recognize the graph of the derivative by looking at the graph of a function. **Lab 3, #4. Lab 4, #5.**
- ❑ Use implicit differentiation to find derivatives and tangent lines for implicitly defined curves. **"Sample Test Problems" p149, #41a-e.**
- ❑ Use differentials to estimate changes and error. "Sample Test Problems" p149, #43; Problem Set **2.9 p146, #18-20, 23, 27.**
- ❑ Solve "story problems" involving related rates as in Section 2.8. **"Sample Test Problems" p149, # 35-37; Section 2.8 Examples 1-5; problems from Labs and Webwork.**
- ❑ Find the maximum and minimum of a continuous function on an interval using the critical points. **"Sample Test Problems" p210, #1-12.**
- ❑ Solve optimization "story problems". **"Sample Test Problems" p210, #40-43; Section 3.4, Examples 1-2, Example 8 (business optimization).**
- ❑ Determine when a function is increasing or decreasing (using the first derivative). Determine when a function is concave up or concave down (using the second derivative). Find inflection points of a function. **"Sample Test Problems" p211, #13-19.**

- ❑ Find local extrema of a function. Know how to use both the First Derivative test (Theorem A p163) and the Second Derivative test (Theorem B p164) to determine if a critical point is a local max or min. **"Sample Test Problems" p211, #20-21.**
- ❑ Sketch a graph of a function, showing local maxima and minima, inflection points, increasing/decreasing, concavity, and asymptotes. (We will not do oblique asymptotes.) **"Sample Test Problems" p210, #23-27, 29, 37, 38.**
    - ❑ NOTE: On the test, this will be broken up into two separate questions, for example one question will ask: Find [all the things above] for the given function. Then the next question will ask: Sketch a graph having the following features: local max at (2,1), inflection point at (-1,3), concave up on the interval (-1,3), etc.
- ❑ Verify the Mean Value theorem for derivatives (**p189, Problem Set 3.6, #1-21**) and integrals (**p258, Problem Set 4.5, #15-28**) in specific examples. Know when they apply.
- ❑ Know what an antiderivative is. Find antiderivatives (like **p212, #53-58, #60-67**) using:
    - ❑ The power rule.
    - ❑ Sin and cos rules.
    - ❑ U-substitution.
- ❑ **No first fundamental theorem!**
- ❑ Understand the interpretation of definite integrals as area, and compute them using basic area formulas. **Webwork 4.1-4.2 #7.**
- ❑ Understand the relationship between the area under the velocity/speed function and the net displacement/total distance traveled. **p239, Example 5; p279 Example 7.**
- ❑ **We won't compute integrals with the limit of Riemann sum definition.**
- ❑ Use the Second Fundamental Theorem to evaluate definite integrals using antiderivatives. When using u-substitution, deal able to deal with the limits (endpoints) of integration by changing them or switching back to the original variable. **Sample Test Problems, p271 #1-12.**
- ❑ **No symmetry or periodicity!**
- ❑ Find the area of a plane regions between two or more functions. **p280, #1-28.**
- ❑ Find the volume of surfaces of revolution. You may need to use the disk method, washer method, or shell method. Formulas for the methods will NOT be provided! You will have to

decide for yourself which method is appropriate. **Sample Test Problems p322, #1-5. Problem Set 5.2 1-16. Problem Set 5.3, #1-12.** Also, I may ask you to set up several integrals without solving them. **p249, Example 4.**

- ❑ Find the volume of a solid with a given base and cross sections. If the cross sections are not semicircles or squares, I will give you the appropriate area formula. **p285, Example 5; Problem Set 5.2 #26, 32.**