

The exam will be in two parts, the cumulative part and part covering new material, each worth half the credit on the exam.

New Material

Half of the credit on the final exam will be for the material completed since Exam 3.

- I. Section 7.1 Antiderivatives. While this was part of Exam 3, I list it here, as the problems testing this section will be mixed in with the problems from the newer material. You will be asked to solve integrals using the formulas from this section.
- II. Section 7.2 Substitution. You will be asked to solve integrals using the techniques of this section.
 - A. In addition to straight forward substitution problems, make sure you can solve problems requiring the techniques shown in Example 6 page 384. There were problems of this type in WeBWork, as well as in the in class activity. **Exercise for practice: page 388 #25.**
- III. Section 7.3 Area and the Definite Integral.
 - A. You may be asked to find the definite integral of a function whose graph is given. **Exercise for practice: problem #16 page 398.**
 - B. You may be asked to find the definite integral of a function whose graph is a semicircle, given as $\int_a^b \pm \sqrt{r^2 - x^2} dx$. **Exercise for practice: problems #17, 18 page 398.**
 1. If you are asked to solve such a problem on the final exam, it will be among the other integration problems, so make sure you can recognize the formula for a semicircle.
- IV. Section 7.4 The Fundamental Theorem of Calculus.
 - A. You will be asked to state the Fundamental Theorem of Calculus, as given in the blue box page 403.
 1. Memorize it; the details are important.
 - B. You will be asked to solve definite integrals using the Fundamental Theorem of Calculus, and the techniques from the other integration sections, as well as the properties given in the Blue Box on page 405.
 - C. You may be asked to find the area of a region shown on a graph. See the Blue Box on page 408.
- V. Section 7.6 The Area Between Two Curves
 - A. You will be asked to find the area between two curves.
 1. You may be asked to graph the functions before finding the area between them. To make this feasible, the functions will be lines, parabolas, exponential functions or logarithmic functions. Know what the graphs of these functions look like.
 2. **Exercises for practice: problems #1,3,5,7,9, 13 page 424.**

Use the activities, WeBWork and the odd problems in the text to practice finding integrals.

Cumulative Material

The cumulative part of the final exam (half of the credit) will cover the following material.

From Exam 1:

- I. Section 1.4 Quadratic functions. As a part of a larger problem, you may be asked to
 1. Calculate the vertex and x - and y -intercepts of a quadratic function and use it to graph the function (see page 46).
 2. Solve a problem using the quadratic formula.
 3. This material may be part of a problem in the cumulative or the non-cumulative part of the exam.

- II. Section 3.3 and 3.4 Rates of Change and the Definition of the Derivative. You may be asked to
 - A. State the definition of the derivative of a function (and differentiate) (in the blue box page 177).
 1. Memorize it, and write it carefully; details are important.
 - B. Calculate the average rate of change of a function $f(x)$ between $x=a$ and $x=b$; and calculate the instantaneous rate of change of a function $f(x)$ at the point $x=a$.
 1. Remark: We did not know how to take derivatives at the time, but now we do, so to find the instantaneous rate of change of a function $f(x)$ at $x=a$, find the derivative $f'(x)$, and then evaluate it at $x = a$.
 2. Examples for practice: page 170 #23 and 25.

- III. Section 3.5 Graphical Differentiation. You may be asked to
 - A. Identify intervals or points on a graph of the function at which the derivative of the function is positive, negative, zero or does not exist.
 - B. Draw the graph of the derivative given the graph of the function.
 1. Examples for practice: page 194 problems #7, 9, 11.

From Exam 2:

- I. Section R6, Laws of exponents.
 - A. Properties of exponents, in particular the blue box on page xxxvii.
 - B. You may be asked to simplify an expression using the laws of exponents.
 1. Examples for practice: (a) $\frac{x^5 - x^{-2}}{\sqrt{x}}$, and (b) $\sqrt{x}\left(x^5 + \frac{1}{x^2}\right)$.
 Answers: (a) $x^{9/2} - x^{-5/2}$, and (b) $x^{11/2} + x^{-3/2}$.
 2. If you are asked to find a derivative of such an expression, you may use the product or quotient rule or you may simplify and then use the power rule, as you see fit.
 3. If you are asked to find the integral of such an expression, the easiest, and possibly the only, way to proceed is to do this sort of simplification.

- II. Section 2.2 Logarithmic functions.
 - A. The parts of this section that you need to know are those covered in the WeBWork on logs, including finding the domains of functions with logs.

III. Sections 4.1-4.5 Techniques for taking derivatives.

- A. You will be asked to find the derivative of a variety of functions, using a variety of techniques. Use the WeBWork problems as well as problems from Exam 2 to practice.
- B. Know how to find the equation of the tangent line to the graph of a function at a point.
 1. **Example for practice: problem #31 page 212.**

From Exam 3:

- I. Critical Number (Section 5.1). You may be asked to find the critical numbers of a function, both from a graph and from a formula.
- II. You may be asked to find the intervals of increase and decrease for a function, both from a graph and from a formula. You may also be asked to draw a number line showing the intervals.
- III. You may be asked to determine the local and absolute maxima and minima of a function, and the values of x at which they are attained. Sometimes you will be asked to study a function only on a given interval.
- IV. You may be asked to find the intervals of concavity and the inflection points for a function, both from a graph and from a formula.

Use the problems given on the review sheet for Exam 3 and on Exam 3 itself for practice.

Overview of the Final Exam

About the part of the exam covering new material:

- I. There will be a page on which you must calculate integrals, both definite and indefinite.
- II. There will be a page on which you will be asked to use integration to find areas (see the review material for Sections 7.4 and 7.6 below).
- III. You will be asked to state the Fundamental Theorem of Calculus, as given in the blue box page 403.

About the cumulative part of the exam:

- I. You will be asked to state the definition of the derivative of a function (and differentiate) (in the blue box page 177).
- II. There will be a page on which the questions pertain to a given graph of a function.
- III. There will be a page on which you must calculate derivatives.
- IV. You will be asked at least one of the questions like those described on the review sheet for Exam 3, numbered II, III, and IV.