

The Basics: Midterm IV will be Monday 10 December. The midterm will cover sections 4.8, 4.9, 5.1-5, 6.1. It is closed-book and closed-note. Calculators are not allowed.

Outline of Topics

section 4.8 Newton's Method

In this section we learned about Newton's method for finding...what?

This is a numerical technique and, since calculators are not allowed, the nature of the questions here is somewhat limited. Below are two examples.

example 1: Use Newton's method to approximate a solution to $e^x = 2$. (Assume $x_1 = 1$. Find x_2 .)

example 2: Use Newton's method to approximate $\sqrt{2}$. (Choose $f(x)$. Pick x_1 to be a nearest integer. Find x_2 .)

Note: You should ask yourself why choosing $f(x) = x - \sqrt{2}$ is an unacceptable choice of function in the second example.

section 4.9 Antiderivatives

see section 5.4

section 5.1 Areas and Distances

You should be able to use rectangles to approximate area under a given curve. You should be able to approximate distance traveled given a table of velocities.

See problems 1,3,11,15 at the end of this section (page 364)

section 5.2 The Definite Integral

Here is where we get the formal definition of the definite integral. I will not ask you to state the formal definition. You should know that the formal definition involves approximating rectangles and letting the number of rectangles go to infinity (as opposed to the Fundamental Theorem of Calculus). It is fair to ask a question similar to those of homework #12 problem B. The closed form versions of summations will be provided (i.e. $\sum_{i=1}^n i = n(n+1)/2$)

It is crucial that you know the properties of the definite integral. See the series of red boxes starting on page 373.

Two last facts you need to know are (1) the definite integral is only defined for "well behaved" functions and (2) the number that results from evaluating a definite integral corresponds to signed area (not just plain area). Another way to think about part (2) is that you should be able to use geometry (when appropriate) to evaluate an integral.

section 5.3 The Fundamental Theorem of Calculus

You will not be asked to state either version of the Fundamental Theorem of Calculus. But you will have to know how to use both of them. Also, you must remember that they are THEOREMS with HYPOTHESES. That is, you must be able to answer the question, Is $\int_a^b f(x)dx = F(b) - F(a)$ for any antiderivative $F(x)$ of $f(x)$ and any interval $[a, b]$?

section 5.4 Indefinite Integrals and the Total Change Theorem

You should know what the indefinite integral is and what an antiderivative is. You should know the difference between AN antiderivative and the most general antiderivative. The indefinite integral formulas in table 1 on page 392 should be second nature to you (with the exception of the hyperbolic functions and with the caveat that derivatives of inverse trig functions will be provided.) You should know how to check that your answer is correct.

Also, you should be familiar with the idea that the definite integral corresponds to net change. A specific example of this is the fact that the definite integral of velocity corresponds to displacement, which may be distinct from distance traveled.

section 5.5 The Substitution Rule

You should know how to integrate (definite and indefinite) complicated integrands. The method of substitution is a good method. I recommend that you learn it.

section 6.1 Areas Between Curves

You should be able to use the definite integral to find the area of a region bounded by curves. You should be able to do this both slicing vertically and horizontally. For such problems you are likely to be asked to sketch the region and a typical approximating rectangle. Also, you are likely to be asked to set up the integral and not to evaluate it.

Suggested Problems

Chapter 5 Review (page 409) # 1,3, 9-37,43,45,57,61,67,69

Chapter 6 Review (page 446) # 1-6

Several Notes:

1. Numerical answers should be exact and simplified. That is, write $1/3$ not 0.33 , write 2 not $\sqrt{4}$, write 1 not $\sin(\pi/2)$.
2. There will be problems in which you are asked to SET UP the integral only. In this case, DO NOT evaluate it. No extra points will be given for doing this.
3. Double-angle formulas and Half-angle formulas will also be provided along with formulas for the derivatives of inverse trig functions.