

Review for the First Midterm Exam - Math 124

The primary topics for this exam are **limit**, **continuity**, the **derivative** and their applications.

The sections of the text relevant for this exam are 1.2, 1.3, 1.5, 1.6, 2.1, 2.2, 2.3, 2.5, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, and 3.4.

Here's a summary of each section.

- 1.2 Mathematical Models: A Catalog of Essential Functions
A review of a number of essential function types: polynomials, rational, algebraic, trigonometric, exponential, logarithmic and transcendental functions.
- 1.3 New Functions from Old Functions
A review of the notions of shifting, scaling and reflecting.
I like problems 63-66 especially.
- 1.5 Exponential Functions
A review of the relevant facts and methods of exponential functions.
Problem 29 is fun.
- 1.6 Inverse Functions and Logarithms
A review of inverse functions generally, and logarithmic functions specifically.
- 2.1 The Tangent and Velocity Problems
Introduces two of the fundamental questions that calculus allows us to solve.
- 2.2 The Limit of a Function
An important section, this introduces the notion of the **limit**, the most important idea in calculus.
Problems like 25-32 are good practice.
- 2.3 Calculating Limits Using the Limit Laws
This important section introduces a number of methods for evaluating limits.
Problems 3-9, 11-30, and 37-44 are good practice. Problems 60 and 61 are fun, too.
- 2.5 Continuity
This section introduces the very important notion of continuity.
You should know the definition of continuity. What does it mean for a function to be continuous at a point? What does it mean for a function to be continuous everywhere? Can you give an example of a function that is continuous everywhere except at $x = 5$? Can you give an example of a functions that is continuous everywhere except at every integer multiple of 5?
Problems 15-28 are good.

- 2.6 Limits at Infinity: Horizontal Asymptotes

This chapter presents the notion of limits at infinity.

A function f is said to have a **horizontal asymptote**, $y = L$ if

$$\lim_{x \rightarrow \infty} f(x) = L$$

or

$$\lim_{x \rightarrow -\infty} f(x) = L.$$

Problems 15-36, 39-44 are all good.

- 2.7 Derivative and Rates of Change

The **derivative** is introduced.

Problems 51 and 52 are interesting.

- 2.8 The Derivative as a Function

This section extends the notion of the derivative "at a point" to the derivative as a function.

Higher order derivatives are also introduced.

Problems 51, 52, and 53 are interesting.

- 3.1 Derivative of Polynomials and Exponential Functions

Starting with the definition of the derivative, this section shows simple rules for finding the derivative of polynomials and e^x .

Problems 3-32 are basic practice. Lots of later problems in this section are interesting and good practice: 63-75, for instance.

- 3.2 The Product and Quotient Rules

The important product and quotient rules are introduced.

Problems 3-30 are basic practice.

- 3.3 Derivative of Trigonometric Functions

The derivatives of trigonometric functions are treated.

Problems 1-16 are good, basic practice, and 17-20 are good, too.

- 3.4 The Chain Rule

The super-powerful chain rule is presented.

Problems 7-46 are all good practice for all of the derivative rules we've covered.

For extra practice, problems 1-50 on page 262 are good, but skip any with logarithms or inverse trig functions: we'll talk about how to deal with those after the exam.