

MATHE FUNCTIONS AND GRAPHS SPRING 2012

MATTHEW AUTH, LECTURER OF MATHEMATICS

GENERAL INFORMATION

Course information like homework assignments, exams dates, class topics, and additional materials will be posted on our course website: http://math.sci.ccny.cuny.edu/people?name=Matthew_Auth. Office hours will be held in NAC 6-288 or by appointment.

COURSE GOALS

The concept of a function is of paramount importance at every level of mathematics from middle school all the way through graduate school. A student who finishes high school without a basic understanding of functions will undoubtedly struggle in college math courses.

Yet functions are difficult to introduce. In middle and high school the study of functions is often motivated by introducing the example of the height of a ball being dropped off a building as a function of time or the example of the size of a bacteria population as a function of time. These examples are somewhat helpful in that they can convince students that functions are important in the sciences but they fail to explain why teachers spend so much time teaching graphing techniques, like finding intercepts and tracing asymptotes. There must be a mathematical reason for it.

Without proper motivation it is easy to confuse graphing techniques with the essence of the function concept. Luckily mathematical techniques can often be motivated by other topics inside mathematics.

In this course we will explore analogies between functions and numbers. Roughly it goes something like this. In the early grades, after students become comfortable with small numbers, those less than 12 say, they learn to add, subtract, multiply and (when possible) divide them.

We will study functions analogously. Once we get a few functions and their graphs under our belts like $f(x) = x^2$ and $g(x) = 5x - 1$ we will try to add, subtract, multiply, and divide the functions. It is of course much harder to master these operations on functions and their graphs than it is to understand the corresponding operations on integers. Moreover, there are additional operations on functions that we did not have to worry about when studying numbers like finding inverses, differentiating, integrating, and composing two functions. But we carry on nonetheless. We've traveled a similar path studying numbers.

We will spend a large portion of the course studying the basic operations on functions and their graphs. At the end of the course, in order to better understand

the many varieties of functions, we will try to classify functions in a fashion similar to the way numbers are classified in middle school—some are integers, some are rational, This will require a significant effort. In fact, we will get the most modern and inclusive classification by introducing some calculus concepts during the final few weeks.

TEXTS AND MATERIALS

- (1) Gelfand, I. M. et al, Functions and Graphs, Dover Publications, 2002, ISBN: 9780486425641.
- (2) Gelfand, I. M. et al, Trigonometry, Birkhuser Boston, 2001, ISBN: 9780817639143.
- (3) Courant, Richard, and Herbert Robbins, What is Mathematics? An Elementary Approach to Ideas and Methods, 2nd ed. Oxford University Press, USA, 1996. ISBN: 9780195105193.

GRADING

I grade the homework assignments but I do not grade all the problems. I grade a randomly chosen subset of the assigned problems. Before computing your final course grade, I will drop your lowest homework score.

Final Grades will be determined using the following averaging:

Midterm1	25%
Midterm2	25%
Final Exam	35%
Homework	10%
Attendance and participation	5%

COURSE MEETING TIMES

During class I will try to give you some time to work in small groups on the homework assignments. Therefore, in order to get the most out of class, it important to keep up with the assigned readings and problems. Even if you do not have enough time to do every assigned problem, try to at least read the problems before class.

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