MTH 30 LECTURE NOTES (Ojakian)
Topic 1: Introduction to Functions and Relations

OUTLINE
(References: Section 1.1)

1. Relations: Definition and Examples

2. Functions: Definition and Examples

3. Terminology for functions

1. <u>Intuitive Ideas of Functions</u>

   (a) Given by algebriac expression (Ex: $f(x) = 2x$)
   (b) Given by a graph (graph the last one)
   (c) Given by a precise description (describe last one)
   (d) Consider the typical intuitive definition via a "precise rule" ...

2. WHY CARE? ...

   (a) Example 1 (section 1.1, page 9) - Donuts!
   (b) Notion: One value may be "a function of" another value.
   (c) Example 3 (section 1.1, page 11) - Days in a month

3. <u>Relations</u>

   (a) Binary (ignore n-ary)
   (b) Example represented in following ways

      i. List pairs (Class makes it up ...)
      ii. Table
      iii. Graph on the plane
      iv. Two sides with lines/arrows

   (c) More Examples

      i. All pairs of integers (x, y) such that $y = x^3 + 1$
      ii. $<$ on the rationals
      iii. (x, x^2) for x real
      iv. (x^2, x), for x real.
      v. The pairs (t, y) such that t ranges from the year 2000 up to the present year, and for any t, we have that y is the number of enrolled CUNY students in that year.

4. <u>Functions</u>

Special kind of relation:

For any number x, the x appears in the first entry in at most one pair.

OR

Each possible input value leads to exactly one output value.

   (a) Which of the above relations are functions?

   (b) Vertical Line Test

       i. From Section 1.1 do: 43 - 46

   (c) More Examples

       i. Consider some small finite examples, some are, some are not...

5. <u>Basic Function Terminology</u>

   (a) Function Notation

   (b) Independent Variable versus Dependent Variable
      (and checking if one variable is "a function" of the other variable)

       i. Example: $y - 7 = x + 1$. Find y as a function of x. Find x as a function of y.

       ii. More Complicated Example 9 (section 1.1, page 9)

       iii. Examples - Section 1.1: 8, 9, 10

6. <u>Function Evaluation</u>

   (a) From algebraic definition

   (b) From table definition

       i. Section 1.1 do 66, 67

   (c) From graph definition

       i. From Section 1.1 do 52, 53

   (d) Evaluating at algebraic inputs (instead of numerical inputs).

7. <u>Opposite of Function Evaluation</u>

Find the input that gives the desired output? (from formula, graph, or table)

8. <u>One to One Function</u>

   (a) Definition ...

   (b) Table: Look at arrows

   (c) Graph: Horizontal Line Test

       i. Example - From Textbook 1.1: 55-57

9. <u>Basic Toolkit of Functions</u>

   (a) See end of Section 1.1 (pages 26 - 28)

10. <u>Application Problems</u>

From Section 1.1 do: 88, 90