

Math 200 – Homework 1

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This assignment is due on **Friday, February 10, 2017** at 9:50 AM.

Reading: Chapter 1, and sections 2.1 – 2.3 of Chapter 2. Chapter 1 is just meant to be an overview so you don't have to read it in detail. In section 1.3, it's ok if you don't completely understand what a relation is, we will study them more thoroughly in Chapter 8; the main point of this section is to understand what a function is. You can skip Example 2.3.14 (and any related problems) if you want. If you're interested in physics or electrical engineering (in particular electrical circuits), you can look at Section 2.4, and if you are majoring in Computer Science and/or are interested in Cryptography, I highly recommend you to read Section 2.5, because it tells you how to convert decimal numbers into base 2 (so 28 becomes 11100 for example), which is how numbers are stored in a computer. That said, section 2.4 and 2.5 will not be on the exam.

Note: Here and henceforth, AP refers to the Additional Problems (on the next page).

- **Section 1.1:** Nothing
- **Section 1.2:** 4, 9
- **Section 1.3:** 12, 15, AP1, AP2
- **Section 2.1:** 13, 24, 46, 54, AP3
- **Section 2.2:** 15, 19
- **Section 2.3:** 12, 28

Additional problem 1: Define $f : \mathbb{Q} \rightarrow \mathbb{Z}$ by

$$f\left(\frac{m}{n}\right) = mn$$

For example, $f\left(\frac{2}{3}\right) = 6$. Is f a function? Why or why not?

Additional problem 2: This problem illustrates that, when defining a function $f : A \rightarrow B$, it is crucial to define what A and B are. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \setminus \{2\} \rightarrow \mathbb{R}$ be defined by the following formulas:

$$f(x) = x + 1, \quad g(x) = \frac{x^2 - x - 2}{x - 2}$$

(a) Is $f(x) = g(x)$ for all $x \in \mathbb{R} \setminus \{2\}$? (all real numbers except for 2)

(b) Is $f = g$? (in other words, are they the same function?)

Additional Problem 3: How many possible truth tables are there involving p only? (for example, the truth table of $\sim p$ is one of them) How many involving p and q ? (e.g. the table of $p \wedge q$) How many involving p, q, r ? Can you guess how many there are involving n variables p_1, \dots, p_n ? (no need to justify your answer for the last one). You don't have to draw all of the truth tables out, just tell me how many there are.

Hint: First, count how many rows there have to be in each truth table. Then, for each row, how many possible values of your expression are there? (**Note:** this problem has nothing to do with logic, but it's a good prep for Chapter 9, which is all about counting).