

MA121, Spring 2008 — Problem Set 1

This assignment is due on **Wednesday, February 20**. We will spend most of the class on Monday, February 18, discussing these problems. Make sure you have looked over the problems so that you know which ones you need to ask about. The problems mostly deal with functions, stressing the simpler ones. It's intended to help you "gear up" for the more advanced stuff to come.

Notice that the problem sets at the end of each section in the book are divided into "Exercises" and "Problems." The idea is that the exercises are just things to help you learn and retain the information, while the problems challenge you to think more deeply. Most of the time, I will *not* be assigning many of the exercises. You should take charge of your own learning and do on your own as many of those as you need to do in order to control the material.

1. Problems from the textbook:

- a. Section 1.1, problems 10, 12, 30, 36.
- b. Section 1.3, problems 38, 44, 54.
- c. Section 1.6, problems 16, 20, 22.

2. In each example below, do two things:

- i. Describe the way the second variable (abbreviated DV for "dependent variable") depends on the first variable (abbreviated IV for "independent variable"). If at all possible, give a formula.
- ii. Find the domain and range of each function.

Feel free to ask for help with background information. And be careful: one of these is really *very* hard.

- a. IV: an acute angle x in a right triangle whose hypotenuse has a fixed length h
DV: the area A of the triangle
- b. IV: one leg L of a right triangle whose other leg has length 2
DV: the hypotenuse H of the triangle
- c. IV: temperature C in degrees Celsius
DV: temperature F in degrees Fahrenheit
- d. IV: any real number x
DV: the larger of x and $1 - x$ (call it y)

- e. IV: the angle X of a sector in a circle with radius R
DV: the area A of the sector
- f. IV: the time t that it takes for a rock to reach the ground.
DV: the height h from which the rock was released.
- g. IV: the central angle θ of a wedge cut from a cake of radius R
DV: the radius r of the smallest plate on which the wedge will fit

3. Suppose you know the following: the function f is periodic with period 3, $f(-2) = 0$, $f(-1.5) = 1$, f is linear between -2 and -1.5 , and f is linear between -1.5 and 1 .

Draw the graph of f . For which values of x do we have $f(x) = 1$? For which values of f do we have $f(x) = 0.5$? What is the range of f ?

4. Consider the six functions

$$f_1(x) = x \quad f_2(x) = \frac{1}{x} \quad f_3(x) = 1 - x$$

$$f_4(x) = \frac{1}{1-x} \quad f_5(x) = \frac{x}{x-1} \quad f_6(x) = \frac{x-1}{x}$$

- a. If you take any two functions from this list (repeats allowed) and compose them, the result is a function from this list. Check this by constructing a “composition table” like this:

	f_1	f_2	f_3	f_4	f_5	f_6
f_1	f_1
f_2
f_3	.	f_6
f_4
f_5	.	.	f_6	.	.	.
f_6

where the dot in the i -th row and j -th column should be replaced by the result of the composition $f_i \circ f_j$. I’ve started you out by doing three of the compositions (which you should check—typos happen!).

- b. A function g is called the *inverse* of another function f if composing them gives the “do-nothing” function: $f(g(x)) = g(f(x)) = x$. Find the inverse functions of each of the functions in our list.