Math 41: A Precalculus Checklist

Section 1.1:

- Given a description of a function in one of the four ways (verbal, numerical, visual, algebraic), be able to describe the function in each of the other three ways. In particular, be able to switch descriptions in the following ways:
  - Visual (graph) to verbal and vice versa (See for example p. 22: # 9, 10, 16 and 17).
  - Algebraic to visual
  - Numerical to visual, numerical to verbal
  - Verbal to algebraic (e.g. p. 23: # 47-50)
- Given a description of a function in each of the four ways, find its domain and range. Know how to use interval notation. For example, what is the difference between $(0, \infty)$ and $[0, \infty)$?
- Identify where a function is increasing and decreasing.
- Be able to determine whether a function is even or odd, and sketch its graph using symmetry.

Section 1.2:

- Know how to find the equation of a line given:
  - A slope and a y-intercept
  - Two points on the line
  - A slope and a point on the line
- Be able to sketch rough graphs of the following standard functions: $y = x$; $y = x^2$; $y = x^3$; $y = \sqrt{x}$; $y = \sqrt[3]{x}$; $y = \cos x$; $y = \sin x$; $y = \tan x$; $y = a^x$; $y = \log_a x$; $y = |x|$; $y = \frac{1}{x}$; $y = \frac{1}{x^2}$; $y = \sqrt{1 - x^2}$

  For each of the above functions, be able to identify the domain, range, where the functions are increasing and decreasing, and whether the functions are even or odd.
- Given a function defined numerically, be able to choose which type of algebraic function best describes the data (see for example p. 36: # 19, 20)
- Find the domain of a rational or algebraic function

Section 1.3:

- Given the graph of a function $f(x)$, be able to sketch the graph of the new function obtained from stretching, shifting, reflecting, or any combination of these procedures found in the boxes on p. 38. (See for example p. 44: # 4, 5)
- Given two graphs, be able to write down how one was obtained from the other using stretching, shifting, reflecting, etc. (E.g. p. 44: # 6, 7)
- Given an equation, graph a function by starting with a graph of a standard function from section 1.2, then applying transformations to the graph. (E.g. p. 44: # 9-24)
- Given graphs of two functions and a point a, be able to find:
  - $(f + g)(a)$, $(f - g)(a)$, $(fg)(a)$, $(f/g)(a)$. What are the domains of these functions?
  - $(f \circ g)(a)$, $(g \circ f)(a)$, $(g \circ g)(a)$, $(f \circ f)(a)$. (E.g. p. 45: # 51)

- Given equations of two functions, be able to find:
  - $f+g$, $f-g$, fg, f/g, and state their domains
  - $f \circ g$, $g \circ f$, $g \circ g$, $f \circ f$, and state their domains

Section 1.5

- Be able to graph $f(x) = a^x$ for different values of the positive constant a. For what values of a is it different?
- Use rules for roots and exponents (p. 53, 54) to manipulate an expression involving radicals and/or exponential functions
- Convert a growth or decay description in words into an exponential function using information about the rate of growth (or decay) and initial conditions. (See for example p. 60: # 29, 32)

Section 1.6

- Given a graph, determine if it is one-to-one and if it has an inverse. If so, sketch a graph of the inverse. (See p. 64 Example 5) Identify $f^{-1}(a)$ where a is some point. (E.g. p. 70: # 15)
- Starting with an equation for a one-to-one function $f(x)$, find $f^{-1}(x)$.
- Be able to simplify the equation of a logarithmic function using rules on p. 65 and 67 (laws of logarithms, $\log_a(a^x) = x$, $a^{\log_a x} = x$, change of base). Use these rules to evaluate exactly a numerical expression involving logs. (See for example p. 70: # 35-38)