Midterm Two Review Sheet - Math 120

- Chapter 7 - Quadratic Functions
  - You should know that quadratic functions are those of the form $f(x) = ax^2 + bx + c$ and that these can always be put into vertex form $f(x) = a(x-h)^2 + k$. You should be able to find the vertex of a quadratic function.
  - You should be able to create quadratic models given three generic points, or the vertex and one other point.
  - You should be able to find the maximum or minimum value of a quantity determined by a quadratic function by considering the vertex.
  - I like problems 7.7-7.15 a lot.
- Chapter 8 - Composition
  - You should know what it means to compose two functions. You should understand what is meant by $f(g(x))$. You should know that $f(g(x))$ and $g(f(x))$ are generally different functions. You should be able to write simplified rules for compositions $f(g(x))$ and $g(f(x))$ given rules for $f(x)$ and $g(x)$.
  - I particularly like problems 8.2, 8.3 and 8.4.
- Chapter 9 - Inverse Functions
  - You should understand what an **inverse function** is, what conditions a function must satisfy in order to have an inverse (do all functions have inverses? can you tell if a function has an inverse by looking at its graph?), and how to find the inverse of a given function
  - You should understand what a **one-to-one function** is, and what is special about the graph of a one-to-one function
  - I like problems 9.2, 9.5, and 9.7.
- Chapters 10, 11, 12 - Exponential functions, modeling and logartithms
  - You should be able to recognize functions of the form $f(x) = A_0 b^x$ or, equivalently, $f(x) = A_0 e^{kx}$. You should be able to put exponential functions into these forms.
  - You should be able to create exponential models of quantities that change over time. Given two values of the quantity at two data points in time, you should be able to come up with an exponential model that fits the data. Given a single data point and information about the quantity's rate of growth (e.g., percentage annual increase, or doubling time), you should be able to come up with an exponential model that fits.
  - You should be able to solve equations involving exponential functions using the natural logarithm.
  - Relevant problems include 11.1, 11.2, 12.7, 12.9, 12.10, 12.12, 12.13.
- Chapter 13 - Three Construction Tools
  - You should understand horizontal and vertical **shifting**, and horizontal and vertical **scaling** (aka dilating)
  - You should understand how to derive the graph of $g(x) = af(bx + c) + d$ from the graph of $f(x)$ (see, e.g., problem 13.2)
  - I especially like problem 13.2, 13.3, and 13.5.
- Chapter 14 - Rational Functions

- You should be able to find the **asymptotes** (horizontal and vertical) of a **linear-to-linear rational function**, and be able to sketch the graph of a rational function like those in problem 14.1
- You should be able to model with **linear-to-linear rational functions**. This comes down to finding a rational function of the form

$$f(x) = \frac{ax + b}{x + c}$$

  whose graph

  1. passes through three given points
     or
  2. has a given asymptote and passes through two given points
     or
  3. has two given asymptotes and passes throuh one given point

  You will need to translate the language of the modeling problem.

  Pay particularly close attention to the words "linear-to-linear".

  Note that a linear-to-linear function is not a **linear function**.
- I especially like problems 14.1, 14.3, 14.5, 14.6, 14.7, and 14.9.

- Chapter 15 - Measuring an Angle
  - You should understand how to convert between **degrees** and **radians**
  - You should understand and be able to use the relationships between **radii**, **angle**, **arc length** and **area**
  - I like problems 15.8 and 15.9.

- Chapter 16 - Measuring Circular Motion
  - You should understand the various measures of **angular speed** (aka **angular velocity**), like rpm, radians per second, or degrees per hour
  - You should understand the relationship between **radius**, **angular speed** and **linear speed**
  - You should know how solve a belt-and-pulley problem (e.g., the bicycle example from lecture, example 16.4.1, problems 16.2, 16.7 and 16.8)