Math 120 Chapter 13 through 15 Review

This review is not all inclusive. You are expected to know how to do all the problems in the homework.

1. **Chapters 13 - Moving Functions Around** - Understand how to reflect, shift and dilate known functions.
   - We discuss six types of movement (The change is given along with what you actually do to the coordinates):
     (a) Reflect across y-axis: Replace “x” by “− x”. (Flip signs of x-coordinates)
     (b) Reflect across x-axis: Replace “y” by “− y”. (Flip signs of y-coordinates)
     (c) Shift horizontally by h: Replace “x” by “x − h”. (Add h to all x-coordinates)
     (d) Shift vertically by k: Replace “y” by “y − k”. (Add k to all y-coordinates)
     (e) Dilate horizontally by c: Replace “x” by “cx”. (Divide all x-coordinates by c)
     (f) Dilate vertically by d: Replace “y” by “dy”. (Divide all y-coordinates by d)
   - Here is the recipe to perform movement from a given graph \( y = f(x) \). I will illustrate using the example \( y = 2f(3x - 4) - 5 \)
     (a) Label several points in the graph of the known function.
     (b) Move “outside stuff” to the y side: \( \frac{1}{2}(y + 5) = f(3x - 4) \). The two cases for order of operations are illustrated here:
        - \( c(y + d) \): Do the ‘c’ movement first.
        - \( ax + b \): Do the ‘b’ movement first.
     (c) Horizontal movement: For this example you would
        1. Add 4 to x-coordinates.
        2. Divide x-coordinates by 3.
     (d) Vertical movement: For this example you would
        1. Multiply y-coordinates by 2.
        2. Subtract 5 from y-coordinates.
     (e) Plot the new points and draw the resulting graph.

2. **Chapter 14 - Linear-to-Linear Modeling** - Know the features of linear-to-linear models and how to find the models when given various information.
   - All linear-to-linear models and be written in the form:
     \[
     y = \frac{ax + b}{x + d}
     \]
     for some constants \( a, b \) and \( d \).
   - Linear-to-linear models have the following features:
     - One vertical asymptote at \( x = -d \).
     - One horizontal asymptote at \( y = k \).
     - Once you draw the asymptotes, the basic shape is either like \( y = \frac{1}{x} \) or \( y = -\frac{1}{x} \). You can plot one or two other points to sketch the graph.
   - In story problems, we can ask you to find a linear-to-linear model given:
     (a) 3 points (like in HW 14.5, 14.9ab) : Plug in all three data points for \( x \) and \( y \) to get three equations. Combine and solve for \( a, b, \) and \( d \).
     (b) 2 points and an asymptote (like in HW 14.6, 14.7, 14.9c, 14.10): Use the asymptote information first, then use the data points for \( x \) and \( y \), combine equations and solve.
   - Be able to solve equations involving multipart functions (like in HW 14.5, 14.7, 14.10b)
3. Chapter 15 - Radian/Degree Intro

- Be able to convert from radians to degrees and vice versa (As in HW 15.1). Remember \( 2\pi \) radians = 360 degrees.

- Be able to find the area of a wedge and the arc length along the edge of a circle when given an angle and radius (the formulas are first written in the way we derived them, then they are simplified):

  WHEN \( \theta \) IS IN DEGREES:
  
  \[
  \text{Arc Length} = (2\pi r) \left( \frac{\theta}{360} \right) = \left( \frac{\pi}{180} \right) r \theta
  \]
  
  \[
  \text{Area of a Wedge} = (\pi r^2) \left( \frac{\theta}{360} \right) = \left( \frac{\pi}{360} \right) r^2 \theta
  \]

  WHEN \( \theta \) IS IN RADIANS:
  
  \[
  \text{Arc Length} = (2\pi r) \left( \frac{\theta}{2\pi} \right) = r \theta
  \]
  
  \[
  \text{Area of a Wedge} = (\pi r^2) \left( \frac{\theta}{2\pi} \right) = \frac{1}{2} r^2 \theta
  \]

- Be able to use these in problems like in HW 15.3, 15.4, 15.8.