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 $y = 1/x$ or $y = -1/x$. 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 2π radians = 360 degrees.
- Be able to find the area of a wedge and the arc length along the edge of circle when given an angle and radius (the formulas are first written in the way we derived them, then they are simplified):

$$\begin{array}{lll} \text{WHEN } \theta \text{ IS IN DEGREES:} & \text{Arc Length} & = (2\pi r)\left(\dfrac{\theta}{360}\right) = \left(\frac{\pi}{180}\right) r\theta \\ & \text{Area of a Wedge} & = (\pi r^2)\left(\dfrac{\theta}{360}\right) = \left(\frac{\pi}{360}\right) r^2\theta \end{array}$$

$$\begin{array}{lll} \text{WHEN } \theta \text{ IS IN RADIANS:} & \text{Arc Length} & = (2\pi r)\left(\dfrac{\theta}{2\pi}\right) = r\theta \\ & \text{Area of a Wedge} & = (\pi r^2)\left(\dfrac{\theta}{2\pi}\right) = \frac{1}{2} r^2\theta \end{array}$$

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