Homework 3

Math 112

Due April 24th at the start of class

Textbook Exercises

2.1: 2.1.1B, 2.1.3B, 2.1.4B, 2.1.5B, 2.1.6B, 2.1.8B

2.2: 2.2.1B, 2.2.2B, 2.2.3B, 2.2.4B, 2.2.5B, 2.2.6B, 2.2.7B, 2.2.10B, 2.2.13B, 2.2.16B

2.3: 2.3.1B, 2.3.2B, 2.3.3B, 2.3.4B, 2.3.5B

Exercise 1: We did some heavy lifting this week! Let's take one of the exercises to take a thorough look at some of what we did.

a) Draw a unit circle with axes. Draw it big! We're going to be marking it up a lot in this problem.

b) Draw the points on the unit circle with the following angles (counter-clockwise from the positive x-axis, as always):

$$\theta = 0°, 30°, 45°, 60°, 90°, 120°, 135°, 150°, 180°, 210°, 225°, 240°, 270°, 300°, 315°, 330°.$$

c) Now we'll start to label the points. Begin by labeling the ones with angles $0°, 90°, 180°$, and $270°$ — you don't need any trig functions for those.

d) Starting with $30°$ and going from there, label the rest of the points. The first three you can do directly, and for the rest, you'll need a reference triangle. You can draw the triangle on the circle if you like, but drawing them separately will keep your main picture neater.

Exercise 2: A tree casts a shadow on the ground. We want to climb the tree, and for some reason, we decide the best way to do that is to use a rope that is stretched tight between the points where it's tethered — one end at the top of the tree and the other at the tip of the tree's shadow.

a) If the tree is 100 feet tall and the rope makes a $10°$ angle with the top, how much rope will we need? (Draw a picture!)

b) How long must the shadow be?

c) Now suppose the tree is h meters tall. Find a function $r(h)$ that gives the length of the rope, assuming the it still makes a $10°$ angle with the tree. Sketch a graph of r.

d) Once you've simplified r, there shouldn't be any trig functions in it, even though they're all over the place in this problem. Why is that?

Bonus: You may have noticed that the values of $\cos\theta$ and $\sin\theta$ are exactly reversed for $\theta = 0°, 30°, 45°, 60°$, and $90°$. Show with a triangle that for **any** θ between $0°$ and $90°$, $\cos\theta = \sin(90° - \theta)$. (Fun fact — we'll see eventually that this is true for any θ at all!)