

Homework 3

Math 112

Due October 21th at 10:00 AM

Textbook Exercises

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

2.2: 2.2.1B, 2.2.2B, 2.2.3B, 2.2.5B, 2.2.6B, 2.2.7B, 2.2.10B

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):
$$\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ, 120^\circ, 135^\circ, 150^\circ, 180^\circ, 210^\circ, 225^\circ, 240^\circ, 270^\circ, 300^\circ, 315^\circ, 330^\circ.$$
- c) Now we'll start to label the points. Begin by labeling the ones with angles $0^\circ, 90^\circ, 180^\circ$, 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 $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$, and 90° . Show with a triangle that for **any** θ between 0° and 90° , $\cos \theta = \sin(90^\circ - \theta)$. (Fun fact — we'll see eventually that this is true for any θ at all!)