Math 120Q - Elementary Functions
Graphing Trig Functions

1. Trig Functions for a 45-45-90 Triangle
   a. Carefully sketch a 45-45-90 isosceles right triangle
      Assign length 1 to sides opposite the 45° angles.
      What it the length of the hypotenuse?
   
   b. Using your triangle determine the values for the following trig functions

      \[ \sin(\pi/4) \quad \csc(\pi/4) \]
      \[ \cos(\pi/4) \quad \sec(\pi/4) \]
      \[ \tan(\pi/4) \quad \cot(\pi/4) \]

      Remembers this construction! Use it to derive the trig functions for \( \pi/4 \).

2. Trig Functions for a 30-60-90 triangle
   a. Carefully sketch an equilateral triangle with sides of length 2. How many degrees is each angle?

   b. Carefully bisect one of the 60° angles dropping a perpendicular to the opposite side. What are the dimensions of the right triangle created by the bisector? Label the lengths of the sides for one of the right triangles and the measure of each angle

   c. Using your triangle determine the values for the following trig functions

      \[ \sin(\pi/6) \quad \csc(\pi/6) \quad \sin(\pi/3) \quad \csc(\pi/3) \]
      \[ \cos(\pi/6) \quad \sec(\pi/6) \quad \cos(\pi/3) \quad \sec(\pi/3) \]
      \[ \tan(\pi/6) \quad \cot(\pi/6) \quad \tan(\pi/3) \quad \cot(\pi/3) \]

      Remember this construction! Use it to derive trig values for \( \pi/6 \) and \( \pi/3 \).
3. The following unit circle (radius = 1) is centered at the origin (point q). On the circle the 16 points, a - p, identify the terminal sides of rays making angles with the positive x-axis. The angles are $a \sim 0$, $b \sim \pi/6$, $c \sim \pi/4$, $d \sim \pi/3$, $e \sim \pi/2$, $f \sim 2\pi/3$, $g \sim 3\pi/4$, $h \sim 5\pi/6$, $i \sim \pi$ etc.

a. Label the coordinates for each point a - p. For example, the coordinates of a is (1,0). Use the results of the previous two exercises to help you. Think reference triangles. The fact that the radius of the circle is 1 makes this simple! Make use of x and y axis reflections

b. Recalling that the definition of $\sin(t)$ is $y/r$ and that in this case $r = 1$, plot the graph of $\sin(t)$ using 16 values obtained from the unit circle diagram above. Connect the points to obtain the graph of the function $y = \sin(t)$.

c. Recalling that the definition of $\cos(t)$ is $x/r$ and that in this case $r = 1$, plot the graph of $\cos(t)$ using 16 values obtained from the unit circle diagram above. Connect the points to obtain the graph of the function $y = \cos(t)$.

Answer the following questions

1. What is the range of $\sin(t)$ and $\cos(t)$?
2. Identify the coordinates of the maximum/minimum points