

Advanced Functions and Modeling **Name** _____
Lab – Graphing Trig Functions with Spaghetti

Find out which trig function you will be graphing – Sine or Cosine? _____

Remember that since we are using the Unit Circle, you will graph either the x or y value.

$$y = \sin \theta \quad \text{for the Unit Circle}$$
$$x = \cos \theta$$

Gather these supplies for your group

2 pieces of large paper taped together the long way

several colored markers

a ruler or meter stick

glue

one piece of yarn about 30 inches long

about 10 strands of spaghetti

several pieces of tape

your copy of the Unit Circle

Mark the yarn from the Unit Circle

Carefully wrap the yarn around the outside of the Unit Circle – along the circumference of your circle. PLACE ONE END OF THE YARN AT THE POINT $(1, 0)$. Use the marker to mark points on the string at each of the special angles that you have indicated on your circle $\rightarrow 0, \pi/6, \pi/4, \pi/3, \pi/2$, etc. You may tape the yarn down if this makes it easier to mark.

Set up your axes on the large paper

On the two large pieces of paper, use your ruler to draw a y -axis in the center of the paper. Then, make an x -axis the length of the paper. You are going to graph either the function $f(\theta) = \cos \theta$ or $f(\theta) = \sin \theta$ (see above). This means that you are going to use the horizontal or independent axis for the angle θ . You will use the vertical or dependent axis for $f(\theta)$, your trig value. Indicate the appropriate values along your axes.

Use the yarn to mark the angle values (in radians) on the horizontal axis

You will use the yarn that you previously marked from your Unit Circle. Place the end of the yarn that was at the point $(1, 0)$ on your Unit Circle at the origin and run it along the horizontal axis which represents the angle θ (use radians). The marks that you previously made on the yarn will give you the angle measures that you need. Thus, the first mark can be transferred to the paper and labeled $\pi/6$. The second mark can be transferred to the paper and labeled $\pi/4$ and so on. Once you have finished with the positive horizontal axis, you can flip the string over (reflecting it across the vertical axis) and mark the negative horizontal axis in the same fashion.

****Sine function only** – If you have been assigned the sine function, follow these directions: For each reference angle, there is a corresponding right triangle that can be constructed. You are going to graph the y or sine value at each of these points. Rather than using a ruler to measure the length of the y or vertical side, you are going to place a length of spaghetti with one end on the x -axis and the rest pointing up through the point on the Unit Circle. Break the noodle off at the point where the vertical side of the triangle intersects with the Unit Circle. Now take the spaghetti noodle over and place it on your new graph at the spot that corresponds to the angle that you have measured. Glue the spaghetti to that spot. You will repeat this for each different angle in the Unit Circle including on the axes themselves. When you get to the third and fourth quadrants, remember that you are measuring down so you should glue your spaghetti below the horizontal axis.

****Cosine function only** – If you have the cosine function, follow these directions: For each reference angle, there is a corresponding right triangle that can be constructed. You are going to graph the x or cosine value for each of these triangles. Rather than using a ruler to measure the length of the x or horizontal side, you are going to place a length of spaghetti with one end on the y -axis and the rest pointing horizontally through the point on the Unit Circle. Break the noodle off at the point where this horizontal side of the triangle ends. Now take the spaghetti noodle over and place it on your new graph at the spot that corresponds to the angle that you have measured. Glue the spaghetti to that spot. You will repeat this for each different angle in the Unit Circle including on the axes themselves. When you get to the second and third quadrants, remember that you are measuring in the negative direction so you should glue your spaghetti below the horizontal axis.

Connect the graph

Once you have glued all your spaghetti down, get your graph checked by your teacher. You will then make a smooth curve connecting the ends of the spaghetti to see what your trig function looks like as a function of the angle θ .