

# An Italian Lunch with the Sine and the Cosine

## Activity Guide

1. Tape together two sheets of butcher paper along the shortest side of the paper.
2. On the left side of the paper draw a unit circle on a Rectangular Coordinate System on the paper using the plastic rulers provided. Please note, 1 linguini = 1 unit. (See figure 1)
3. Draw a Rectangular Coordinate system showing only Quadrants I and IV. Make the x-axis as long as the circumference of the circle (Think about how long that should be ahead of time). Make the y axis go from  $-1$  to  $+1$  linguini units. (See figure 1)

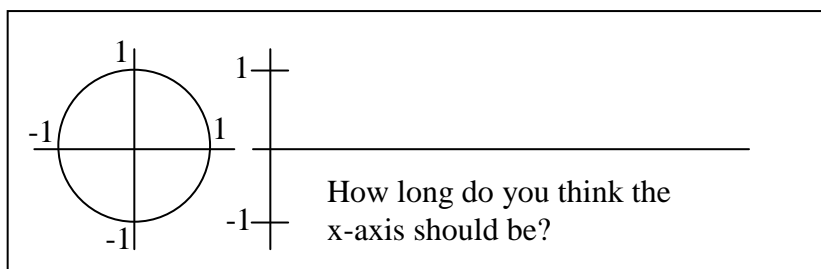


Figure 1

4. Mark and label the circumference of the unit circle every  $15^\circ$ . (See Figure 2)
5. Get some string (Think ahead of time about how much string you will need). Place the string around the circumference of the circle and use a marker to transfer the degree marks to the string.
6. Stretch the string along the x-axis to the long Rectangular Coordinate System. Transfer and label the degree marks to the x-axis. (See Figure 2)

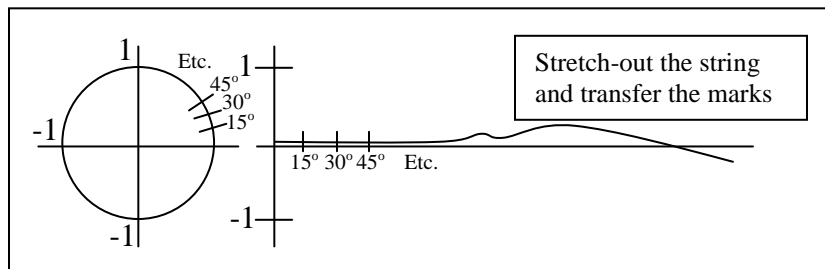
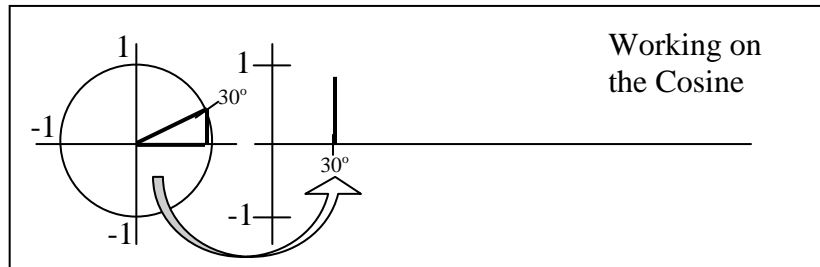


Figure 2

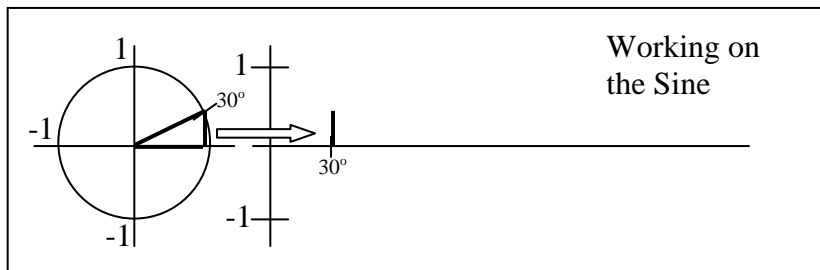
7. Remember that in the case of the unit circle, the length of the x-side of the triangle can represent the value of the cosine. Likewise, the length of the y-side of the triangle can represent the value of the sine. Another way to think about it is that  $\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{x}{r}$ , but since  $r = 1$ ,  $\cos \theta = \text{adjacent} = x$ . Similarly,  $\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{y}{r}$ , but since  $r = 1$ ,  $\sin \theta = \text{opposite} = y$ .
8. Using Linguini (Uncooked!!!), build reference triangles for each of the angles marked on the unit circle. Make sure to also include  $0^\circ$ ,  $90^\circ$ , etc.

9. If you are working on the cosine, transfer the x-side of the triangle from the unit circle to the corresponding angle in the Rectangular Coordinate System. If you are working on the sine, transfer the y-side of the triangle from the unit circle to the corresponding angle in the Rectangular Coordinate System. (See Example in Figure 3)



Working on  
the Cosine

Figure 3



Working on  
the Sine

10. Continue building and transferring the linguini sides to the corresponding location on the Rectangular Coordinate System. Be careful where you locate the linguini sides that correspond to a negative x-value or a negative y-value.
11. Answer the questions on the handout provided. Work in your group to discuss the questions. Work first on the questions related to the trigonometric function that you worked on. Then look at the work from another group that has the other trigonometric function and discuss the questions for that trigonometric function. For example, if you were working on the graph of the sine, discuss the sine questions first. Then look at the work of another group that has the cosine and answer the questions related to the cosine.