SM3 6.1 Circular Spaghetti

Setting Up

Find a partner. Clear your table, you will need the entire space.

Each partnership needs to collect the following materials:
- One strip of butcher paper
- One length of yarn measuring about two feet
- One dry erase marker
- One pen or pencil
- Twelve spaghetti noodles (don't break them… yet)
- Tape
- Copy of the Unit Circle

Instructions

Lay the butcher paper on your table.

You'll need to anchor the sides of the paper with a paperweight.

Cut out your unit circle and glue it to the top left corner of the butcher paper. Use your ruler to draw an x and y axis next to your unit circle as shown in the picture to the right.

Take your yarn and starting at 0° wrap it around the unit circle, and mark the 16 degrees shown onto the yarn. Once done lay out the yarn next to the unit circle on the x-axis you just drew.

Use your yarn to place tick marks on the x-axis and label the 16 degrees shown to represent the angles from the circle. Make sure you label the degrees for each tic mark.
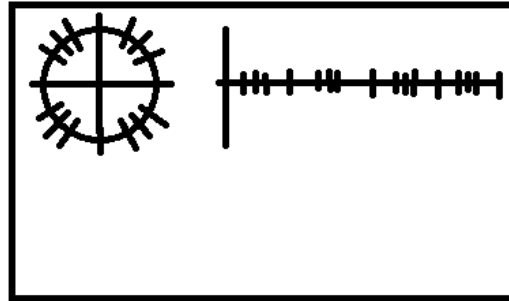
Now that you have created the playing field, it is time to add the spaghetti to the game! Place spaghetti noodles **on the circle** as follows:

- One end of the noodle must touch the **x-axis**.
- The noodle must be **vertical (creates a 90°angle)** .
- The other end should touch a position on the circle at one of the marks you made. The noodle might be too long to measure the distance; decrease the length of the noodle so that it fits!
- Place a total of 16 spaghetti noodles onto your circle, one touching each degree.

Transfer the noodles from the circle to the coordinate axis as follows:

- The end of the noodle that is touching the x-axis of the circle should now touch the x-axis on the coordinate axis that you drew earlier.
- The noodles should be vertical on the x-axis
- Noodles that were aimed upward on the circle are aimed upward on the axis; noodles that were aimed downward on the circle are aimed downward on the axis.
- Attach noodles to the butcher paper with tape.

Draw the curve that connects the tips of the noodles that are farthest from the x-axis.

We'll now place noodles in a slightly different fashion:

- One end of the noodle must touch the **y-axis**.
- The other end should touch a position on the circle at one of the marks you made.
- The noodle must be **horizontal**.
- Place a total of 16 spaghetti noodles onto your circle, one touching each position.

Transfer the noodles from the circle to the coordinate axis as follows:

- The end of the noodle that is touching the **y-axis** of the circle should now touch the **x-axis** (not a typo!!) on the coordinate axis.
- The noodles should be vertical on the x-axis
- Noodles that were aimed to the right on the circle are aimed upward on the axis; noodles that were aimed to the left on the circle are aimed downward on the axis.
- Attach noodles to the butcher paper with the tape.

Draw the curve that connects the tips of the noodles that are farthest from the x-axis.

Homework Questions

1. You may not have heard the names of these two curves before. The shape of the curves is called a sinusoidal curve. We call them sine and cosine. The sine curve intersects the origin while the cosine curve intersects the point (0,1). What is the name of the first curve you made? What is the name of the second curve you made?

2. What measurements of the circle does each function measure?

3. Write 3 sentences that describe how the functions are similar:

4. Write 3 sentences that describe how the functions are different:

For questions 5 through 7, describe how your functions' shapes change given each procedural change:

5. The radius of the circle is twice as long:

6. The radius of the circle is half as long:

7. Instead of 16 points of interest, we measure with 200 points of interest:

8. At which angle measurements do the functions intersect?

9. Which function tells you the x-coordinate? Which function tells you the y-coordinate?

10. Assume the radius of the circle is 1; find the x- and y-coordinates (from the circle) of the points of intersection: