

Sine Curves and Spaghetti

(for the Teacher)

MATERIALS NEEDED:

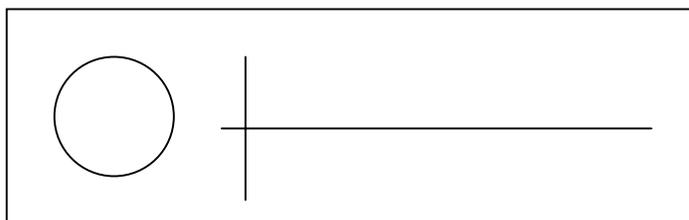
- 1 box of uncooked spaghetti
- Butcher Paper, approximately 2 feet wide, 8 feet long (1 for each group)
- String, approximately 6 feet long (1 for each group)
- Compass (1 for each group)
- Protractor (1 for each group)
- Meter Stick (1 for each group)

THE SETUP:

1. Divide students into groups of three.
2. Give each group some spaghetti, a piece of butcher paper, string, compass and protractor.
3. The groups will need enough room to spread out the butcher paper on the floor or a large desk.

THE ACTIVITY:

1. On the left side of the paper, construct a circle that has a radius of the length of one spaghetti piece.
2. Draw an x-axis and y-axis through the center of the circle.
3. Using the protractor, mark every 15° on the circle.
4. To the right of the circle, draw another x and y-axis as shown below. The x-axis should be approximately 6.5 spaghetti lengths long.



(Note: Since the unit of measurement of the radius is one spaghetti, we have constructed a *unit circle*.)

5. Place the string along the circumference of the circle. Starting with 0° , mark every 15° from the circle to the string. (*Since the string was placed on the circle to mark off the 15° markings, they have technically used arc length to determine the intervals on the x-axis. Depending on the level of student, you may wish to discuss radians versus degrees.*)
6. Put the string on the long x-axis and transfer the marks from the string to the axis. (The 0° mark should line up with the origin.)
7. Place a piece of spaghetti on the circle starting at the center going to the 15° mark. This is the radius, but it is now also the hypotenuse of a right triangle. To finish the triangle, place another piece of spaghetti at the 15° mark and drop it perpendicular to the x-axis. Break the spaghetti so that it is the correct length to fit between the 2 points.
8. Move the broken piece of spaghetti to the other x-axis and place it perpendicularly on the first mark (which corresponds to 15°).
9. Make a dot above the spaghetti piece to show the vertical length.
10. Repeat this process for each mark on the circle.
11. Don't forget to mark the distances for 0° , 90° , 180° and 270° (*To avoid potential confusion in later discussions, pay attention to the way students handle building the triangles, whether they realize they could use the same piece of spaghetti in four places and why, and that the lengths between 180° and 360° are considered to be negative.*)