It is possible to create curves using only straight lines. String is perfect for this, giving rise to the name string art, but it is also possible to make intricate string art drawings using the same ideas.

A Circle from Straight Lines

1. Draw a circle and mark points around it at regular intervals. In the picture below, we used a protractor to accurately measure 24 intervals of 15°. If you don't have a protractor, you can approximate the measurements by first marking the 8 compass points on the circle to create 8 intervals, and then further dividing each of these intervals into 3. (Or you can use one of our templates if you prefer.)
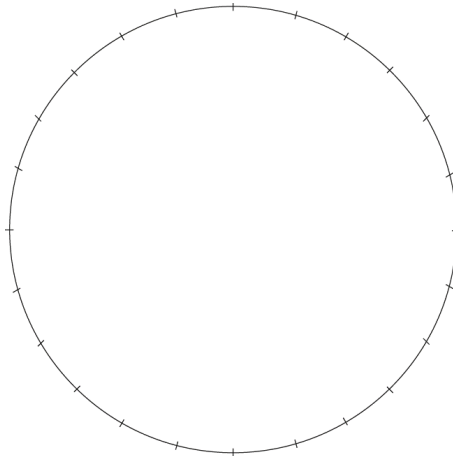
2. Draw a straight line from one point on the circle to another. Count the number of points on the circle between the starting point and the end point of your line, call that number **N**. In our drawing below there are 7 points, so **N** = 7. Continue around the circle, drawing straight lines between every pair of points which is **N** points apart.
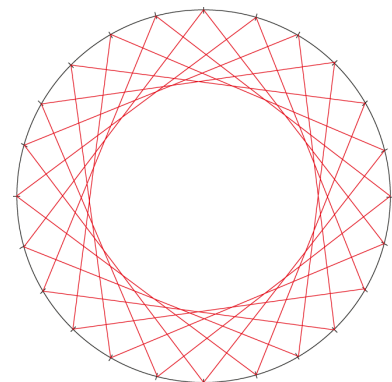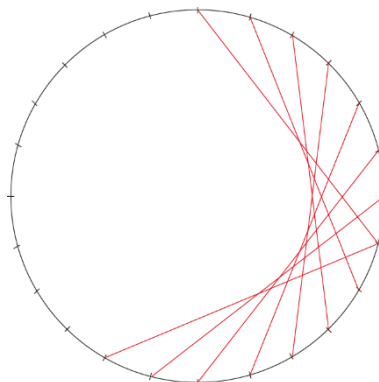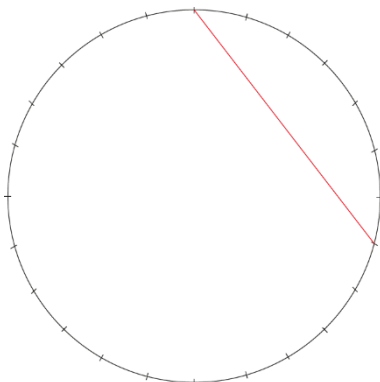
You have created a second circle inside the first one, also called **concentric** circles. How does your circle change if you make **N** bigger or smaller? If you start at one point on the circle, and trace along the lines you have drawn, from one point to the next, without lifting your pencil off the page, how long does it take you to get back to your starting point? Did you trace over every line, or only some of them? The answer to this will depend on how many intervals you have on your circle, and your number **N**. *Hint*: try drawing a few circles where **N** is a composite number, and some where **N** is a prime number.

String Art Hearts

In the first exercise, we drew lines between every pair of points on a circle that were **N** points apart. In this next exercise, we will once again go around the circle drawing lines between pairs of points, but this time, we will increase the number of points between the start and end point of every line. You can think of this as starting with **N** = 1 and adding 1 to it for each new line we draw.

1. To start, choose a point on the circle and draw a line between it and the point beside it (**N** = 1). Now move from your starting point to the next point along the circle and draw a line from it to the point 2 points away (**N** = 2), as shown below. Continue like this, moving to the next point along the circle and advancing your end point by one each time (by adding 1 to **N**).
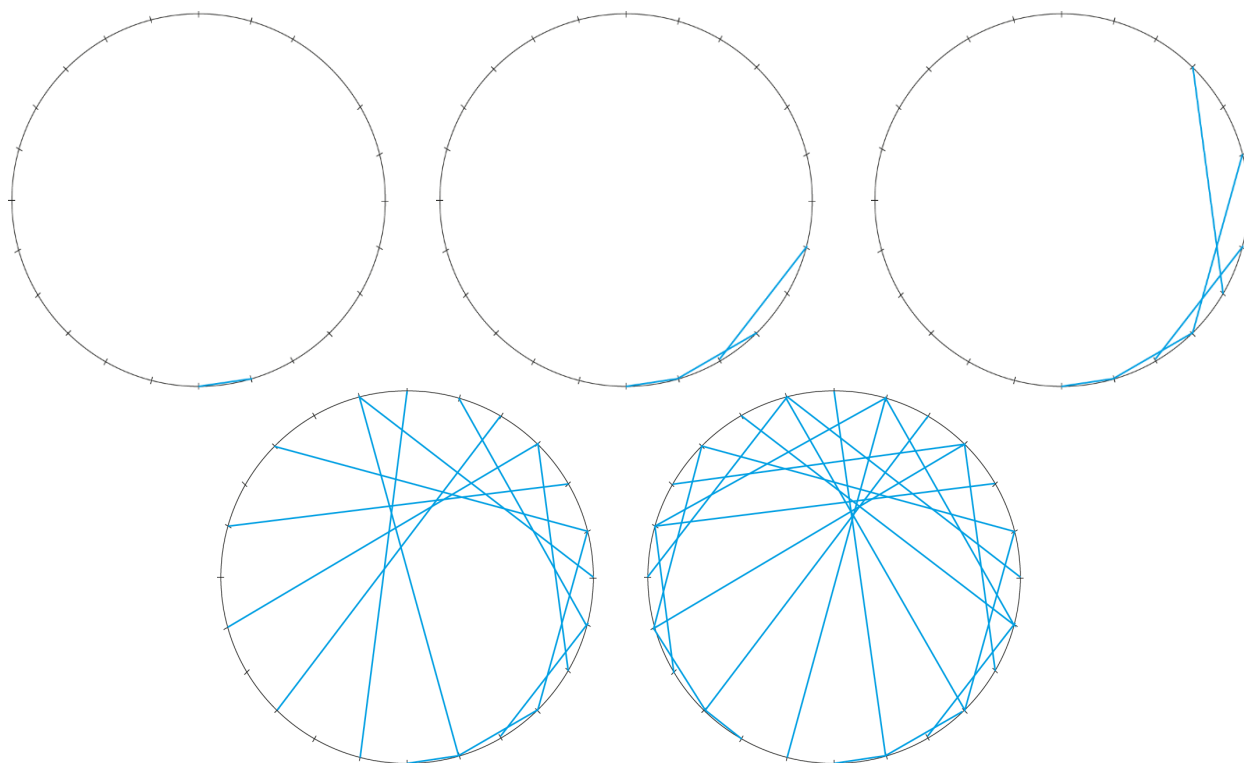
You have created a heart, or what is known as a **cardioid** in mathematics. You can experiment with different cardioid shapes by changing how much you add to **N** each time (try 2 or 5, for instance), changing how frequently you increase **N** (perhaps every other line, or every 4th line), and varying the number of points on the outside of your circle (try 36, for example).
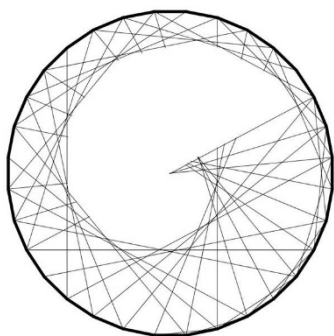
The picture on the left is a cardioid made by marking points at 10° intervals on the circle (36 in all), and advancing the end point by one (adding 1 to **N**) each time, except on every 4th line, when it is increased by two (by adding 2 to **N**). Many combinations are possible!

There are more mathematical string art ideas to explore on the website http://bit.ly/1pakrYv.