Figures with Sticks and String

If you were on a Pacific beach and found a piece of old fishing net, and you unraveled some string from it, you'd find a couple of pieces of driftwood, tie the string to it and trace out an ellipse in the sand. Wouldn't you?

Well, I did, but I didn't get an ellipse. In this activity, we'll model what I did get.

While a class trip to the Pacific may be invigorating, it is of course unnecessary, you can do all the required tracing with pins and string, or with dowels inserted in a whiteboard. The pins however have to project from the paper and interfere with the string in the same way my driftwood interfered with the fishing net.

Half an Ellipse

Attach a piece of string to two sticks on a beach and draw round with a third stick keeping the string tight.

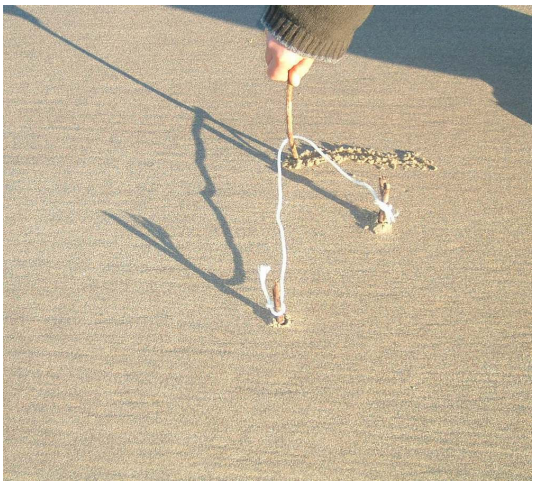

Figure 1. The familiar construction for an ellipse

This can be modeled in Geometry Expressions directly. Let's assume that the string is length L and that the sticks are distance 2a apart. We set the locations of the sticks to be the points (-a,0) and (a,0). We then draw a triangle representing one position of the string. We make the distance to the apex from one of the sticks t (t will vary and be a parameter of the motion). We make the distance to the other stick L-t.

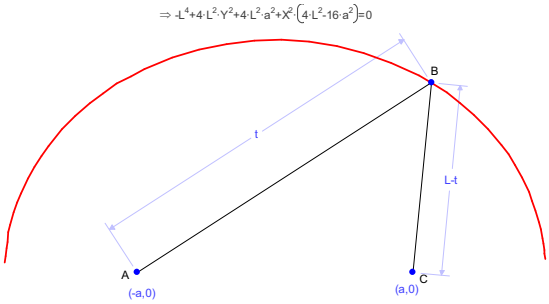

Figure 2: Geometry Expressions model of the ellipse construction

By examining the equation for the ellipse, can you determine its width and height? Can you verify these equations by thinking about the string?

Our software has only drawn half an ellipse. In the sand we have drawn half an ellipse.

Figure 3: Completed semi-ellipse

What happens when you keep on going?