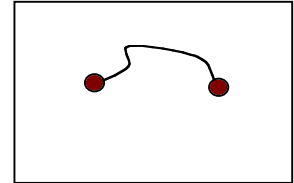


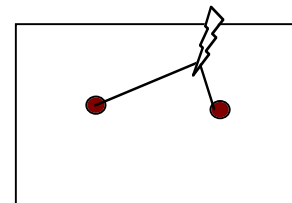
### Activity 5: Two ways to construct an ellipse.

The orbits of all the planets, satellites (natural and artificial), and most comets in our solar system are ellipses. There are two ways to draw ellipses and find where the foci are. (One focus, two foci, and the Sun will be at one focus for the planets.)

First method: Take two thumbtacks and a bit of foam core or some other material that you can push the tacks into. Put a piece of paper on the foam core and push the thumbtacks through the paper into the foamcore. For best results, put the two tacks a few inches apart near the center of your piece of paper. Then tie a length of string between the tacks, leaving some slack; again, for best results, make the string slightly smaller than the long direction on the paper. Your setup might look like this:

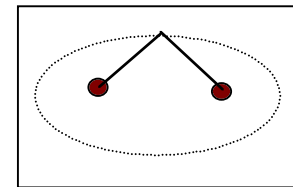


Take a pencil and set it against the paper so that the string is tight: Draw around the two dots keeping the string tight. (You'll probably have to pick it up and put it back into the loop when you cross the line connecting the tacks)



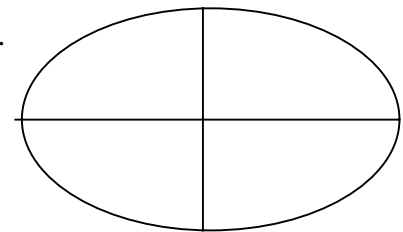
The result will be an ellipse with each tack at one focus of the ellipse, and with the longest dimension equal to the length of the string.

We call the longest dimension the semi-major axis, so it is equal to half the length of the string.



Now consider what happens when your pen is at the midpoint of the string: Half the string is on one side and half is on the other. So each of the pieces has the same length as the semi-major axis. The second way to draw an ellipse and find its foci takes advantage of this fact.

Take any computer drawing program, including Microsoft Word. The "oval" shape will be an ellipse, so draw any oval and draw lines for its longest and shortest widths:



The line from the top of the minor axis (the shortest width) to the focus has to have the same length as half of the major axis, as we found, so we can find the focus this way:

