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Astronomy Resources

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Astronomy Resources

"The locus of points such that the sum of the distances between each point and two other fixed foci is constant." This definition of the ellipse, that figure from geometry so important to the understanding planetary and stellar orbits, may be familiar, yet it often remains confusing. We find that creating an ellipse in front of a class as we discuss its features helps to clarify this mathematical definition.

Two round kitchen magnets (usually sold in sets of two or more) can be attached to a metal blackboard. (For a nonmetallic board, small suction cups can be applied with glycerin.) These magnets form the foci of the ellipse. A string is draped over the two magnets and then pulled taut by placing a piece of chalk in the loop and pulling the string away from the magnets with the chalk. The ellipse is created by pushing down on the chalk against the board while at the same time moving the chalk around the taut string loop.

We point out to students that the distance around the now triangle-shaped loop is constant. Indeed, as the length between the two magnets also remains constant, only the segments between the chalk and the magnets change in length. As the ellipse progresses, sometimes the length between the chalk and the left magnet will be long and that between the chalk and the right magnet will be short and vice versa. However, as the total amount of string does not change, the sum of the two lengths leading from the chalk must remain constant.

The size of the ellipse can be changed by using different lengths of string. The eccentricity can be changed by altering the separation between the magnets. This demonstration works best for an ellipse with a fairly large-eccentricity where the distance between the magnets is more than one-third the entire length of the string.