Print Name _____ Period _____ Date _____

# CA1 6.8: Ellipse Lab

**Purpose:** To understand some basic properties of ellipses and to relate these to orbits.

**Equipment needed:** cardboard, paper, string, ruler, two pushpins

**Procedures:** Gather the equipment listed and follow the directions below.

1. Make your own ellipse in the following manner. Take a piece of cardboard and place a piece of blank paper on top of it. Put two pushpins in the paper, near the center. They should be separated several centimeters.

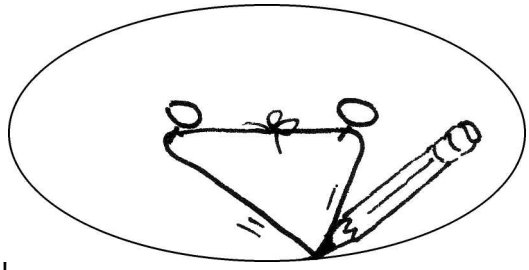
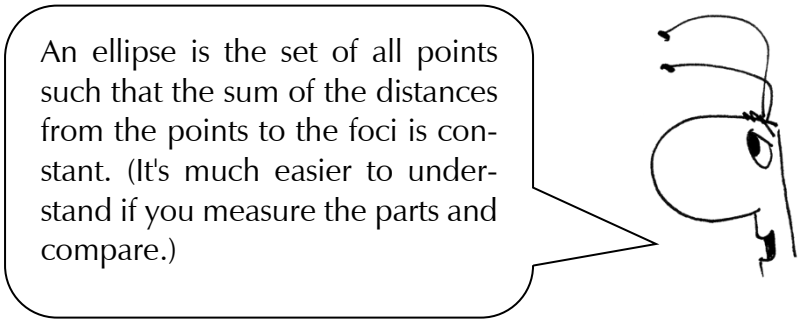


**Figure 1: How to draw an ellipse**

Tie a string loop which can loop around both pins and have a little slack. The loop should not go off the edge of the paper.

Using a SHARP pencil, LIGHTLY draw a curve around the pins by placing your pencil point inside the loop, pulling it taut, and letting the sting guide your pencil around the pins as shown. Remove the pins and string.




2. Examine the diagram of an ellipse that you drew. The two holes in the paper where the pins were are called *foci* (singular, *focus*).

These two points determine the shape of the ellipse.
Label these *F1 and F2*. Label one of the foci "sun."

**Labeling the ellipse**

1. Pick a point on the edge of the ellipse. Label the point P1.
2. Measure the distance from P1 to the first focus, F1.
3. Measure the distance from P1 to the second focus, F2.
4. Add the two together.
5. Repeat this process for a second point, P2.
6. Your result for the total distance should be the same. Is it? Try another point P3 if you're not sure.
7. Does the definition make sense now? Read it again.

Print Name _____ Period _____ Date _____

## *CA1 6.8: Ellipse Lab*

**Parts of an ellipse**
The ellipse has several features that are of concern to the astronomer or physicist.
8. Measure the longest dimension of the ellipse. (That's how long it is, measured *through both foci*, from edge to edge.) This line will pass through both pin-holes if you used pins and string to draw the ellipse. The line you have measured is called the *major axis*. **Label the major axis on your diagram. Measure the major axis. Record your answer on the diagram**.

9. The *semi-major axis* is determined by cutting the major axis in half. Mark the center of the major axis. **Label the semi-major axis.** The variable ***a*** is generally used to represent the length of the semi-major axis. This variable will come up again and is usually the one listed in text-books as the "mean distance from the sun" or "orbital radius."

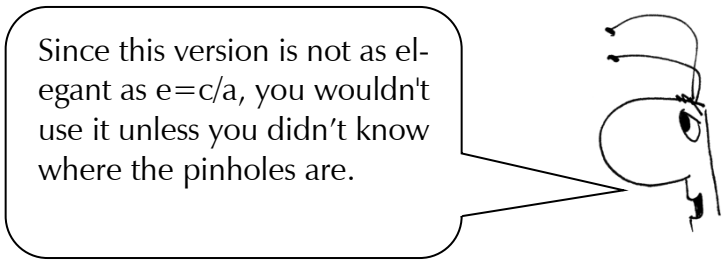
10. **Record the length of the semi-major axis on the diagram.**

11. Now we are going to draw a shorter axis, called the *minor axis*. **Draw a line through the center of the ellipse but perpendicular to the major axis**. Label it. Similarly the *semi-minor axis* is half this length. **Label the ellipse with these terms and record the length of the semi-minor axis.** The variable ***b*** is generally used to denote the length of the semi-minor axis.

12. The variable c is the distance from the intersection of the major and minor axes to either of the foci. In other words, measure from the middle to one focus and record this length as "c". In math class this is referred to as the "focal length." **Mark the focal length *f* on your diagram.**

13. The *eccentricity* of an ellipse is a measure of its flatness. The larger the value of eccentricity, the more flat the ellipse appears to be. The eccentricity may be calculated two ways. One way is to use the relation **e=c/a**. Use this formula to calculate the eccentricity of the sample ellipse. **Record the eccentricity on the worksheet**. Show your work.

14. The other way to calculate eccentricity is to use the equation $e = \frac{\sqrt{a^2 - b^2}}{a}$.
The series of ellipses in CA1 6.9 require the use of this equation.




15. Finally, look up the definitions of the following parts of an orbit and **identify them on your diagram: perihelion, aphelion**.