

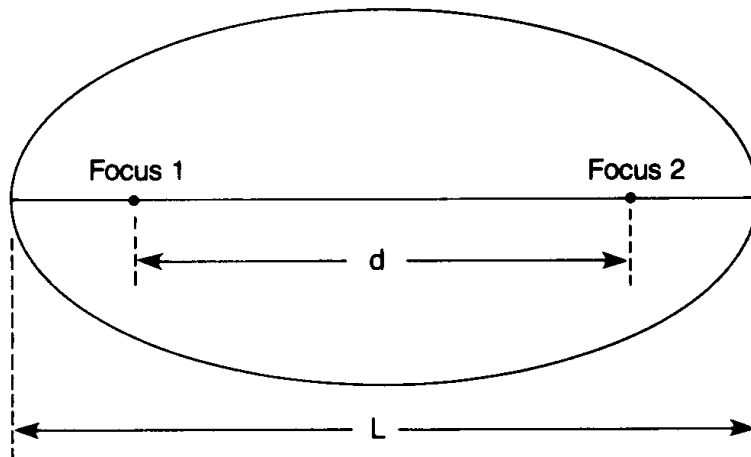
Name _____

Partners _____

ORBITS (Ellipses)

INTRODUCTION: Earth revolves around the sun in an orbit which is a special geometric figure called an ellipse. An ellipse has two “center points”. Each one is called a focus. The sun is not in the exact middle of Earth’s orbit. Rather, it is found at one of the focal points.

OBJECTIVE: You will be able to compare the shape of Earth’s orbit and orbits of other planets with the shape of a circle.



VOCABULARY

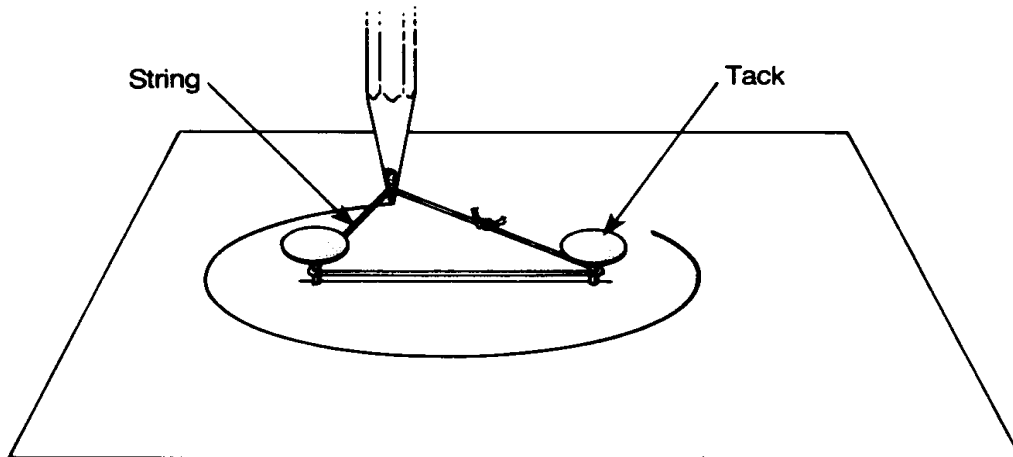
ellipse: an “oval” around 2 fixed points, called foci. The orbits of all planets are ellipses, with the Sun at one of the foci.

eccentricity: the “out-of-roundness” of an ellipse. The farther away from a value of 0.0, the less circular the ellipse.

focus (plural is foci): one of the 2 fixed points of an ellipse.

PROCEDURE:

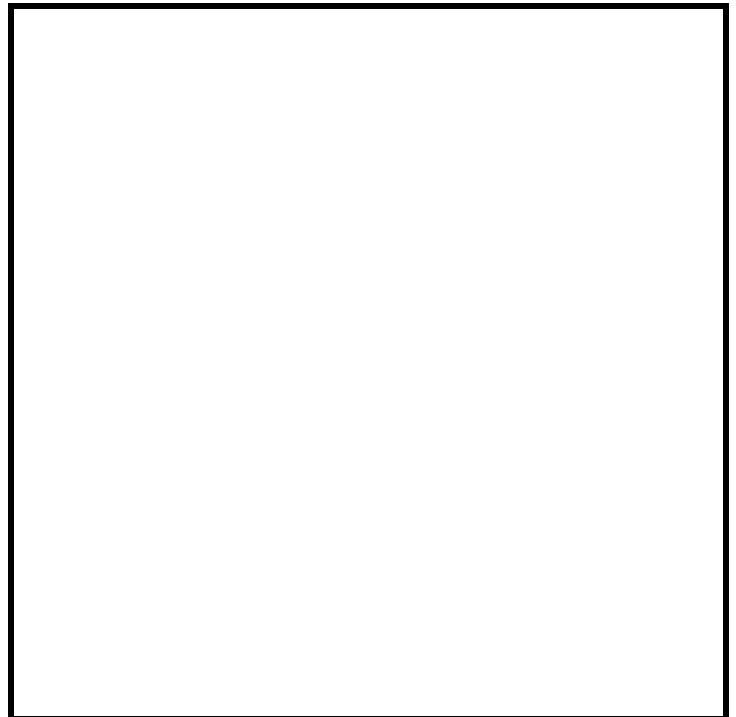
1. Cut a piece of string about 22 cm in length and tie the ends together to form a loop.
2. On plain white paper draw a straight line lengthwise down the middle of the paper.
3. Near the center of this line, draw two dots 3 cm apart.
4. Placing the paper on a piece of cardboard, put a thumbtack in each dot (focus).
5. Loop the string around the thumbtacks and draw the ellipse by placing your pencil inside the loop as shown below.



6. Label this ellipse #1.
7. Measure the distance between the thumbtack holes (foci). This is "d". Record this on your Report Sheet.
8. Measure the length of the major axis (L) and record this on the Report Sheet.
9. Move each tack out 1 cm and draw a new ellipse. Label it #2 and measure and record d and L.
10. Move each tack out another 1 cm and draw a new ellipse. Label it #3 and measure and record d and L.
11. Using the equation $e = d/L$, calculate the eccentricities of each ellipse. Show all work on the report sheet.
12. The table below gives the eccentricities of the planet's orbits. In the box at right, draw a picture of what Earth's orbit should look like.

ECCENTRICITIES OF THE PLANETS

<u>PLANET</u>	<u>ECCENTRICITY</u>
Mercury	0.206
Venus	0.007
Earth	0.017
Mars	0.093
Jupiter	0.048
Saturn	0.056
Uranus	0.047
Neptune	0.009
Pluto	0.250



REPORT SHEET

Ellipse #1

Calculations

d = _____

L = _____

e = _____

Ellipse #2

Calculations

d = _____

L = _____

e = _____

Ellipse #3

Calculations

d = _____

L = _____

e = _____

DISCUSSION QUESTIONS

1. When you increase the distance between the foci, the eccentricity of an ellipse _____.
2. The most eccentric of the ellipses was number _____.
3. The least eccentric ellipse was number _____.
4. The minimum eccentricity an ellipse can have is _____.
5. The geometric figure that has the minimum eccentricity is a _____.
6. As the shape of an ellipse approaches a straight line, the numerical value of "e" _____.
7. In a diagram of Earth's orbit, the Sun is located at _____.
8. Which is rounder, the Earth's orbit or ellipse #1? _____
9. In the table, *Eccentricities of the Planets*, the planets are listed in order by their distance from the Sun. According to the table, is there a relationship between a planet's distance from the Sun and the eccentricity of its orbit? _____
10. List the planets in order of the increasing eccentricity of their orbits.
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
 - 7.
 - 8.
 - 9.

CONCLUSION: Describe the true shape of Earth's orbit in terms of its eccentricity, and describe where the Sun is located within Earth's orbit.