INSTRUCTOR _____ *PERIOD* ____ *NAME* _____

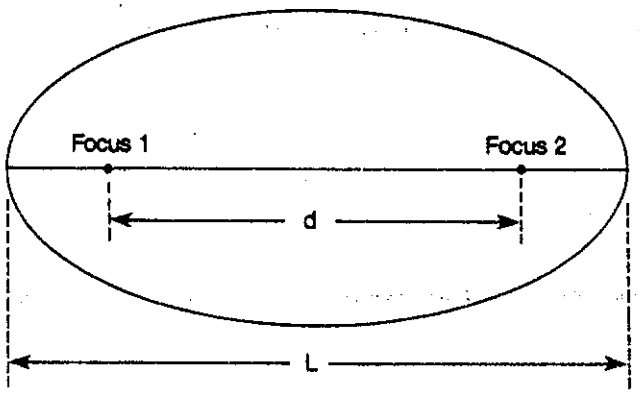
PARTNER _____

TOPIC IV: Earth's Motions

LAB 4-3: ELLIPSES

INTRODUCTION: The 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 the earth's orbit. Rather, it is found at one of the focal points.

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



VOCABULARY

ellipse:

eccentricity:

focus (plural is foci):

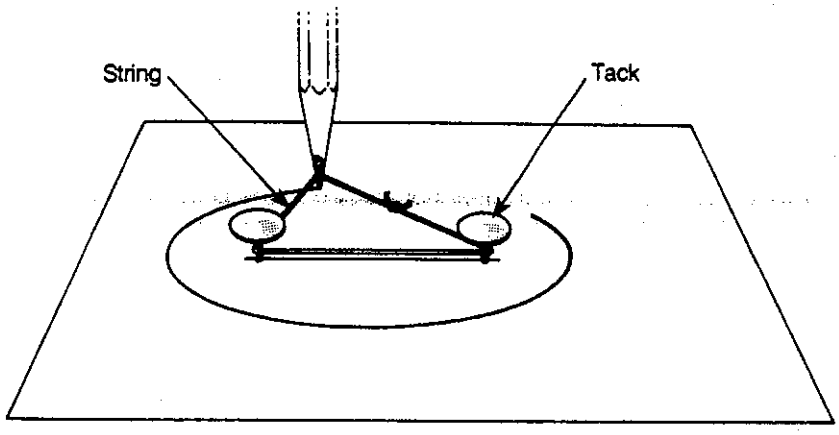
major axis:

circle:

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. Move each tack out another 1 cm and draw another ellipse. Label it #4 and measure and record d and L.
12. Place a dot in the exact middle of the first two foci. Using a drawing compass with a red pencil, construct a circle. Place the point of the compass in the center dot. Extend the compass along the major axis so the pencil touches ellipse #1. This will be the radius of the circle you are to draw.
13. Using the given equation, calculate the eccentricity (e) of each of the five figures. Show all work on your Report Sheet.

$$e = \frac{d}{L}$$

ECCENTRICITIES OF THE PLANETS

PLANET	ECCENTRICITY
Mercury	0.206
Venus	0.007
Earth	0.017
Mars	0.093
Jupiter	0.048
Saturn	0.056
Uranus	0.047
Neptune	0.008
Pluto	0.247

REPORT SHEET

Ellipse #1

Calculations

d = _____

L = _____

e = _____

Ellipse #2

Calculations

d = _____

L = _____

e = _____

Ellipse #3

Calculations

d = _____

L = _____

e = _____

Ellipse #4

Calculations

d = _____

L = _____

e = _____

Ellipse #5 (circle)

Calculations

d = _____

L = _____

e = _____

DISCUSSION QUESTIONS: *(Answer in Complete Sentences)*

1. What change takes place in the eccentricity of the ellipses when you increase the distance between the foci?

2. Which of the four ellipses you drew (not counting the circle) was the most eccentric?

3. Which of the four ellipses you drew (not counting the circle) was the least eccentric?

4. What is the minimum eccentricity an ellipse can have?

5. What is the name of the geometric figure which has the minimum eccentricity?

6. How does the numerical value of "e" change as the shape of the ellipse approaches a straight line?

7. Where is the sun located on a diagram of the earth's orbit?

8. What was the eccentricity you calculated for Ellipse #1?

9. Which is rounder (less eccentric), the orbit of Earth or your Ellipse #1?

10. In the table, *Eccentricities of the Planets*, the planets are listed in order by their distance from the sun. Is there a direct relationship between the eccentricity of its orbit and the distance a planet is from the sun?

11. List the planets in order of the increasing eccentricity of their orbits.

CONCLUSION: Describe the true shape of the earth's orbit?