Name _____Date_____ Period_____

Graphing Homework #_____

Kepler created 3 laws of planetary motion. Kepler's first law states that all natural orbits are ellipses. An ellipse is a closed curve that is drawn around two fixed points called foci. In our solar system, the sun is located at one of the foci of every planetary orbit. Ellipses can show a great variation in shape depending on the distance between the foci. It is easy to construct ellipses using a loop of string, some cardboard, and 2 pushpins. Place the pins in the cardboard and then loop the string around the pins. Using a pencil pull the string tight and carefully draw a curve all the way around the pins.

A formula can be used to describe the shape of an ellipse. This formula is called eccentricity (e = Distance between foci / Length of Major Axis or **e = d/L**) and indicates how flattened an ellipse is. A value for e that is closer to zero means the ellipse is more circular. A higher value for eccentricity indicates the orbit is more flattened. The value for Earth's orbit is 0.017 showing it is a slightly eccentric ellipse.

The data below was collected by a student using a loop of string 11 cm long. The student changed the distance between the pins and then measured the length of the major axis. For each measurement, calculate the eccentricity to the nearest thousandth place (.001) and then graph the data.

What does Kepler's first law state? _____

_____

What are the foci of an ellipse? _____

_____

What is the formula for eccentricity?

_____

What is the eccentricity of Earth's orbit? _____

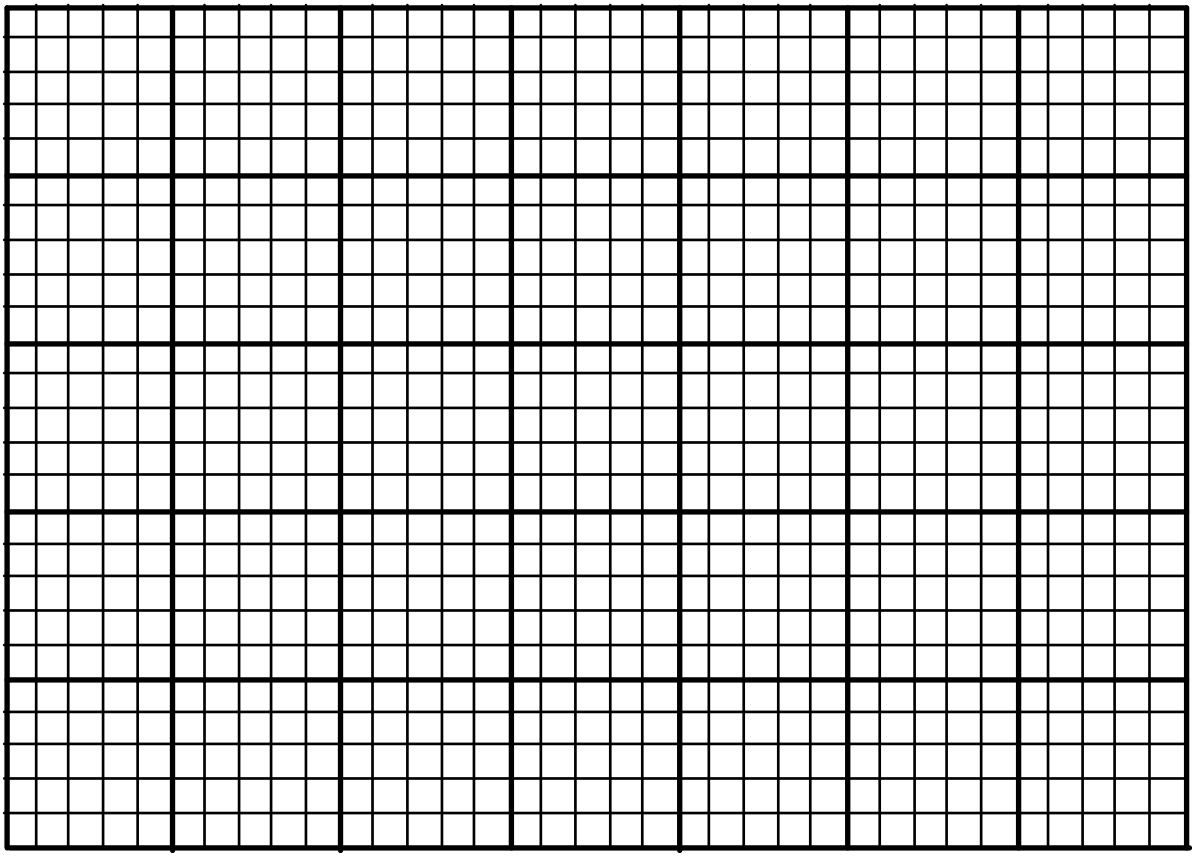
What does this value indicate about the shape of Earth's orbit? _____

Distance between Foci (cm)	Length of Major Axis (cm)	Eccentricity (3 decimal places)
0	**22**	
1	**21**	
2	**20**	
4	**18**	
6	**16**	
7	**15**	

<u>Create a line graph from the data table on the Graph Paper on the back.</u>

- create a uniform scale for Distance between foci on the x - axis (2 points)
- Label the x - axis with both a label and a unit. (2 points)
- create a uniform scale for Eccentricity on the y axis. (2 points)
- label the y - axis. (1 point)
- plot all six points on your graph (2 points)
- connect the points to draw your line (1 point)
- put an appropriate title on top of your graph. (1 point)

(2 points)	x- axis	y - axis
Range		
Boxes		
Divide		
Round up		



Answer the questions below in Complete Sentences (2 points each)

1) As the distance between foci increased, what happened to the value for eccentricity of the ellipse?

2) Use the graph to estimate the eccentricity if the pins were 5 cm apart.

3) What happened to the length of the major axis when the distance between foci was increased?

4) If a longer string had been used, how would the values for eccentricity have been changed?

5) On your graph, sketch and label a new line where the eccentricity would be if the string had been 9 cm.