Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_

BOCES Science Laboratory Investigation

ECCENTRICITY OF AN ELLIPSE

**Background Information**

Most things in the universe are not perfect circles – most of them are ellipses. Orbits, planets, stars and so on all contains elements of an ellipse. An ellipse has two foci, and when dealing with an orbit, there is usually something located at only one of them. As an example, in the Earth’s orbit, the sun is at one focus, and there isn’t anything at the other one.

**Procedure**

1. Obtain a piece of cardboard, two pins, some paper, a ruler and a piece of string.

2. Tape the paper to the cardboard.

3. Draw a line across the center of your paper using the ruler.

4. Stick the pins on the line. Put them in more toward the center of the paper, not near the edges.

5. Loop the string around your pencil and the pins and pull it tight to make a triangle.

6. Keeping the string tight, produce an ellipse on your paper.

7. Measure the major and minor axes and record them on the chart below.

8. Use the formula for the area of an ellipse to calculate the area of the one you drew, and enter it in the table.

9. Measure the distance between the foci.

10. Finally, use the eccentricity formula to calculate the eccentricity of your ellipse and enter that data in the table.

11. Draw at least four more ellipses for a total of at least five.

12. Create a graph that relates the distance between the foci to the eccentricity.

Semi-major axis

Minor axis

Semi-minor axis

Major axis

Area of an ellipse = π x (semi-major axis) x (semi-minor axis)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ellipse Number** | **Major Axis** | **Minor Axis** | **Area** | **Distance Between Foci** | **Eccentricity** |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |

Table 1. Data table from ellipse construction.

**Analysis**

QUESTION 1: What happened to the area of the ellipse as the major axis got longer?

QUESTION 2: Upon what two things does the eccentricity of the ellipse depend?

QUESTION 3: Why was it important that we didn’t change the length of the string that we used?

QUESTION 4: What shape do you have if the major and minor axes are the same length?

QUESTION 5: