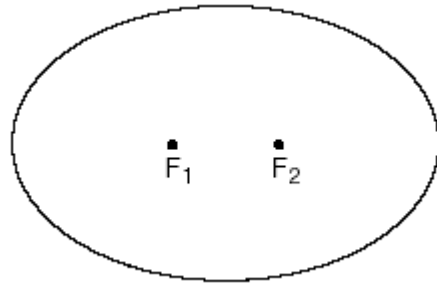


Calculating Eccentricity and Kepler's Laws – ANSWERS

(don't worry if your measurements are off by a little bit)

Formula: **eccentricity** =
$$\frac{\text{distance between foci}}{\text{length of major axis}}$$

1. Using a ruler and the eccentricity formula, calculate the eccentricity value of the orbit shown to the right.



Write Formula:
$$e = \frac{\text{distance between foci}}{\text{length of major axis}}$$

Substitute Data:
$$e = \frac{1.3}{5.3}$$

Solve (rounded to the thousandths place):
$$e = .245$$

2. The diagram to the right shows an orbit of a satellite traveling around the Earth.

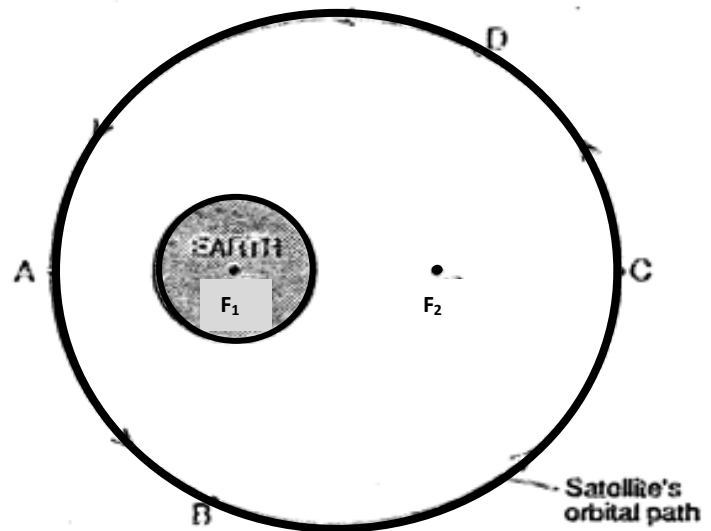
Use a ruler to measure the following:

- a. distance between foci (to the nearest tenth of a cm):

2.5 cm

- b. length of the major axis (to the nearest tenth of a cm)

7.1 cm



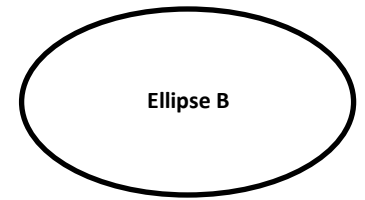
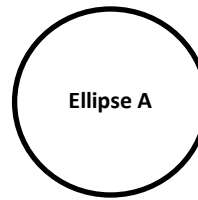
(DRAWN TO SCALE)

- c. Substitute the data into the formula to get the eccentricity value of the satellite's orbit. (round your answer to the nearest thousandths place). **.352**

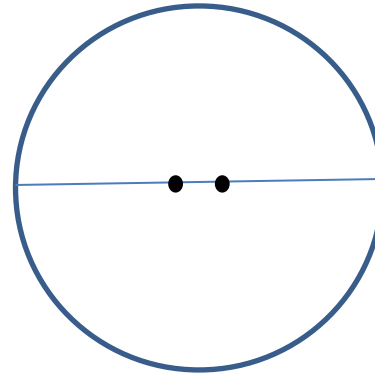
$$e = \frac{2.5}{7.1} = .352$$

- d. At which lettered point in its orbit will the satellite have the greatest orbital velocity? **A**
- e. At which lettered point in its orbit will the satellite have the least gravitational attraction to Earth? **C**

3. Orbits with a higher eccentricity value
 (1) **are more elliptical and appear more oval-shaped**
 (2) are less elliptical and appear more circular
 (3) are more elliptical and appear more circular
 (4) are less elliptical and appear more oval-shaped



The diagram to the right represents the orbit of a new planet as it revolves around a star in the far reaches of the Milky Way.



4. Use a ruler to measure the following:

a. distance between foci (to the nearest tenth of a cm) - **0.6 cm**

b. length of the major axis (to the nearest tenth of a cm) - **4.6 cm**

c. Substitute the data into the formula to get the eccentricity value of the orbit of this new planet.(round your answer to the nearest thousandths place.) $e = \frac{0.6}{4.6} = .130$

d. What is the eccentricity of Earth's orbit? **.017**

e. Which orbit is more elliptical: Earth's orbit or the newly discovered planet's orbit? **newly discovered planet's orbit**

Explain your answer using numerical data.

The newly discovered planet's orbit has an eccentricity of .130 which is higher than Earth's orbital eccentricity which is only .017.

or

The newly discovered planet's orbit has an eccentricity of .130 which is closer to 1 than Earth's orbital eccentricity which is only .017.