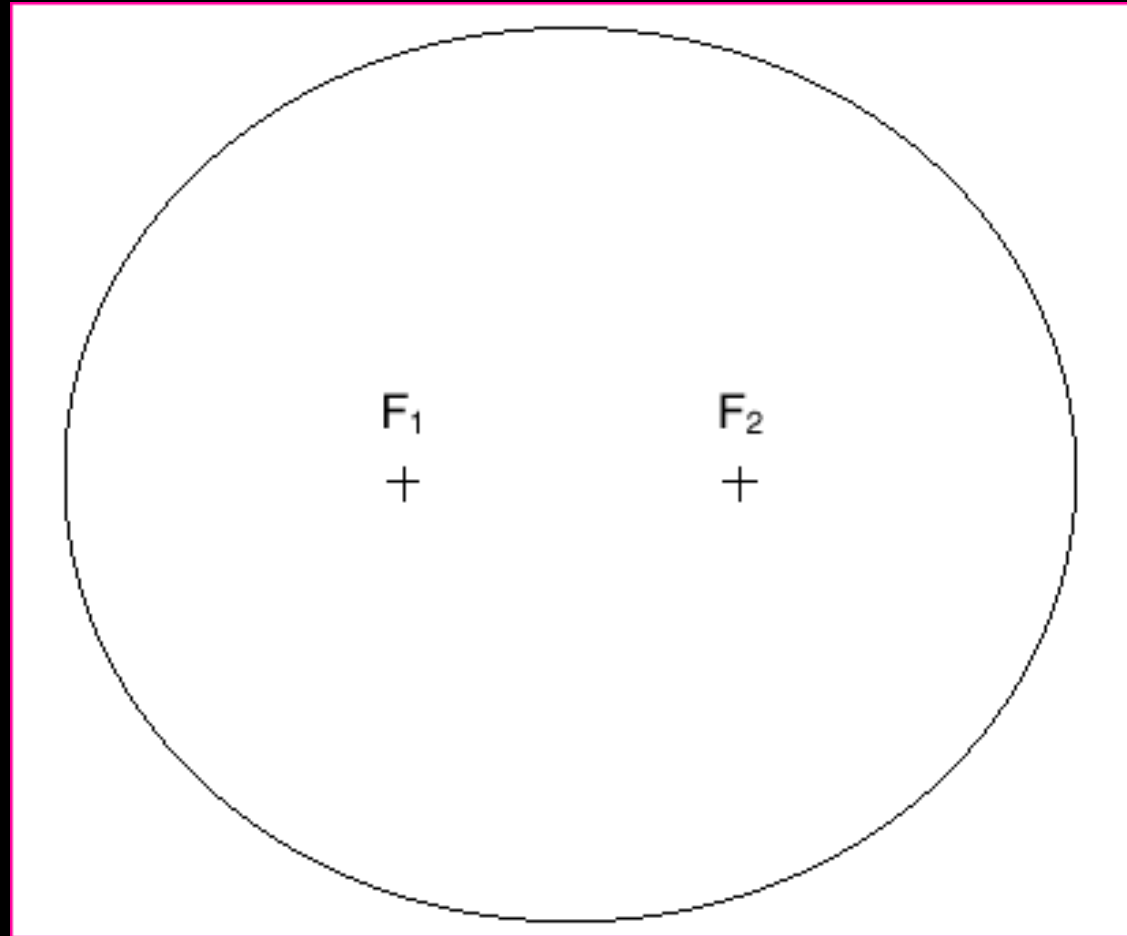


KEPLERS LAWS AND REVOLUTION:

1. Law #1 (Law of Ellipses) -

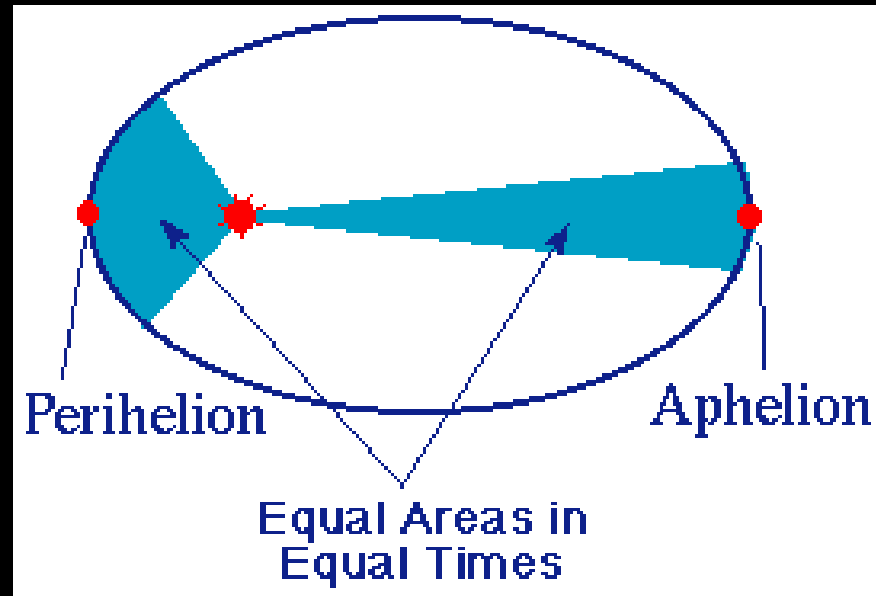
The orbit of each planet is an ELLIPSE with the sun at one foci.



2. Law #2 (Law of Equal Areas) – a planet sweeps out equal areas of an ellipse in equal time periods.

Revolution and Orbital Speed: as a planet orbits the sun, its orbital speed changes

- FASTER when CLOSER to the sun (perihelion)
- SLOWER when FARTHER from the sun (aphelion)



3. Law #3 (Orbital Periods) -

The farther a planet is from the sun, the longer the period of time

of revolution farther planets have longer orbital paths and slower orbital speeds.

- closer planets have shorter orbital paths and faster orbital speeds**

- farther planets have longer orbital paths and slower orbital speeds**

SHAPE OF THE EARTH'S ORBIT AROUND THE SUN

SHAPE OF EARTH'S ORBIT AROUND THE SUN

Ellipse – the **oval** shape of a planet's orbits.

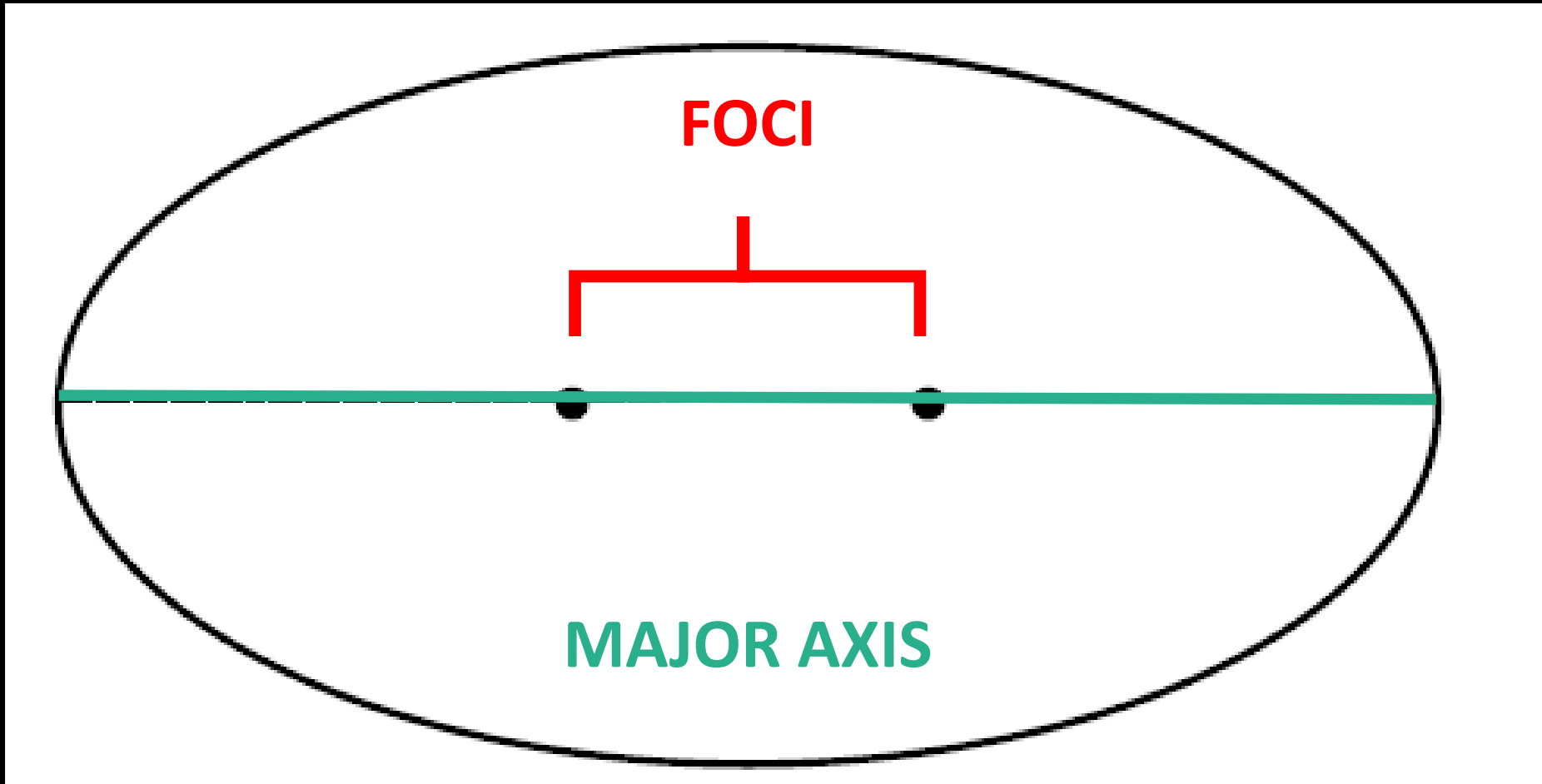
Eccentricity – the degree of **flatness** or “ovalness” of an ellipse.

Eccentricity of a perfect circle is 0

Eccentricity of a flat line is 1

Parts of an Ellipse:

- Foci - two fixed center points of an ellipse
- Major Axis - longest straight lined distance across an ellipse



Calculating Eccentricity: Use the formula from the E.S.R.T

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

No units for eccentricity

0.5 AU



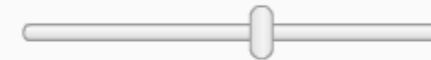
Orbit Settings

set parameters for: Mercury ▼ OK

semimajor axis (AU) 1.00



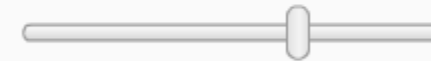
eccentricity 0.400



Animation Controls

start animation

animation rate (yrs/s) 0.20



Visualization Options

☐ show solar system orbits☒ show solar system planets☒ label the solar system orbits☐ show grid

clear optional features

Kepler's 1st Law

☐ show empty focus☐ show semiminor axis☐ show center☐ show semimajor axis☐ show radial lines

$$r_1 + r_2 = 2 \times a$$

$$0.600 \text{ AU} + 1.40 \text{ AU} = 2.00 \text{ AU}$$

Kepler's 2nd Law

Kepler's 3rd Law

Newtonian Features

0.5 AU



Orbit Settings

set parameters for: Mercury ▼ OK

semimajor axis (AU) 1.00



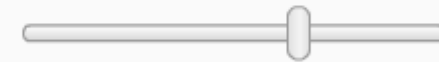
eccentricity 0.400



Animation Controls

start animation

animation rate (yrs/s) 0.20



Visualization Options

- ☐ show solar system orbits
- ☒ show solar system planets
- ☒ label the solar system orbits
- ☐ show grid

clear optional features

Kepler's 1st Law

- ☐ show empty focus
- ☐ show semiminor axis
- ☐ show center
- ☐ show semimajor axis
- ☐ show radial lines

$$r_1 + r_2 = 2 \times a$$

$$0.600 \text{ AU} + 1.40 \text{ AU} = 2.00 \text{ AU}$$

Kepler's 2nd Law

Kepler's 3rd Law

Newtonian Features