

Kepler's Three Laws of Planetary Motion

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Tycho Brahe



Johannes Kepler
(Brahe's Assistant)

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Johannes Kepler
(1571 - 1630)
German

- Inherited Brahe's extensive collection of astronomical records
- From this information developed three laws of planetary motion
- Kepler's Three Laws of Planetary Motion are still the basis for work done in the field of astronomy to this day.

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Kepler's 1st Law

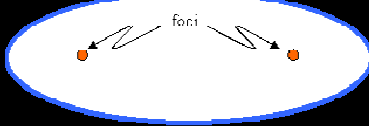
Using your whiteboard:

Draw a sketch of the Earth's orbit around the sun

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Kepler's 1st Law

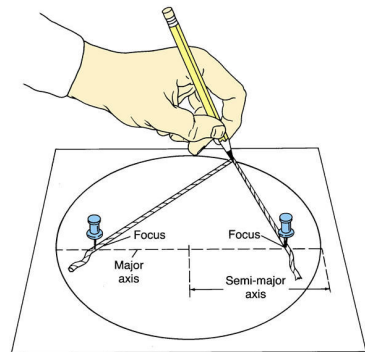
All planetary orbits are elliptical in shape.



"Foci" is plural of "focus"

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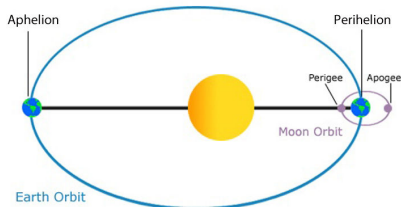
- **Major Axis:**
The long axis across the ellipse
- **Semi-Major Axis:**
Half of the major axis
- **Foci:**
Two interior points



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- **Aphelion:** Point where the planet is farthest from the sun
- **Perihelion:** Point where the planet is closest to the sun



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Take a close look at the planet....

http://www.windows2universe.org/physical_science/physics/mechanics/orbit/perihelion_aphelion.html

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Kepler's 2nd Law

A line joining a planet to its sun sweeps out equal areas in equal times as the planet travel along its orbit.

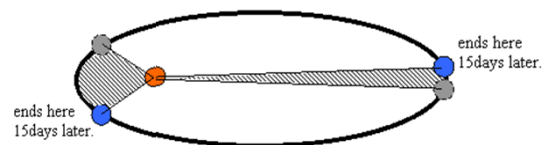
Also Known As: Equal Areas Law

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When the planet is....

closer to the sun it revolves faster.

farther away from the sun it revolves slower.



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Kepler's 3rd Law

The square of a planet's period equals the cube of the semi-major axis.

Also Known As: Periods Law

Write this formula down!!!

$$P^2 = d^3$$

P = Period of Revolution (in Earth Years)

d = average distance between planet and sun in AU

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Example of 3rd Law:

Uranus takes 84 Earth years to revolve around the sun. What is the distance from the center of Uranus to the center of the sun?

$$P^2 = d^3$$

$$84^2 = d^3$$

$$d = 19.18 \text{ AU}$$

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