

gravity is responsible for creating stable/elliptical orbits

↳ Newton's law of universal gravitation:

every body in the universe attracts every other body with a force directly proportional to the product of their masses and inversely proportional to the square of their separation

e.g. a comet at aphelion is 20x further away than at perihelion
at perihelion, the force of gravity acting on it from the sun is 400x (20²) greater than at aphelion

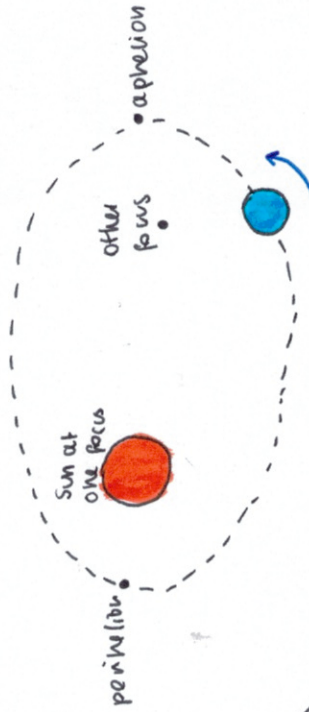
Orbit:

- circle
- elliptical
- parabolic
- hyperbolic

Planetary Motion and gravity

Kepler's first law:

planets move in elliptical orbits around the Sun with the Sun at one focus of each ellipse



Kepler's second law:



Swept out areas are equal
time interval between points equal

Kepler's third law:

$$T^2 \propto r^3$$

orbital period mean distance from sun

also...

$$\frac{\text{constant } K_1}{K_2} = \frac{M_2}{M_1}$$

if star is smaller than sun, K is 3x bigger
central mass

Copernicus suggested a heliocentric universe but was reluctant to because of conflicting with the Church used mathematical models

Tycho Brahe was interested in the motion of planet Mars and plotted its position with great precision for over 20 years

When Brahe died, Kepler used his Mars data and formulated his three laws of planetary motion

Galileo's observations for heliocentric universe:

- Galilean moons around Jupiter
- apparent size of Venus changed and showed phases