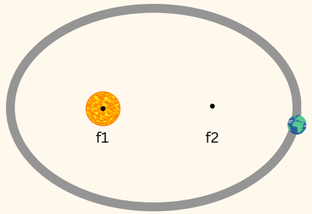
KEPLER'S LAWS OF PLANETARY MOTION

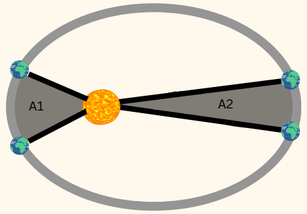
1st Law - Law of Ellipses

The planets move around the sun in elliptical orbits with the sun located at one of the foci of the ellipse



2nd Law - Law of Equal Areas

The planets covers equal areas while moving in its elliptical orbit, over equal periods of time



A1 = A2

3rd Law - Harmonic Law

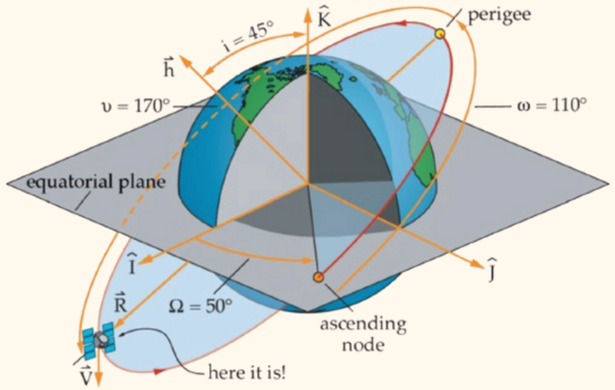
The square of a planet's orbital period is directly proportional to the cube of its average distance from the Sun

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

KEPLERIAN ELEMENTS

Semi Major Axis (**a**) : Half the length of the major axis

Eccentricity (**e**) : Shows shape of the ellipse. Closer it is to 1, the more ellipitical the orbit



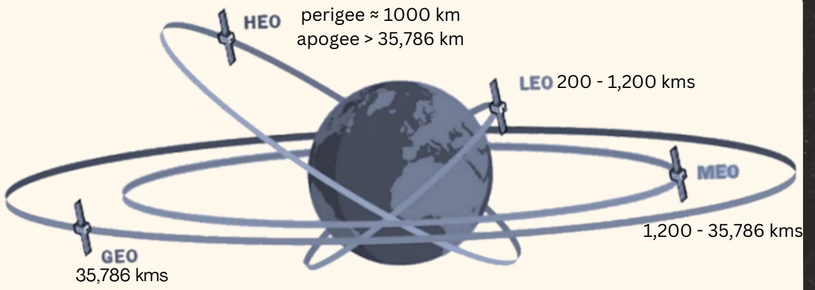
Inclination (**i**) : The angle between the orbital plane and the equatorial plane

RAAN (**Ω**) : Angle measured in the equatorial plane from the vernal equinox
Vernal equinox is the x-axis in the celestial coordinate system

Argument of perigee (**ω**) : The angle from the ascending node to perigee

True Anomaly (**ν**) : The position of the satellite

TYPES OF ORBITS



LEO: Low Earth Orbit
Orbital period ≈ 90 mins
Eccentricity ≈ 0
Uses: Satellite Imaging, ISS

MEO: Medium Earth Orbit
Orbital period: < 24 hrs
Uses: Navigation

GEO: Geostationary Orbit
Orbital period ≈ 24 hrs
Eccentricity ≈ 0
Uses: Communication, Weather monitoring

HEO: Highly Elliptical Orbit
Eccentricity: 0.3 - 0.75
Uses: Communication, Military uses

REFERENCES

Describing orbits. (n.d.).
https://www.faa.gov/sites/faa.gov/files/about/office_org/headquarters_offices/avs/III.4.1.4_Describing_Orbits.pdf

Keplerian elements tutorial. AMSAT. (n.d.).
https://www.amsat.org/keplerian-elements-tutorial/

Types of orbits. ESA. (2020, March 30).
https://www.esa.int/Enabling_Support/Space_Transportation/Types_of_orbits#GEO

Types of orbits. Space Foundation. (2023, January 30).
https://www.spacefoundation.org/space_brief/types-of-orbits/