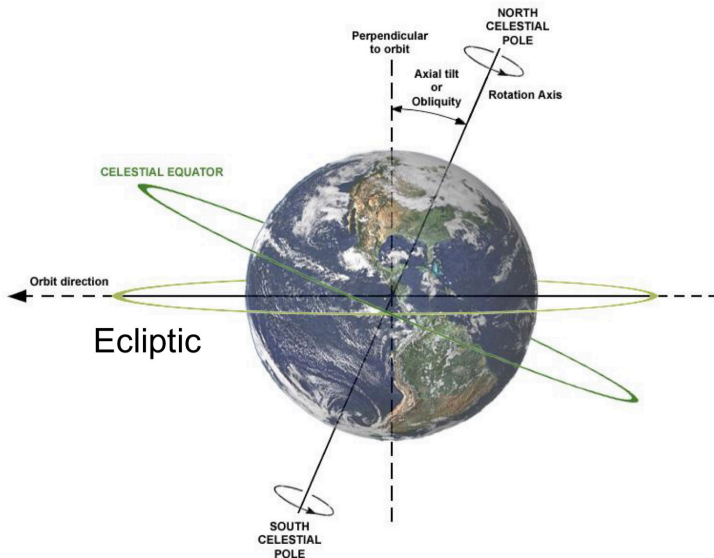
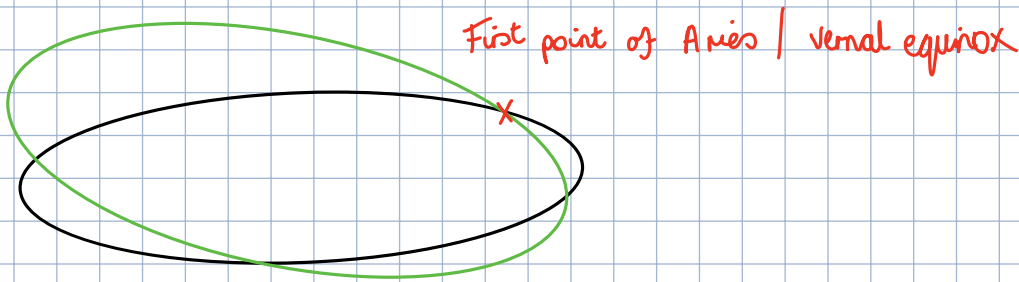


Defining a Reference Frame :



Ecliptic is the mean plane of the orbit
(in this case around the sun)



Coordinate System :

\hat{x} = reference direction (e.g. 1st point of Aries)

\hat{z} = normal to fundamental plane \rightarrow could be ecliptic or equatorial

$\hat{y} = \hat{z} \times \hat{x} \rightarrow$ right hand rule

Earth Centered **Inertial** (ECI) :

\hat{x} = 1st point of Aries

$\hat{y} = \hat{z} \times \hat{x}$

\hat{z} = normal to fundamental plane of **equator or ecliptic**

Earth Centered **Earth Fixed** (ECEF) :

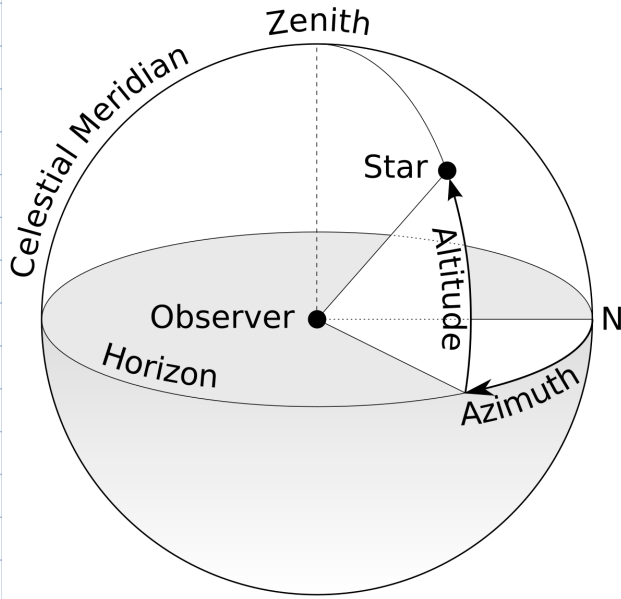
\hat{x} = **Greenwich Meridian** 0° longitude

$\hat{y} = \hat{z} \times \hat{x}$

\hat{z} = normal to fundamental plane of **equator**

Topocentric Horizon:

Local definition to observer



You can define a orbital position in 2 ways:

- Position vector & velocity
- Keplerian / Orbital Elements

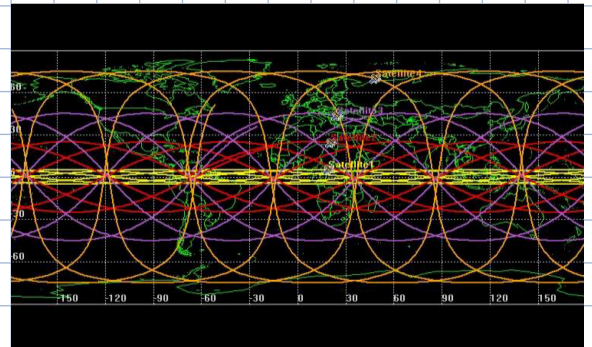
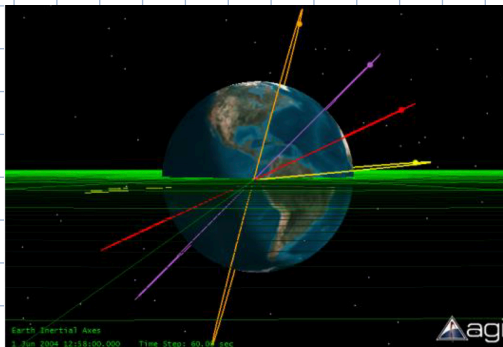
→ 6 Elements:

1. Semi-major axis (size of orbit)

2. Inclination, i

(measured from reference to orbital plane)

$$0 \leq i \leq 180^\circ$$

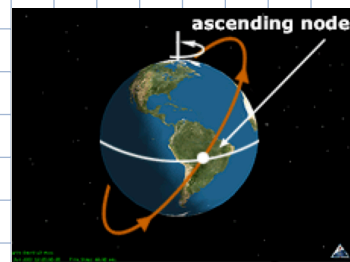


3. Eccentricity, e 'how squashed ellipse is'

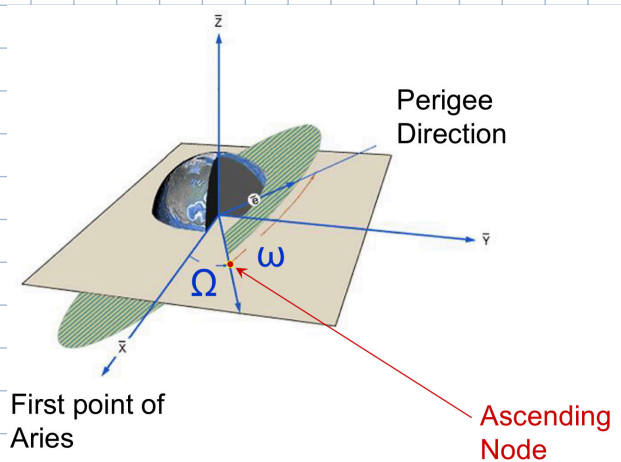
4. Right Ascension of Ascending Node, Ω : angle from vernal equinox to ascending node measured anticlockwise

Ascending Node : point where craft passes up through reference plane

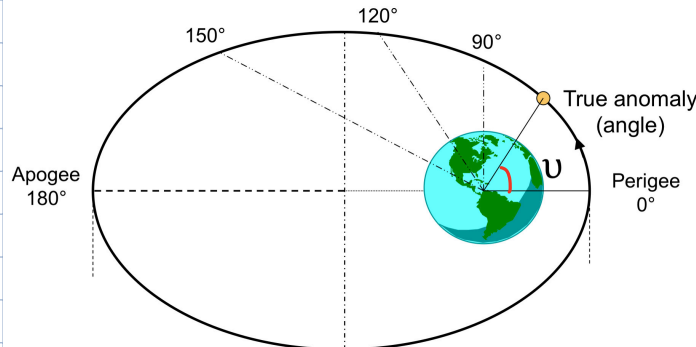
Descending Node : where passes down (180° after)



5. **Argument of Perapsis ω** : angle from ascending node to perigee on orbital plane



6. **True Anomaly, v or θ** : defines satellite angle from perigee



Summary :

