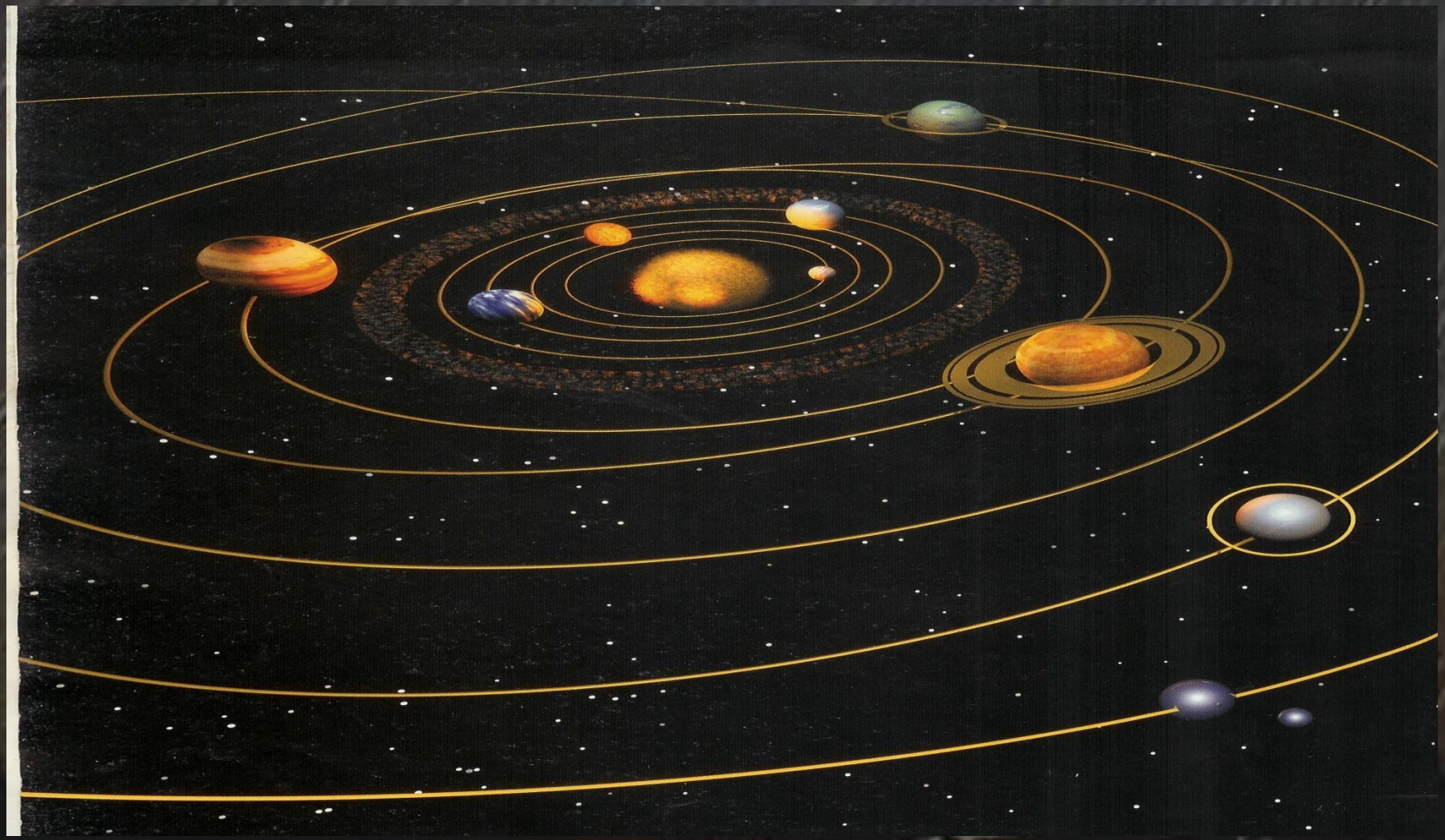
Planetary Orbit

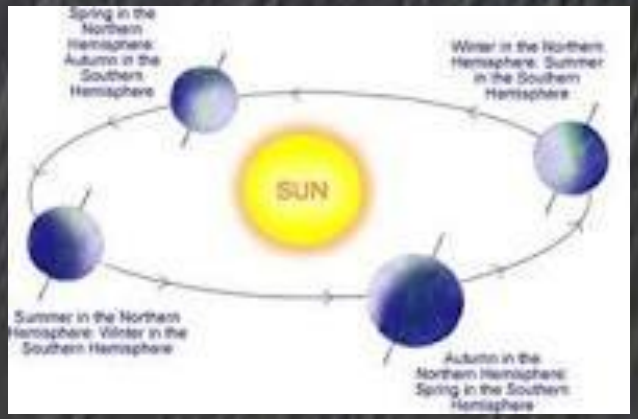


Planetary Orbits

- What shape do planets APPEAR to orbit the sun?
- Planets APPEAR to orbit in a circle.
- What shape do the planets orbit the sun???

  Each planet Orbits the Sun in an ellipse (oval), with the Sun at one foci.

Basic Terms



- Revolve -

  Revolve is to move in a circle or orbit another object. (Revolving doors)

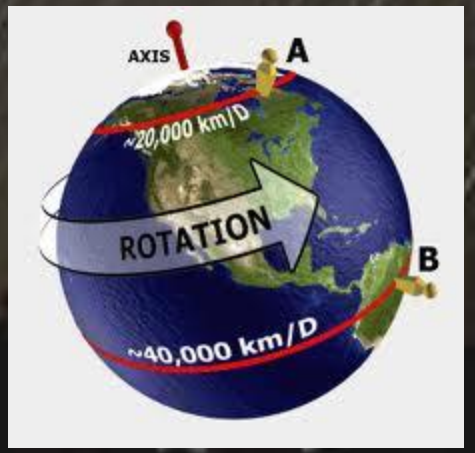
*Earth Revolves around the sun (years)

- Rotate -

  Rotate is to spin around an axis.

  (Hard "T" like a Top)

* Earth Rotates (day/night)



Satellite

- What is a Satellite?

A satellite is an object that orbits another object.

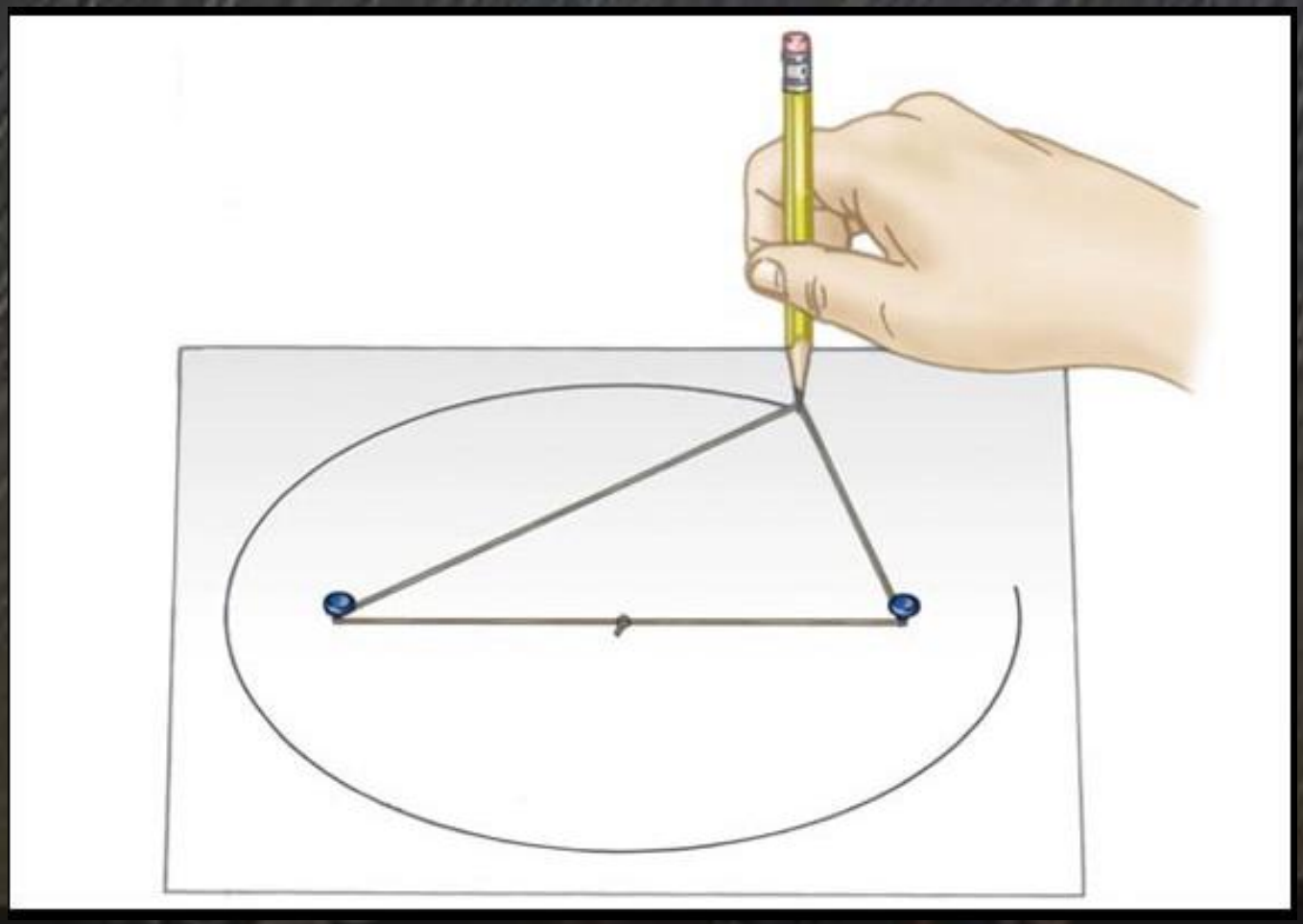
Ex. Radio satellite, moons, planets

What is a Primary?

A primary is an object being orbited.

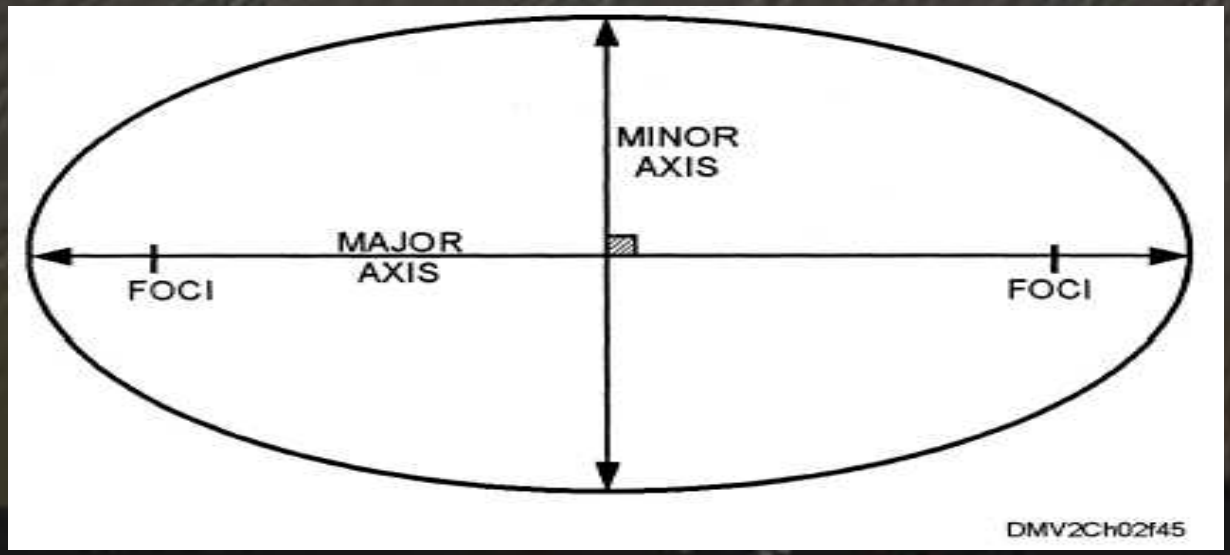
Ex. Earth, the sun

Ellipse



What is an Ellipse

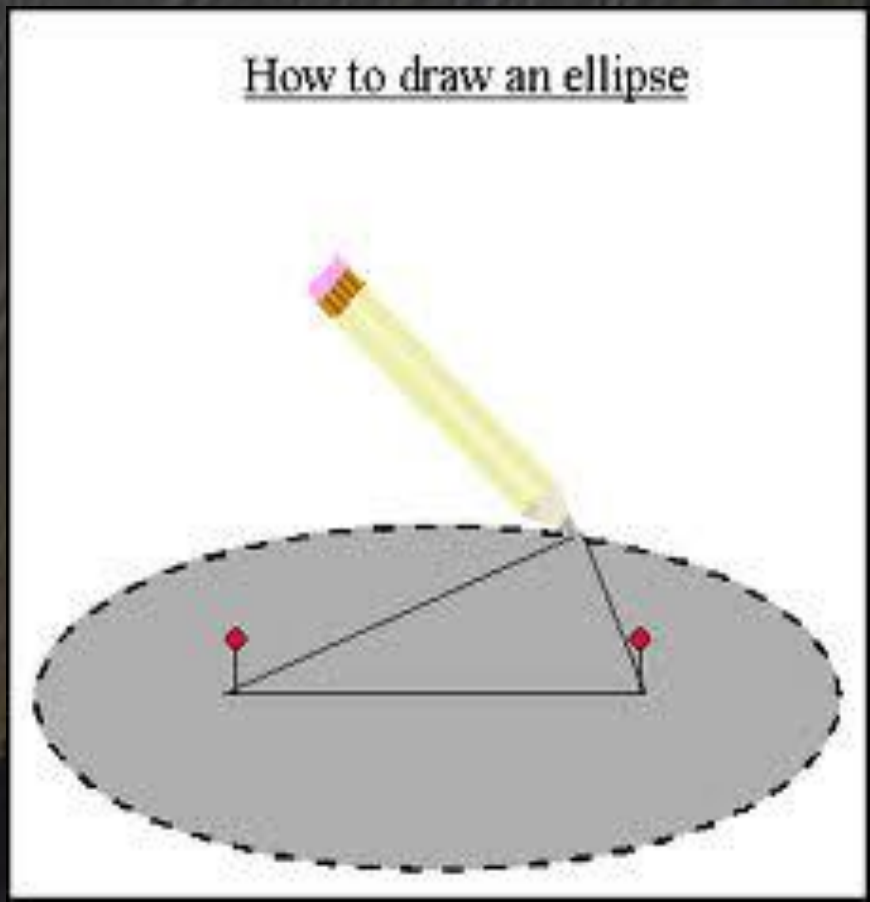
- What is an Ellipse?
- Ellipse - elongated or flattened circle. (oval)
- (Elliptical Machine)



Draw this.

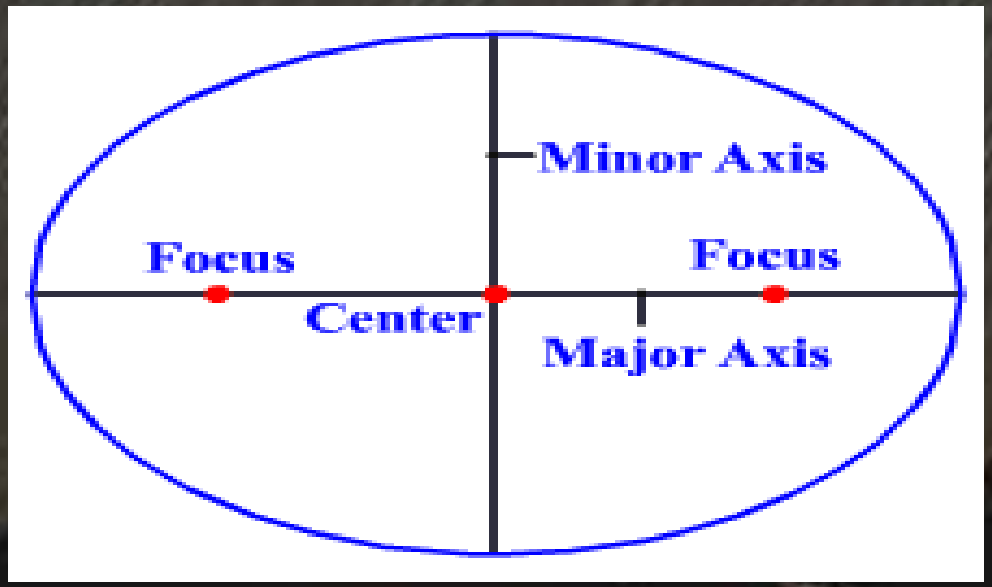
Parts of An Ellipse

- Parts of an Ellipse?
- A circle has 1 Center point
- An ellipse has 2 foci (2 center points)



Major Axis

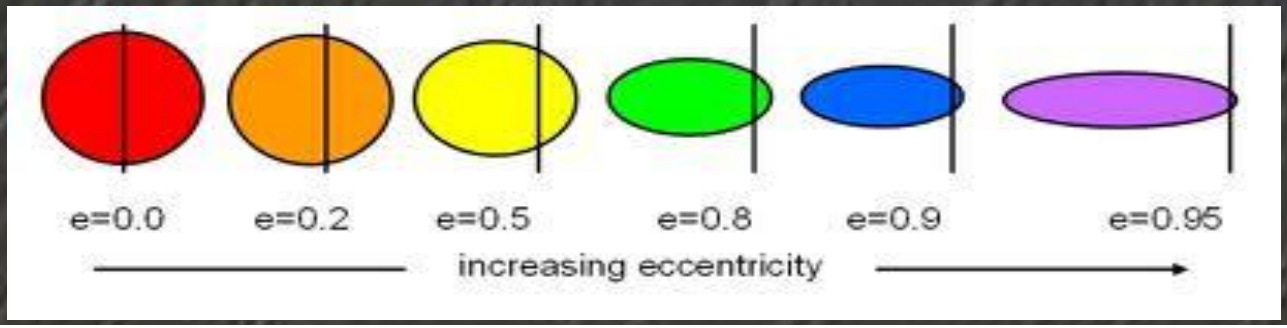
- Major Axis – line running between the widest points of the ellipse. Drawn through both Foci.



- Jake is in Space and not the good kind of Space.

Eccentricity

- What is Eccentricity?
- Eccentricity is how stretched out or flattened an ellipse is (oval like)



How to Calculate Eccentricity

Formula for Eccentricity:

$$E = \frac{\text{Distance Between Foci}}{\text{Length of Major Axis}}$$

$$\frac{5 \text{ in}}{5 \text{ in}} = 1$$

There is no Unit.

Eccentricity is typically given to the thousandth .???

Will always be between 0 and 1

E = 0 is a circle (not stretched at all)

$\frac{0}{} = 0$

?

$\frac{100}{} = 1$

100

E = 1 is a line (fully stretched out)

Eccentricity

- What happens when the foci get closer together?
- The closer the foci are together the less eccentric (less oval like) the ellipse will be.
- A circle has both foci in the exact same spot (they came together as 1 point)
- What happens when you stretch the foci apart?
- The more you stretch the foci, the more eccentric (like a line)

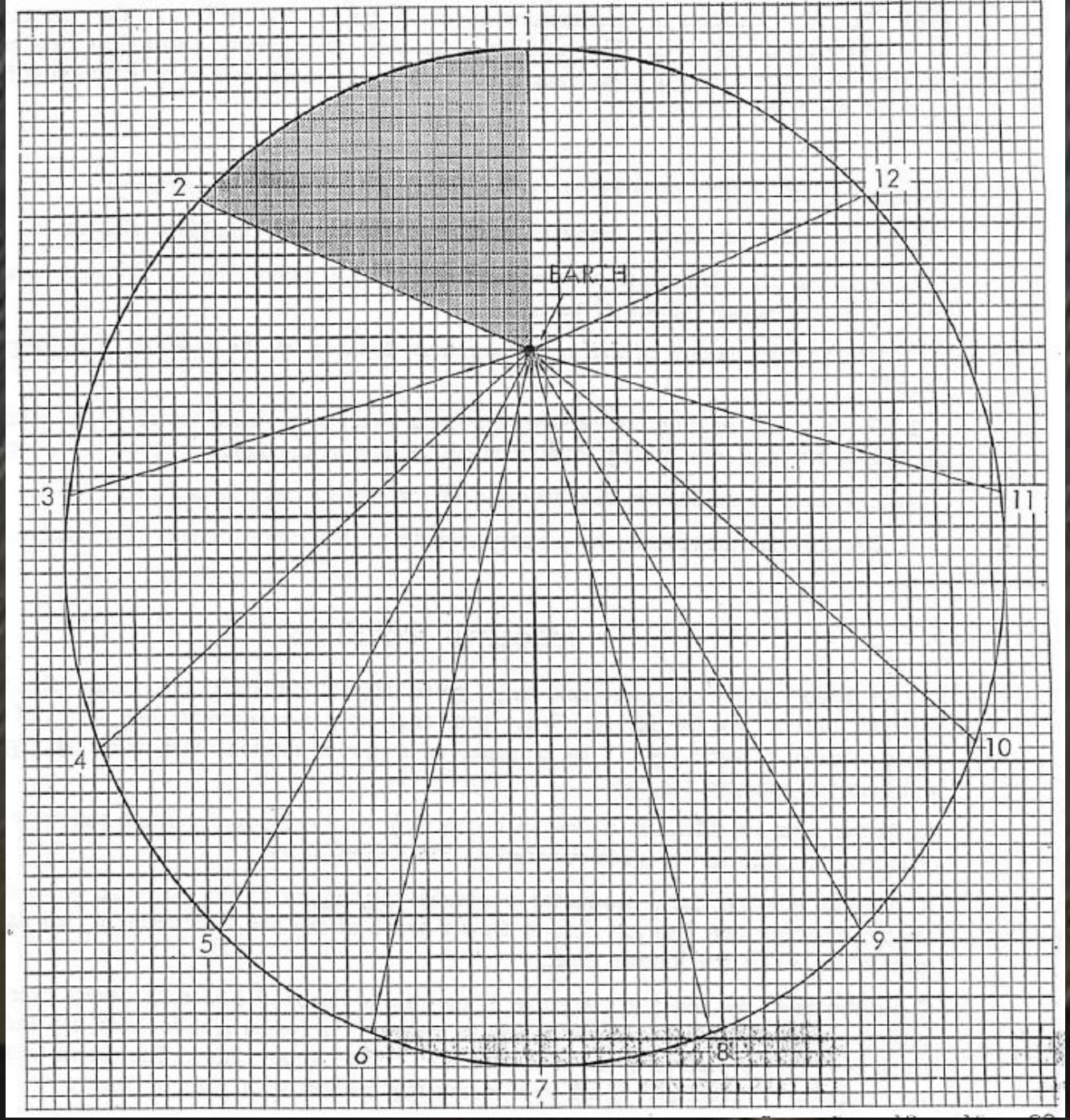
Studied By Who

- Who studied Ellipses?
- Planetary Ellipses were studied by Johannes Kepler to determine planetary motion

- This is Kepler's first Law
- What is a Law in Science?
- A law in science is something that can not be broken (Law of Gravity)

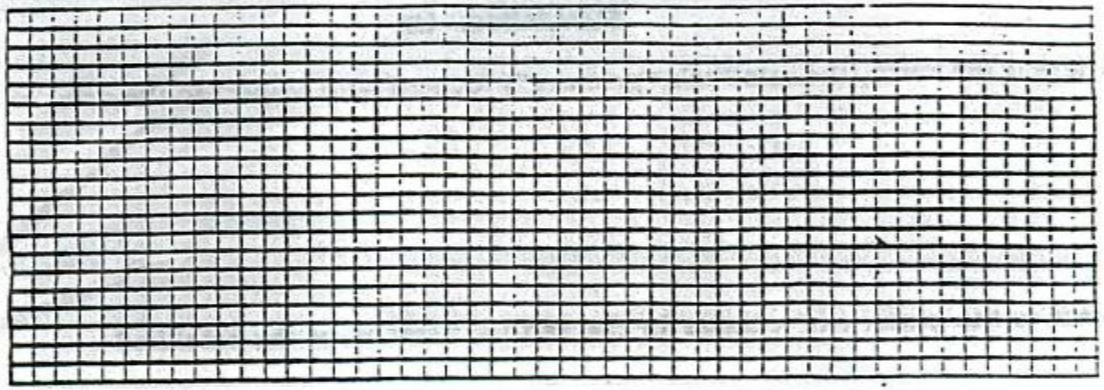
Ellipse Conclusion ?'s (R)

- What shape do planets appear to orbit?
- What shape do planets actually orbit?
- Define Ellipse?
- Define Eccentricity? (give formula).
- What happens when foci are closer together and further apart?
- What is the shape of eccentricity of 0 & 1?
- Who was Kepler? (As a scientist!!!)_


1
2
12
EARTH
3
11
4
10
5
9
6
8
7

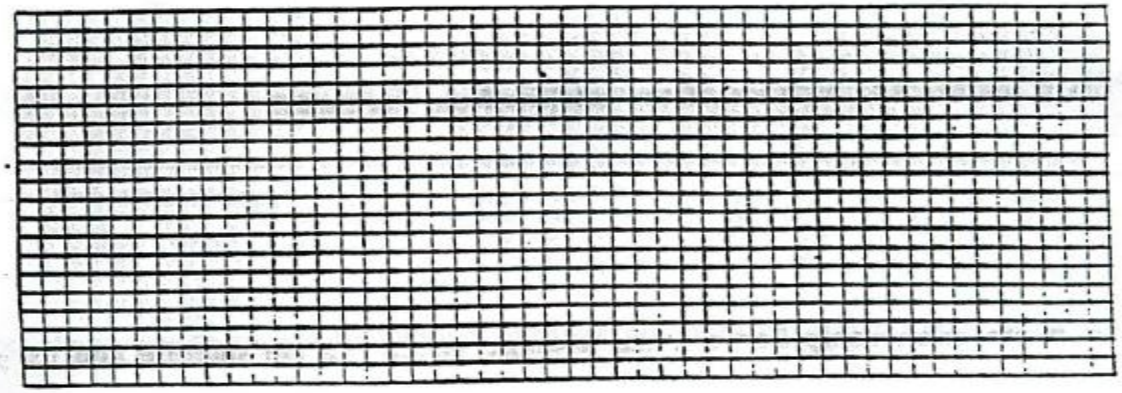
REPORT SHEET

Radius distance (cm)



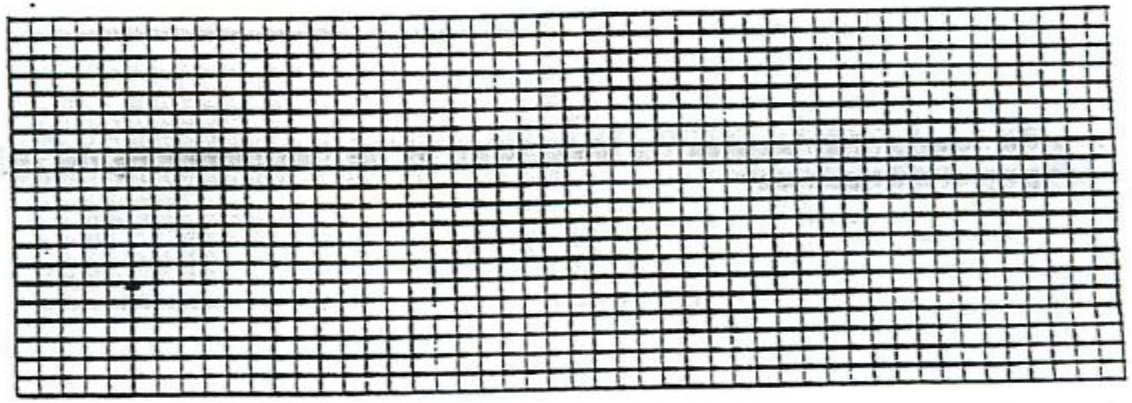
Day number

Angular velocity (degrees/day)



Day number

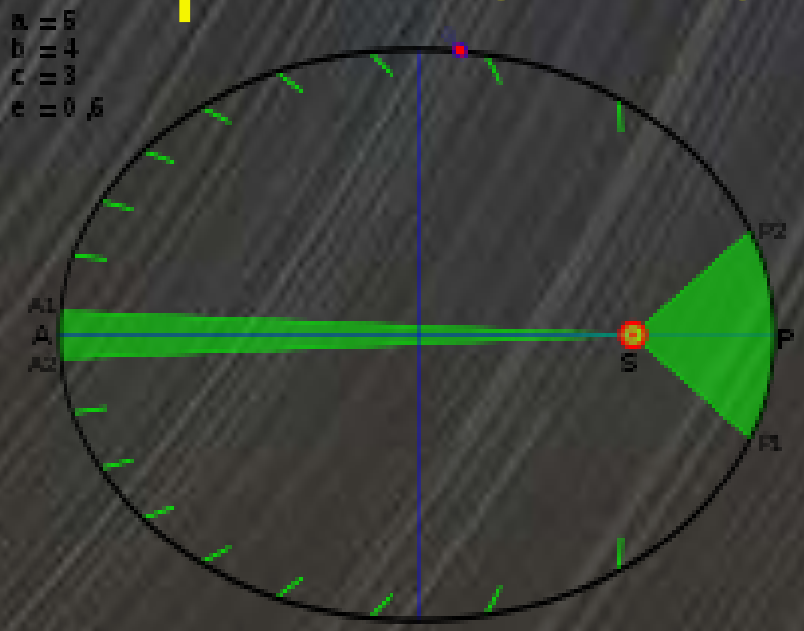
Radius area



Keplers 3 Laws

Keplers 3 laws:
1) All planets travel in an ellipse

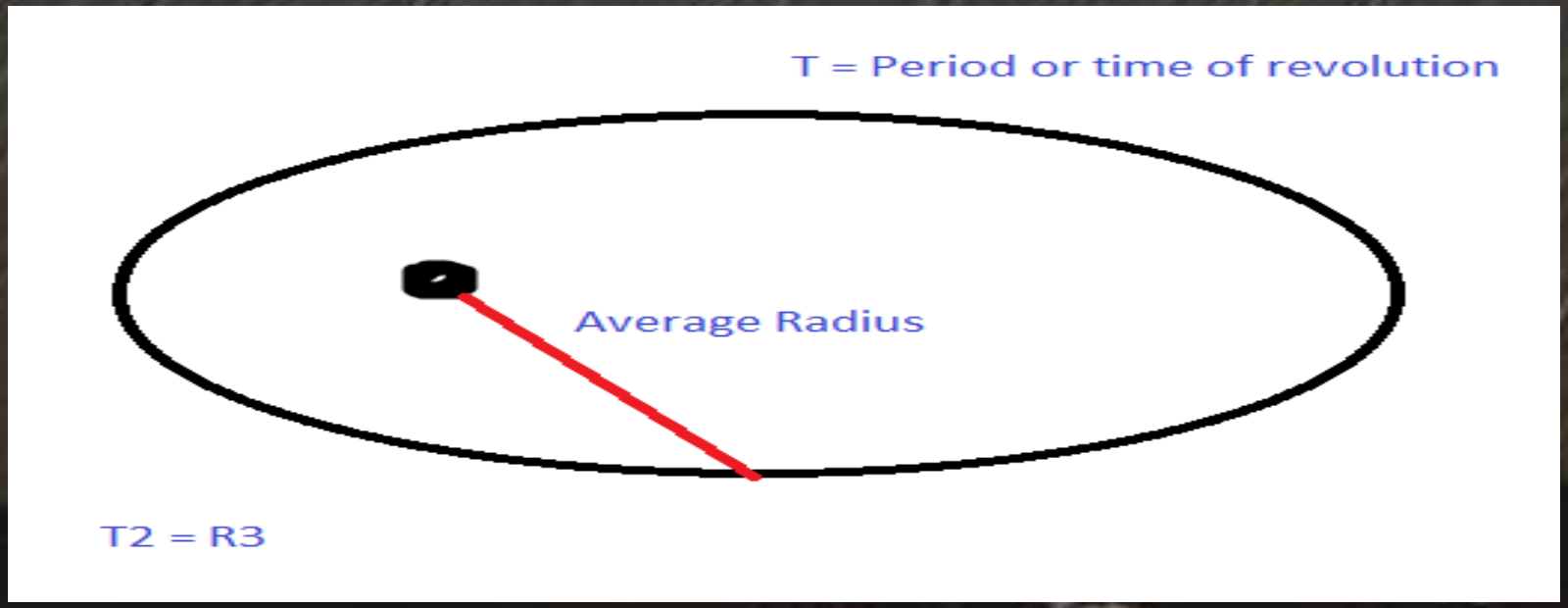
What Kepler noticed



2) A satellite covers equal area in equal time.

What Kepler noticed.

3) Knowing average distance of a satellite we can figure out how long it takes to orbit.
- Knowing orbital time can figure out satellite distance.

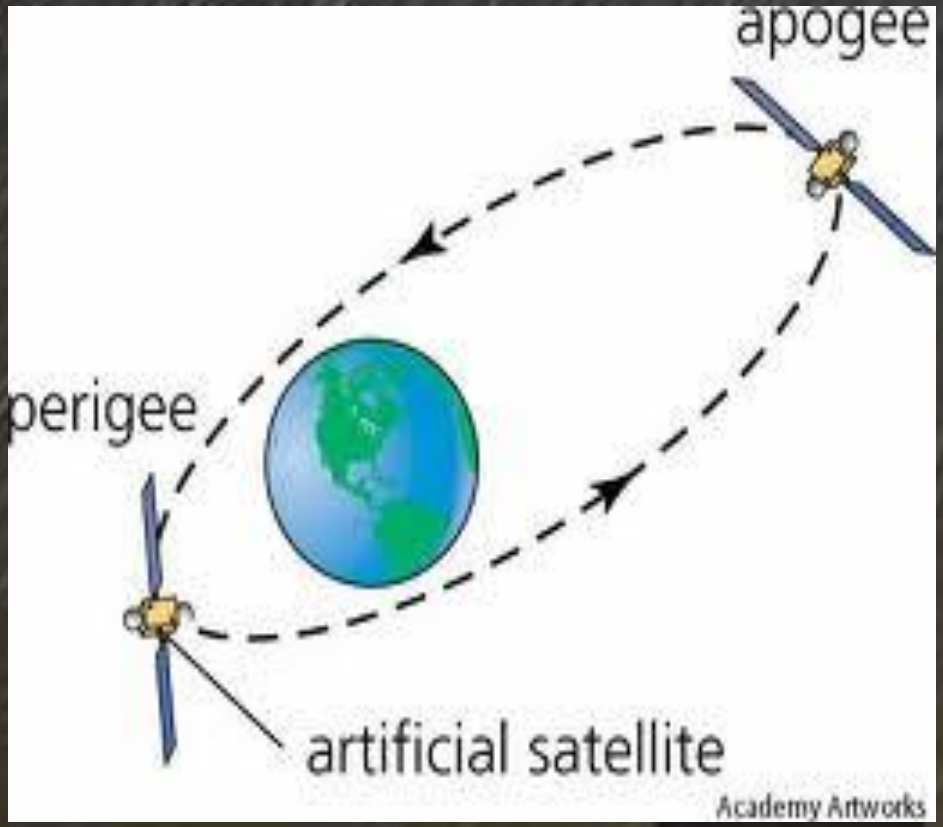


Laws of Orbit Laws

- 1) All planets travel in an ellipse.
- 2) Equal area is covered in equal time
- 3) Knowing how far a satellite is from the primary on average we can figure out how long it takes to orbit. Also, knowing how long it takes to orbit can figure out how far away the satellite is.

R

Basic planetary ellipse terms



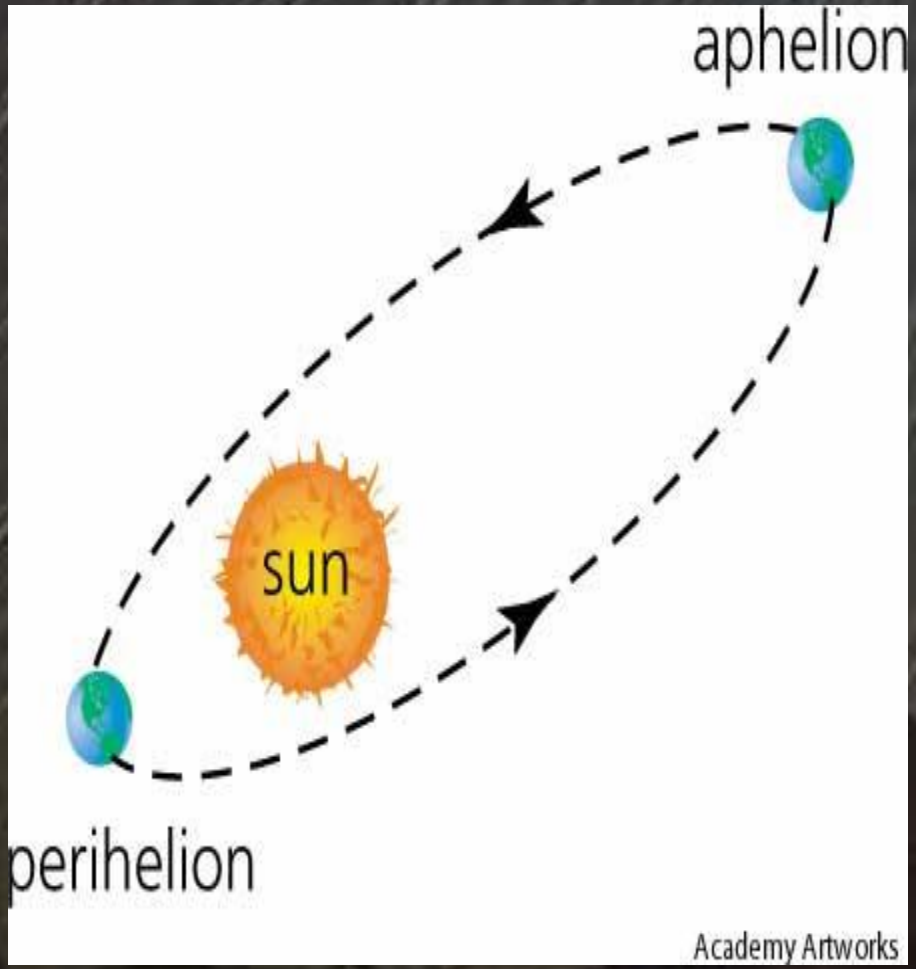
Apogee is when a satellite is furthest from the primary.(A=away)

Perigee is when a satellite is closest to the primary.
(P =by the primary)

- Who was the Greek God of the Sun?
- Helios was the Titan God of the Sun.

R

Basic terms of an ellipse



Aphelion is furthest from the sun.

Perihelion is closest to the sun

Distances in the Solar System

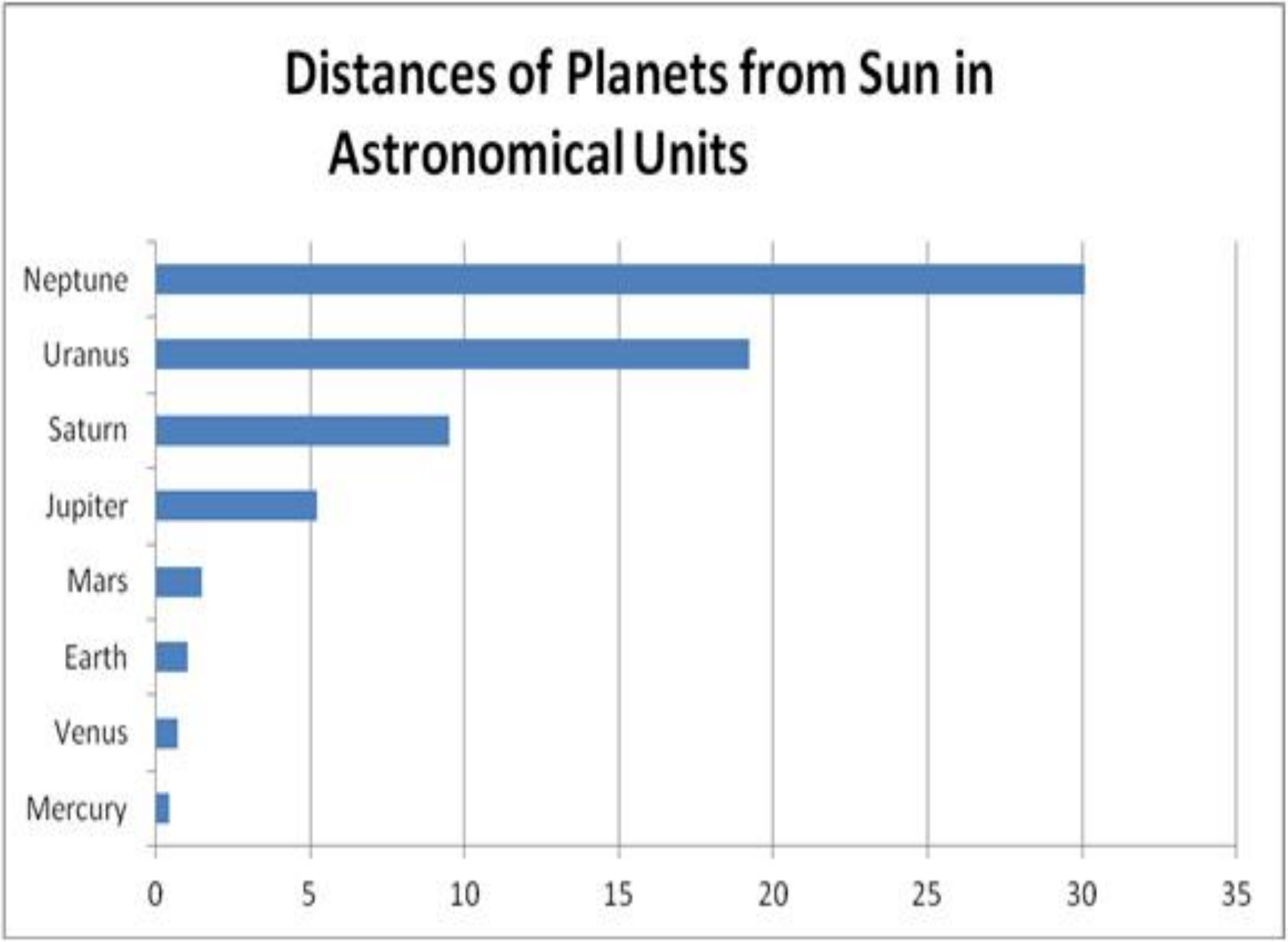
Is it easy to grasp how far away Neptune is if I tell you it is 2,829,691,160 miles from the sun?

Astronomical Unit –

An astronomical unit is the average distance from the Earth to the sun.

1 AU = 93 Million miles.

Neptune is ~ 30 AU from the sun.


Distances of Planets from Sun in Astronomical Units
Neptune
Uranus
Saturn
Jupiter
Mars
Earth
Venus
Mercury
0
5
10
15
20
25
30
35

Distances in the Universe

- Does the distance from Earth to the Sun mean anything in outer space?
- Light Year –

The distance light travels in 1 year.

Light travels 186,000 miles / second.

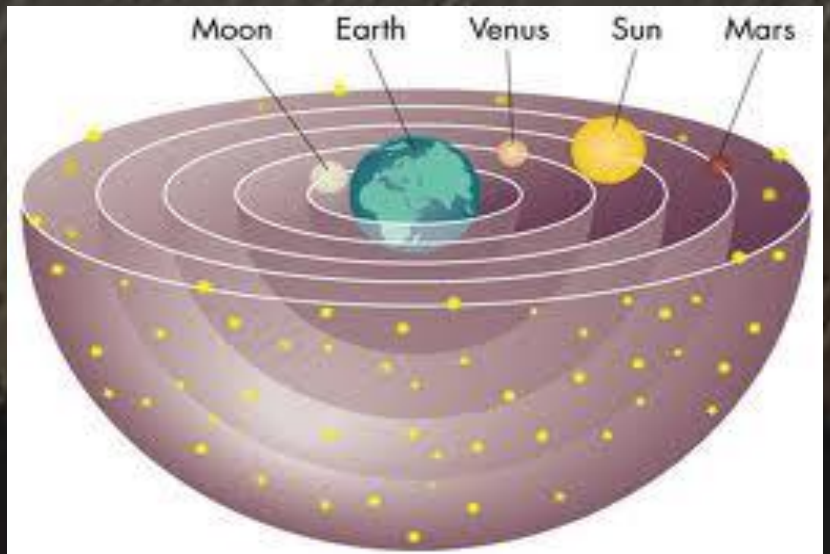
1 light year = **5,865,696,000,000 miles** or 5.8 Trillion miles.

Our Galaxy is 100,000 Light year across.

How does the universe work?

- How did the ancients believe the universe worked?
- Ptolemy thought the universe was:
- Geocentric –
- Earth centered:

  Everything revolves around the Earth.



How does the Universe work

How does our Universe work?

Copernicus said we live in a Heliocentric Solar System –

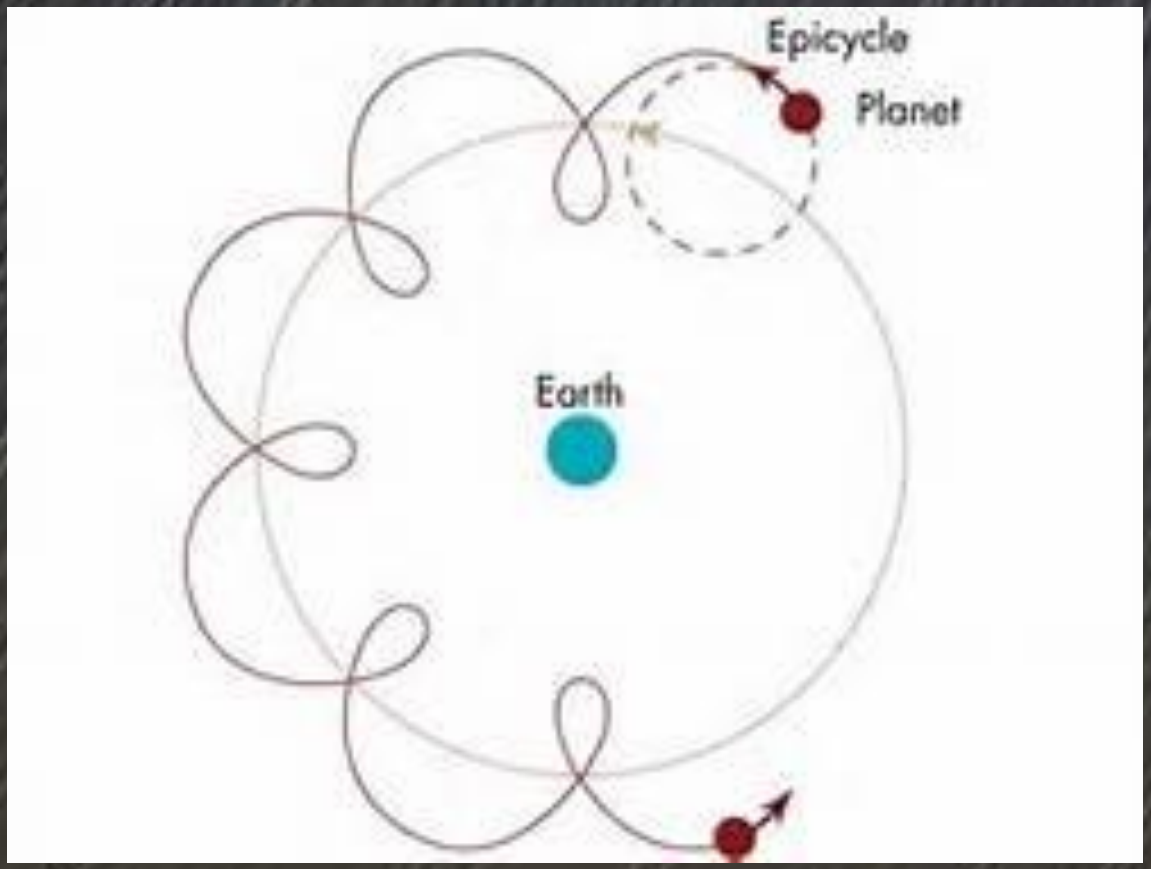
Sun centered:

- Everything revolves around the sun.

R

- Copernicus's only problem was he did not understand Retrograde motion: why some planets seem to reverse their nightly motion.

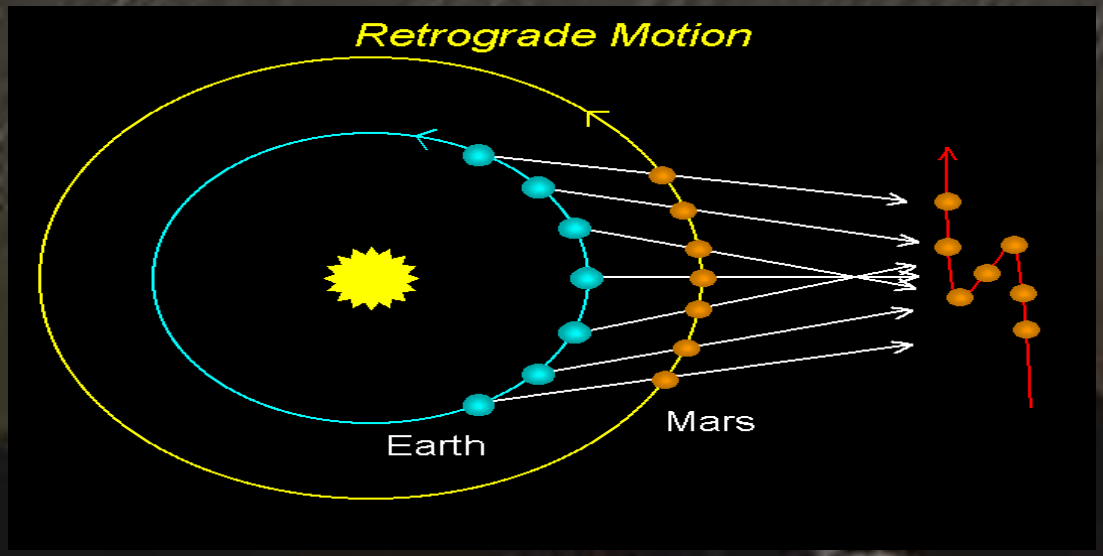
R



- Astronomers attempted to explain this by saying planets make circles inside circles (this was wrong).

R

- Kepler Proved we live in a Heliocentric universe by moving the planets in Ellipses which explained retrograde motion.



How does the universe work.

- Where does the Universe end?
- We do not know where the Universe ends. It is still expanding.
- Where is the Center of the Universe?

We do not currently see a center to the universe.

Kepler Lab Conclusion (G)

- What is a Satellite?
- What is a Primary?
- Define ellipse?
- Define Eccentricity?
- What shape do planets appear to orbit?
- What shape do planets actually orbit?
- Why do planets get faster as they get closer to the sun?
- RESEARCH Kepler?
- Give Keplers 3 laws?

Kepler Lab (R)

- Law 1
- Law 2
- Law 3
- Aphelion
- Perihelion
- AU
- Light year
- Heliocentric
- Geocentric
- Is our Universe Geocentric or Heliocentric?