

Refer to yesterday's lesson for the basics of ellipses.

Find the equation for the ellipse that has its **center at the origin** and satisfies the given conditions.

A Vertices  $V(0, \pm 6)$   
Foci,  $F(0, \pm 2)$

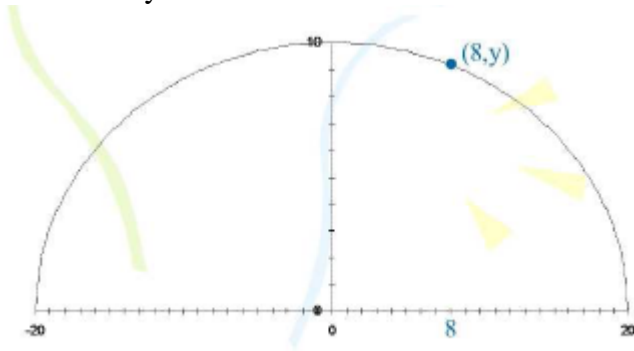
B Vertices  $V(\pm 7, 0)$   
Foci,  $F(\pm 6, 0)$

C Foci  $F(\pm 4, 0)$   
Minor Axis of length 6

D Horizontal minor axis of length 10  
Major axis of length 16

E Vertices  $V(\pm 5, 0)$   
Passing through point  $P(2, 3)$

- F The arch of a bridge is semi elliptical, with major axis horizontal. The base of the arch is 40 feet across and the highest part of the arch is 10 feet above the horizontal roadway.



- a) Find an equation for the arch.                      b) Find the height of the arch 8 feet from the center of the base.

Ellipses can be very ‘round’ (almost circular) or almost ‘flat’. **Eccentricity** is a number that describes the ‘*roundness*’ of an ellipse.

$$e = \frac{c}{a} \quad 0 < e < 1$$

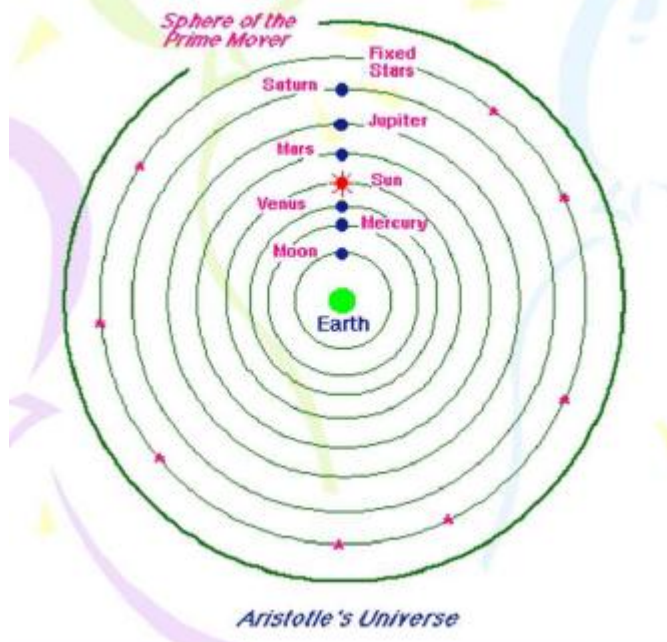
The closer  $e$  is to zero (focus close to center), the more circular or more round the ellipse. The closer  $e$  is to 1 (focus close to vertex), the more flat the ellipse is.

G Eccentricity =  $\frac{7}{8}$   
Vertices  $V(0, \pm 16)$

H Eccentricity =  $\frac{3}{4}$   
Foci  $F(\pm 12, 0)$

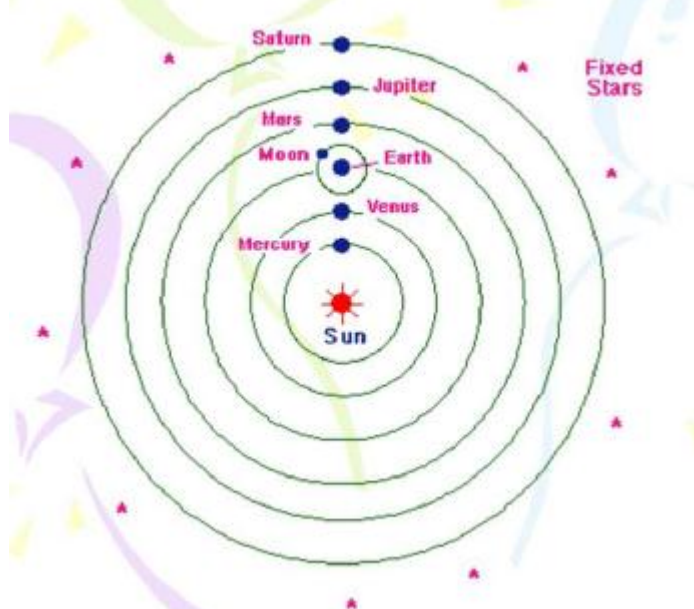
In Aristotle's day, it was thought that earth was the center of the universe. The sun was just a 4<sup>th</sup> planet from the earth. Every planet, plus the sun revolved about the earth.

### Aristotle (384 BC-322 BC)

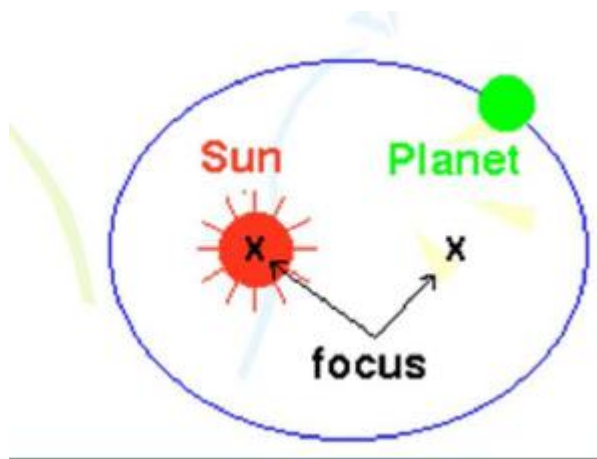


Then Copernicus decided that the earth was a planet and all planets revolved about the sun.

### Copernicus (1473-1543)



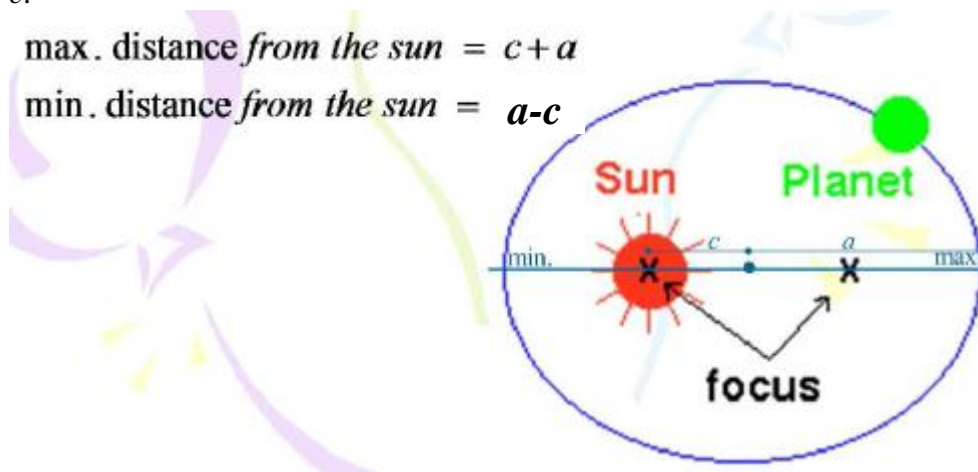
Finally Kepler (1571-1630) is credited with discovering that the planets revolve in elliptical orbits about the sun. He wrote 3 laws of planetary motion. The first law states: The orbit of each planet in the solar system is an ellipse with the sun as one focus. (The sun is not at the center of an orbit, but is one of the foci of the ellipse.)



Kepler's model shows that there is a time when a planet is closest to the sun and the most far from the sun. Examine the major axis below. The maximum distance from the sun will be the distance from the sun to the center ( $c$ ) added to the distance from the center to the vertex ( $a$ ). The minimum distance from the sun will be the difference between  $a$  and  $c$ .

$$\text{max. distance from the sun} = c + a$$

$$\text{min. distance from the sun} = a - c$$



- I The planet Mercury travels in an elliptical orbit that has eccentricity 0.206 and a major axis of length 72,000,000 miles. Find the maximum and minimum distance between Mercury and the Sun.