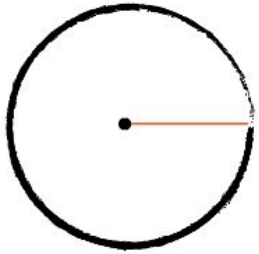
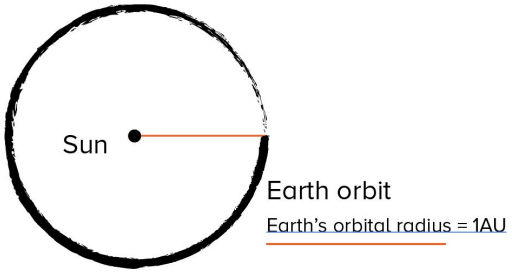
How To Make Scale Drawings of Solar System Orbits:

1. Draw Earth's Orbit *Use a pushpin, loop of string, and a pencil to draw a circle representing Earth's orbit, with the center representing the sun. Next, use a ruler to draw a straight line from the center to the outside of the circle (the Earth's orbital radius).*		**Why do you think it is called the *orbital radius*?**
2. Label Your Drawing *Label the sun, Earth's orbit, and Earth's orbital radius in your diagram. Use a ruler to measure Earth's orbital radius in centimeters, which in real life is equivalent to one* ***astronomical unit (1AU = Earth's orbital radius).***		**Measure your drawing:** Earth's orbit in cm _____ Earth's orbit in AU _____
3. Find The Scale Of Your Drawing *The scale of your drawing is a ratio that indicates precisely how small your drawing is compared to the real thing. In this case, the scale of your drawing is a ratio of the number of centimeters (cm) that represent one astronomical unit (AU).*	***Example*** *If the orbital radius you drew for Earth measures 3cm:* *1AU = 3cm* *Scale = 3cm / 1AU* *Drawing scale = 3cm/AU*	**Calculate scale:** 1AU = _____cm Scale = _____cm/ 1AU Scale = _____ cm/AU

4. Find Other Orbits For Your Drawing

Many objects (like planets and asteroids) orbit our sun! Choose one or more other objects that orbit our sun (you can use the Orbit Guide to help you) and find the orbital radius of each. Multiply each orbital radius length (AU) by the scale of your drawing (cm/AU) to figure out how big to draw each orbit.

Object #1: _____

Object orbital radius: _____AU

Drawing scale: _____cm/AU

Calculate the object's *scale* orbital radius:

= _____ * _____ = _____ cm

scale * *orbital radius*

Object #2: _____

Object orbital radius: _____AU

Drawing scale: _____cm/AU

Calculate the object's *scale* orbital radius:

= _____ * _____ = _____ cm

scale * *orbital radius*

5. Draw More Orbits!

Use the orbit lengths you calculated above to make new loops of string the length of each orbit, then add them to your drawing! For now, assume that all orbits are circular (even though most are elliptical), and make sure to use the sun as the centerpoint, or focus, when you draw.

Object example: Ceres

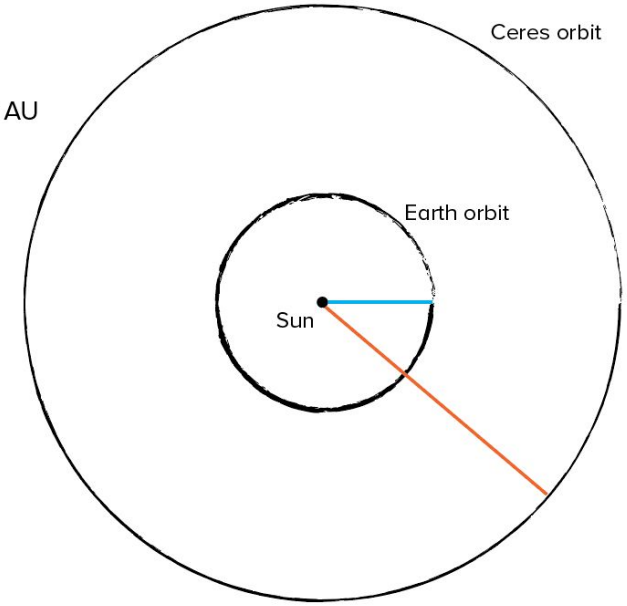
Ceres orbital radius = 2.7675 AU
Drawing Scale = 3.0 cm/AU

= (3.0 cm/AU) * 2.7675AU

= **8.3cm**

Earth's orbital radius = 1AU

Ceres' orbital radius = 2.7675



Reflection Questions:

1. Look at your illustration, which orbit is the largest, and which is the smallest? Does the size of each of the orbits you drew make sense when you consider the size of each orbital radius in real life? Why or why not?

2. Your representation of solar system orbits assumes you are looking at the solar system "top down" - how would your drawing appear differently if you were looking at the solar system from the side?

3. What assumption does your representation of solar system orbits make about the shape of each orbit?

4. Most models or illustrations are incomplete in some way, which can be helpful for simplifying information and conveying a single thing clearly. What information does your illustration not provide about the orbiting objects you chose, or about their orbits in particular? Try to come up with at least five types of information that your illustration doesn't show.
(Hint: how big are the orbiting objects, and how fast are they moving?)

5. How does removing the assumption that all planets are on the same flat plane, make a Hohmann transfer potentially more difficult? Provide evidence and reasoning to support your claim.

6. What problem(s) might occur if the Hohmann transfer was used to travel to an object outside of our solar system?