Name: _____ Date:_____

Mr. Croom's Physics Chapter 7: Rotational motion

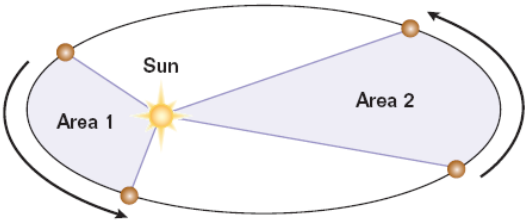
Kepler's Laws

Solve the following problems

1. (Serway, p. 253, #2) Does a planet in orbit around the sun travel at a constant speed? How do you know?

2. (Serway, p. 253, #3) Suppose you know the mean distance between both Mercury and the sun and Venus and the sun. You also know the period of Venus's orbit around the sun. How can you find the period of Mercury's orbit?

3. The planet shown below sweeps out Area 1 in half the time that the planet sweeps out Area 2. How much bigger is Area 2 than Area 1?



4. (Giancoli, p 142, #55) Halley's comet orbits the Sun roughly once every 76 years. It comes very close to the surface of the Sun on its closest approach. Estimate the greatest distance of the comet from the Sun. Is it still "in" the Solar System? What planet's orbit is nearest when it is out there? [*Hint*: The mean distance *s* in Kepler's third law is half the sum of the nearest and farthest distance from the Sun.]

5. (Walker, p. 379, #25) In July of 1999 a planet was reported to be orbiting the Sun-like star Iota Horologii with a period of 320 days. Find the radius of the planet's orbit, assuming that Iota Horologii has the same mass as the Sun. (This planet is presumably similar to Jupiter, but it may have large, rocky moons that enjoy a pleasant climate.)

6. (Giancoli, p 142, #52) The asteroid Icarus, though only a few hundred meters across, orbits the Sun like the planets. Its period is 410 d. What is its mean distance from the Sun?

7. (Giancoli, p 142, #53) Neptune is an average distance of 4.5×10^{9} km from the Sun. Estimate the length of the Neptunian year given that the Earth is 1.50×10^{8} km from the Sun on the average.

8. (Giancoli, p. 143, #59)The asteroid belt between Mars and Jupiter consists of many fragments (which some space scientists think came from a planet that once orbited the Sun but was destroyed). (*a*) If the center of mass of the asteroid belt (where the planet would have been) is about three times farther from the Sun than the Earth is, how long would it have taken this hypothetical planet to orbit the Sun? (*b*) Can we use these data to deduce the mass of this planet?

9. What shape is the orbit of Mars? What about Saturn? What about the Earth? The Moon around the earth? How about planet X around star Z?

10. When the earth is closer to the sun is it moving faster, at the same speed, or slower then when it is at the farthest distance from the sun?