Homework #4 Solutions
Astronomy 10, Section 2
due: Monday, October 3, 2011

Chapter 4; Review Questions 4, 7, 9, 10

4) Why did Copernicus have to keep small epicycles in his model?

Small epicycles were required because of the assumption of circular orbits and uniform speed.

7) How do the first two of Kepler's three laws overthrow one of the basic beliefs of classical astronomy?

The first two laws do away with both circular orbits (1st law) and constant speed (2nd law).

9) Explain how each of Galileo's telescopic discoveries contradicted the Ptolemaic theory.

Sunspots and lunar craters and mountains challenged the idea that celestial objects are unchanging, perfect orbs. The satellites of Jupiter showed that celestial objects could orbit something besides the Earth. And the phases of Venus showed that at least one planet orbited the Sun.

10) Galileo was condemned, but Kepler, also a Copernican, was not. Why?

Kepler was a Protestant living in Austria and Prague during the first half of the Thirty Year War (religious conflict between Protestants and Catholics) whereas Galileo was a Catholic living in Italy. It is said that Kepler was excommunicated for his science. However, he was not subjected to the severe persecution by the Catholic Inquisition which was so common at the time. On the other hand, Kepler had his own problems. His mother was repeatedly charged with witchcraft, and Johannes spent much of his time trying to free her of those charges.

Chapter 4; Problems 3, 5

3) If a planet has an average distance from the Sun of 4 AU, what is its orbital period?

$$P^2 = 4^3 = 64$$

$$P = \sqrt{64} = 8 \text{ years}$$

5) Neptune orbits the Sun with a period of 164.8 years. What is its average distance from the Sun?

$$a^3 = 164.8^2$$

$$a = \sqrt[3]{164.8^2} = 30.05 \text{ AU}$$