Astronomy 1102/1104 9 February, 2009
Exercise 5—Due in section from 16 February

Name: _____

Kepler's Laws

Section: _____

The questions and problems posed below should help you grow more comfortable with Kepler's Laws of Planetary Motion.

Kepler's First and Second Laws.

1. In the space to the right, draw an ellipse. We'll assume this is the orbit of an asteroid.

a. Put the symbol for the Sun at one focus.

b. Draw the semi-major axis of the orbit on your ellipse and label it.

2. Perihelion and aphelion are the points on the ellipse closest to and furthest from the Sun, respectively.

a. Label these points with a "P" and an "A".

b. Label the points on the ellipse where the asteroid will be moving at its fastest and slowest speeds.

Kepler's Third Law

3. Kepler's Third Law can be written as $p^2 \propto a^3$.

a. If p is the period in years, a is the semi-major axis in AU, and we're talking about objects orbiting the Sun, what is the constant of proportionality?

b. For the same units, will the constant of proportionality be the same or different for objects orbiting Jupiter?

Yes! There's more on Kepler's Third Law!

4. If an asteroid is orbiting the Sun with a semi-major axis of 4 AU, what is the period of its orbit? (You can do this calculation in your head—you really don't need a calculator.)

5. If an asteroid is in an elliptical orbit with a perihelion distance of 1.5 AU and an aphelion distance of 3.5 AU, what is the period of its orbit? You can round your answer to the nearest year. *Hint: Redraw the ellipse from questions 1 and 2 and mark the perihelion and aphelion distances. How are they related to the semi-major axis?*