Your name: _____

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AST 9: Homework 3

1] Does Kepler's second law teach us that a planet speeds up as it gets closer to the sun, or slow down?

2] The area of a triangle is $(1/2) \times$ base $\times$ height. If the height halves, how should the base change in order to keep the area fixed? If a planet is twice as far from the sun at its furthest point as it is at its closest, how might you guess the the orbital spends at the two points might be related? Why?

3] If we measure the semi major axis of a planetary orbit in A.U. (Astronomical Units) and the period in earth years, Kepler's third law simplifies (more-or-less) to $P^2 = a^3$. In other words, $P^2/a^3 = 1$. Check this for all the solar system planets.

Periods and semi-major axes of the planets

Planet	Period (years)	Semi-major axis (A.U.)	P^2/a^3
Mercury	0.24	0.39	
Venus	0.6	0.72	
Earth	1.0	1.0	
Mars	1.9	1.5	
Jupiter	11.9	5.2	
Saturn	29.4	9.5	
Uranus	84.0	19.2	
and Neptune	164.8	30.1	

4] We have seen that the smallest value of the eccentricity, $e = \sqrt{1 - \left(\frac{b}{a}\right)^2}$, is zero, when $a = b$. What might you deduce the largest value of e can be? Why? (Hint: it will occur when the semi-major axis, a, is much, much bigger than the semi-minor, b.)