

1. A hypothetical planet Upiter orbits the sun. Upiter's semi-major axis is 5.2 AU. The mass of Upiter is 0.001 that of the sun. The eccentricity is 0.2. For this problem, ignore the other planets.
  - a. (4 pts.) Compute Upiter's specific energy and specific angular momentum. (The specific energy is the energy per unit mass.)
  - b. (2 pts.) Compute the period of Upiter using Kepler's 3<sup>rd</sup> Law.
  - c. (2 pts.) Compute Upiter's distance when it is closest to the sun.
  - d. (5 pts.) Compute Upiter's speed when it is closest to the sun.
  - e. (5 pts.) Sketch the path of the sun. Show Upiter's position on your sketch. Compute the size of the path.
  - f. (1 pt.) Is the sun's orbit within the sun?
  - g. (3 pt.) Compute the sun's fastest speed in km/s. Can you walk that fast?
2. One way to find planets around other stars is to measure the speed of the stars. The speed changes periodically.
  - a. (5 pts.) Find the relationship between the speed of the star and the mass and semi-major axis of the planet.
  - b. (3 pts.) Plot speed the speed of the star vs. semi-major axis for a planet having Upiter's mass.
  - c. (5 pts.) Suppose you could measure a speed of 1m/s. At what orbital distance could you find a planet having Earth's mass ( $10^{-6}$  the mass of the sun)? At what orbital distance could you find a planet with Jupiter's mass?