

1. A comet orbits the sun with semi-major axis 40AU and eccentricity 0.9.
  - a. (3 pts.) Draw the comet's orbit.
  - b. (1 pt.) Find the specific energy of the comet in units of  $GM_{\text{sun}}\text{AU}^{-1}$ . (The specific energy of Earth is -0.5, for example.)
  - c. (3 pts.) Object X has the same absolute value of specific energy, but it is positive. Draw its orbit. Find its perihelion distance. Its eccentricity is 1.9.
2. This question concerns the paper, Fernandez, J. A. 1997, "The Formation of the Oort Cloud and the Primitive Galactic Environment," *Icarus*, 129, 106.
  - a. (5 pts.) Use Fig 1 of the paper by Fernandez to explain why we observe so many comets having semi-major axis of about 20,000AU.
  - b. (5 pts.) Most of the *observed* comets in the Oort Cloud have a semi-major axis of about 20,000AU, and yet that is not the most common value in the Oort Cloud. Explain.
  - c. (5 pts.) In the environment of the newly formed sun, what is most likely to have prevented comets from being expelled by repeated encounters with the Jovian planets? What is the evidence?