

1. Consider these ideas and measurements: A. Size of Earth measured. B. Periods of planets measured. C. Kepler finds Mars' orbit (1601). D. Kepler discovers 3rd law (1618). E. Cassini & Richer measure Earth-Mars distance (1672) using Paris-Cayenne baseline.
 - a. (5 pts.) Draw an idea map for obtaining the distance between Mars and the sun in feet.
 - b. (5 pts.) Draw an idea map for obtaining the distance between Jupiter and the sun in feet.
2. **Parallax.** You are out on the plains east of Denver at twilight. There is a mountain in the distance, and Venus is visible just above the mountain. You want to measure the distance to the mountain.
 - a. (10 pts.) Describe how you could measure the distance to the mountain without going up to the mountain. Draw picture(s) of what you would see. On another drawing show the key items in your description.
 - b. (5 pts.) Make up a plausible numerical example of your method. Show numerical values of the parallactic shift between observing stations for a mountain one km away and for mountain 10 km away. In other words, for the baseline that you chose, compute the parallactic shift for these two distances. Recall that a parallactic shift of 0.0016 radians (1mm at arm's length) is not easy to measure.
 - c. (5 pts. bonus) If the measurements for your method take less than one minute to do, you get a 5-point bonus. You must estimate the time needed to make the measurements.
3. **The distance to a pretend 61 Cyg** is 3.4 pc, and its coordinates are $21 \text{ hr} + 0^\circ$. For this problem, assume the orbit of the earth is along the celestial equator. (For simplicity, the declination has been changed from 38° of the real 61 Cyg to 0° .)
 - a. (5 pts.) Draw a picture to show the location of the star and the location of the earth on the solstices.
 - b. (5 pts.) On which two dates is the parallactic shift the zero? On which two dates is the parallactic shift largest?
 - c. (5 pts.) Sketch a plot to show how the parallactic shift changes with time over the course of a year.
 - d. (5 pts.) How large is the greatest parallactic shift?