

1. You are talking via phone to an alien from planet X. Without transferring any pictures, can you explain to the alien which is his left hand. (Assume the alien has a left and right hand, but nothing else about his surroundings are known; and, you can not transmit any visual information.)
2. The average density of the galaxy is  $3 \times 10^{-28} \text{ kg/m}^3$ . Convert this to protons per  $\text{m}^3$ .
3. Shrink the sun to a point. Compute the escape velocity (from classical physics) as a function of radius. Determine the radius where the escape velocity equals the velocity of light.
4. Your mission, should you choose to accept it,\* is to make a map on a flat piece of paper of the northern hemisphere of the world in such a way that the distance between cities is preserved. Is this possible? Why? (\*P.S. You must accept this mission for full credit.)
5. Is J.R.R. Tolkien's Middle earth flat? Use the information contained in the following figure.

