1. For two people to balance on a see-saw,

   mass1 * (distance between 1 and the pivot) = mass2* (distance between 2 and the pivot)

   a. Use the equation.
      M(al)*1m = M(sal)*x.
      Since Al has the same weight as Sal,
      x=1m
      He should sit one meter away.

   b. Use the equation.
      (M(al)+M(sal))*1m = M(Bernie)*x
      Since the masses are the same,
      2 *1m = x
      Bernie should sit two meters away.

   c. For both cases the center of mass is at the pivot point.

2.

   a. I set up the equation with the sun at the center of the coordinate system. Making x the distance from the origin to the center of mass of the system.
      x * msun = (1.5e8 –x) * (1e-6) * msun
      msun (the mass of the sun) cancels.
      x = (1.5e8 –x) * (1e-6)
      x = 150 – x/1,000,000.
      The second term is negligible. x=150km.

   b. I'll… just tell you what I included in the picture. The earth at one end of a scale with the sun on the other, zoom in on the sun, showing the radius of the sun. Zoom in on the center of the sun, showing the separation between the center of the sun, and the point the sun orbits around. Be sure to label everything, the sun, the earth, the distances, you're scale, and the amount you are magnifying by.

   c. The sun's orbit time is the same as the earth's, one year or 30,000,000 s. The distance the sun travels in that time is the circumference of its orbit. Therefore
      D = 2 * pi * r
      Note that here r is the radius of the sun's ORBIT (from part a), not the radius of the sun. Then the speed, v = D/T = (2*pi*150) / 30,000,000
      This gives a speed of (after converting from km to m) .0314 m/s
      You CAN walk that far. Easily. Think about it. less than a foot in a second. Go ahead, take a step. You did it. (even if you had a bum knee)

   d. The orbital speed of 51 Peg was too slow for it to be orbiting another object of similar mass (a star).

   e. d) The orbital speed of 51 Peg was too slow for it to be orbiting another object of similar mass (a star).