Homework #10

Due by the end of office hours Wednesday, April 11

All of these problems use the mathematical skill of fractions/ratios/percentages that you cultivated in Homework #9. Keep this in mind as you attempt them, and see me at office hours if you have trouble.

1. The diameter of the Earth is 7926 miles at its equator. The highest point on Earth (Mt. Everest) is 5.5 miles above sea level; the lowest point (Mariana Trench in the Pacific Ocean) is 6.8 miles below sea level. Hence, the "roughness" of the Earth's surface is 5.5+6.8 = 12.3 miles. What is the ratio of the roughness of the Earth's surface to the Earth's diameter? Express this ratio as a fraction, decimal and percentage.

2. A basketball has a diameter of about 25 centimeters (cm). The bumps on a basketball's surface are about 1 millimeter (mm) high. What is the ratio of the roughness of the basketball to the diameter of the basketball? Now, express this ratio as a fraction, decimal and percentage.

3. Based on your answers to questions #1 and 2, would you characterize the Earth as lumpy or smooth in comparison to a basketball? Justify your answer in ***one or two*** sentences by discussing the numbers in the first two questions.

4. The distance between the Sun and Earth is 1.5×10^8 km.
The diameter of the Earth is 1.3×10^4 km.
(a) If you could line up a series of Earths side-by-side, how many Earths would fit between the Sun and Earth? Give the "exact answer rounded to the nearest single earth (no decimal point)
(b) Round your answer from (a) to the nearest single power of ten, such as 10^3.
(c) Explain why you think the distance between Earth-Sun seems either crowded or empty by ***discussing*** your answers to parts (a) and (b). Use only one or two sentences. Be sure you think carefully about the meaning of the word "crowded."

5. The distance between the Sun and the nearest star (Proxima Centauri) is 1.3 parsecs. Recall that there are 3.26 light years in 1 parsec.
(a) It takes light 4.64 seconds to cross the diameter of the sun. How far is this in light years?
(b) How many Suns would fit side-by-side between the Sun and Proxima Centauri? Express your answer rounded to the nearest whole sun and then as the nearest power of ten.

6. The distance between our galaxy (the "Milky Way") and the next nearest large galaxy (the Andromeda galaxy or M31) is about two million light-years. The **radius** of the Milky Way is about 50,000 light-years.
(a) How many Milky Ways would fit side-by-side between these two galaxies? Express your answer both rounded to the nearest whole milky way and then as the nearest whole power of ten.
(b) Compare your answers to questions 3, 4b and 5a. Which situation do you think seems most crowded, the Solar System, the space between stars, or the space between galaxies? ***Explain your reasoning*** using complete sentences AND your calculations from problems 4-6.