Homework 3

Please write all your work and answers on separate paper. (You can turn in this page with the questions or not, as you wish). Show all your work on calculations and explain your reasoning whenever you can.

1. **Twinkle, Twinkle:** Explain why stars appear to twinkle.

2. **Mirror, Mirror:** Why are all modern major telescopes reflectors rather than refractors?

3. **Why so high?** Why are major astronomical observatories built on top of mountains?

4. **Fore!** When the astronauts visited the Moon one of them took along a golf club and some golf balls. With the Moon's reduced gravity he hit them pretty far. Would it be possible for a person to hit a golf ball on the Moon hard enough that it would leave the Moon? Let's find out:

   a. What is the escape speed of the Moon (in m/s)?

   b. Estimate the speed of a golf ball hit on the Moon as follows: A well hit golf ball might travel up to 250 yards. For making a rough estimate, a yard is about a meter. That ball might be in the air for about 5 seconds. From this information, what is a rough estimate of the speed of a golf ball on Earth (in m/s)?

   c. Assuming an astronaut can hit the ball on the Moon just as hard as he can on Earth, would he or she be able to hit it hard enough to escape the Moon? Explain why or why not.

5. **Lunar Tug of War:** Gravity pulls the Moon toward the Earth, but gravity also pulls on the Moon toward the Sun. Which is stronger? Let's use Newton's law of universal gravitation to find out:

   a. Compute the force of attraction of the Earth on the Moon (in Newtons).

   b. Compute the force of attraction of the Sun on the Moon (in Newtons) during the new moon.

   c. Are they about the same, or is one larger than the other? If one is larger, how much larger is it <u>relative</u> to the other?

   d. Does your answer change if we compute the attraction of the Sun on the Moon during a full moon rather than the new moon? Explain.