Week 1 In-Class Problems

Unless otherwise indicated, all problems come from "Essentials of College Physics"
Make sure to clearly state all assumptions you make and to show your work.

Note: On this problem set (and future problem sets), I will use the following notation:
[Chapter].[Problem #]
So, the book problem assigned this week is Problem #41 in Chapter 1.

1. You are outside Dickinson trying to get on top of the building (from the outside). Ladders tend to slip when they are too close to horizontal. Say that the minimum safe angle for a ladder is 35 degrees. What is the longest ladder that will work to get up onto the Dickinson roof?

2. How many meters in a furlong? How many square meters in a square furlong? (*Hint: Answers are not the same*).
   (Possibly) Helpful Information: 1 furlong = 220 yards, 1 yard = 3 feet,
   1 foot = 0.305 meters

3. Below are two versions of a famous saying:

   a. "There are more stars in **the universe** than there are grains of sand on all the beaches of Earth."

   b. "There are more stars in **the Galaxy** then there are grains of sand on all the beaches of Earth."

   The number of stars in our Galaxy is about 300 billion (3×10^{11}), whereas the number of stars in the observable Universe is closer to 10^{21}. Using an order-of- magnitude calculation, determine whether the number of grains of sand on all the beaches of Earth is closer to the number of stars in our galaxy or the number of stars in the observable Universe.

4. In Olympic Swimming Races (or any high-level timed swimming event), swimmers are only timed to the nearest hundredth of a second (i.e. $\pm$ 0.01 sec). This is not because of the accuracy of the timing equipment; the equipment has the precision to time to within a thousandth of a second. Instead, tolerances in the construction of the pool limit the accuracy of lane length to within $\pm$ 3 cm. Given this information (and winning times from the Tokyo 2020 50m freestyle race), show that only timing to within a hundredth of a second is warranted. Do longer races allow you to time to higher accuracy? Why or why not?

5. Problem 1.41