

Physics 1090 Homework #2

Due Thursday, September 10, 2:00 pm

Reading assignment: Chapters 4, 5, 6 of [the notes](#).

1. How high does the Sun get in the sky at midday? (The high point is close to 1 pm since we're on EST.) By "how high" I mean an angle; which I want you to measure, by finding an upright object (like holding a pencil vertical) and marking off its shadow (easier to do with two of you!), then drawing a triangle. Or, you could angle a pencil towards the Sun so it has no shadow, then measure the angle it is making with the vertical (or horizontal—just be clear which one you mean in writing this up).

Given that Charlottesville is 38 degrees from the Equator, what would that angle be on Midsummer's day? On Midwinter's day? (This is a lot easier to figure out if you have a globe to look at – try to find one!)

2. Finding the angular size of the moon: choose some suitable round object, such as a dime, quarter, a tennis ball, ping pong ball or whatever, and while you are looking at the moon, have your partner hold the ping pong ball (say) at just the right distance that it looks to you exactly the same size as the moon. You could try it directly in front of the moon, to just block it, or side by side with the moon, whatever works best for you. Now, measure the distance from your eye to the ball, and measure the diameter of the ball. Given that the moon is 230,000 miles away, figure out the moon's diameter. What is the *angular* size of the moon? That is, if you take two pencils, point one at the bottom of the moon, and one at the top, as seen from here, what is the angle between them? You can answer in degrees or radians. (One *radian* is the angle of a piece of pie having the curved side the same length as the straight sides.)

3. You set up base camp on a bear hunting expedition. You travel exactly twenty miles south, rest for a meal, then go twenty miles east, where you shoot a bear. Now you go twenty miles north and you are back at your base camp. What color was the bear? Give your reasoning.

4. Plato defined a regular solid as one with every edge the same length, and the same number of edges meeting at each vertex. Explain in your own words (but with diagrams) why there can only be five such solids.

5. Prove that the square root of *three* cannot be expressed as a ratio of whole numbers. (Hint: remember that any whole number can be expressed as a product of prime factors. The proof of the square root of two was all about odd and even numbers, this time concentrate of factors of 3, not 2.)