Assignment II, PHYS 111 (General Physics I)
Fall 2022
Due 9/2/22 at start of class

In each homework assignment, I will list suggested homework problems out of the book. These are worth practicing – some may even appear on exams verbatim – but since they are in the text, finding answers on-line should be straightforward and these textbook problems will not be graded. I suggest you do them – many of them will be easier than the graded homework and they would be a good thing to tackle if you come to the morning problem-solving sessions or work in any study groups.

After the suggested book problems, I will give a list of problems that I myself wrote. *SOME* of these problems will be graded, but you won't know which ahead of time. The ones that I grade will be the same for everyone in the class.

I will supply you with an answer key to all of the problems that I wrote – even the ones that I did not grade.

As always, please legibly write (or type) your answers on separate paper.

To help with this homework, you should read the first sections of your text and watch the videos associated with the lectures on the course webpage: http://larsenml.people.cofc.edu/phys111_fall22.html.

(Ungraded) suggested textbook practice problems.

(All problems are odd problems (that have answers in the back of the book) out of Halliday, Resnick, and Walker, 10th Ed.)

Chapter 1:
Problems: 1, 7, 13, 15, 23, 37, 41, 49, 55

Chapter 3:
Questions: 1, 7, 13
Problems: 3, 7, 9, 15, 21, 23, 27, 33, 35, 39, 41, 53, 57, 69, 75

Graded homework problems

As stated above, some subset of the problems below will be graded for accuracy. Unless you are a gambler, I recommend completing all of them.

1. A cone expands from a single point to a maximal *diameter* of 3.5 inches. The height of the cone is 21 inches. What is the volume enclosed by the cone *in cubic centimeters*? (1 cubic centimeter, also sometimes called a cc for short, is a volume that is 1 cm x 1 cm x 1 cm).

2. What is the area of the surface of Jupiter in square micrometers? (You may assume Jupiter is a sphere. You may need to refresh your memory to find the surface area of a sphere. The radius of Jupiter is easy to Google.)

3. My dad is a hobbyist farmer. He has a modern tractor pulling a machine behind it (a combine) that harvests some of his crops. A combine works through the crops not too dissimilar to a lawnmower cutting grass in a yard; it can harvest a swath 3 feet across and the tractor can move at a comfortable 6 miles per hour while pulling the combine. What is the minimum amount of time it would take for my dad to fully harvest a 7.3 acre field with this tractor-combine setup? (Assume that there are no machinery break-downs, the tractor stays moving at constant speed throughout, and the dimensions work out right so that there is no "wasted" movement of the tractor that doesn't ingest new crops into the combine.)

4. The gateway arch in St. Louis has a total estimated mass of 43.2 million kg.

   a) The approximate mass of a penny is 2.5 grams. How much money would you have if you had the mass of the gateway arch in pennies?

   b) The approximate mass of a quarter is 5.670 grams. How much money would you have if you had the mass of the gateway arch in quarters?

   c) The hope diamond is worth approximately 250 million dollars. The approximate mass of a dollar coin is 8.100 grams. If you had the gateway arch's mass in dollar coins, how many hope diamonds could you afford to buy the hope diamond at its appraised value? (Justify your answer with a computation).

Define the following vectors (for use in the rest of this assignment):

$$\vec{A} = (5.2\text{ m})\,\hat{\imath} + (0.2\text{ m})\,\hat{\jmath}$$
$$|\vec{B}| = 5.4\text{ m} \qquad \theta_B = 23^\circ$$
$$|\vec{C}| = 10.3\text{ m} \qquad \theta_C = 137^\circ$$
$$|\vec{D}| = 8.7\text{ m} \qquad \theta_D = -24^\circ$$
$$\vec{E} = (1.1\text{ m})\,\hat{\imath} - (4.1\text{ m})\,\hat{\jmath}$$
$$\vec{F} = -\,(5.6\text{ m})\,\hat{\jmath}$$

Angles are measured as done in class; (starting from the x axis, in such a way that the positive y axis is 90°).

5. Calculate the following. For each, leave your answer in both of the following forms: (i) Component form (like vectors $\vec{A}, \vec{E}$, and $\vec{F}$ above), and (ii) magnitude and direction form (like vectors $\vec{B}, \vec{C}$, and $\vec{D}$ above).

   a) $\vec{A} + \vec{B}$
   b) $\vec{B} - \vec{C}$
   c) $\vec{C} + \vec{D} - \vec{E}$
   d) $\left(\vec{B} + \vec{C}\right) - \left(\vec{E} + \vec{F}\right)$

6. Find a vector $\vec{M}$ that satisfies the following: $\vec{A} + \vec{B} - 2\vec{C} + 3\vec{M} = 0$.

7. If $\vec{A} \cdot \vec{G} = 17.0\text{ m}^2$ and $\vec{E} \cdot \vec{G} = -10.0\text{ m}^2$, then what is $\vec{G}$? (Leave your answer in magnitude and direction form).

8. Compute the following.

   a) $\vec{A} \cdot \vec{E}$
   b) $\vec{E} \cdot \vec{F}$
   c) $\vec{E} \cdot \vec{E}$