Physics 237 Due: February 18, 2022
Homework Set # 4 12.00 pm

Write the following text on the front cover of your homework assignment and sign it. If the text is missing, 20 points will be subtracted from your homework grade.

Honor Pledge for Graded Assignments
"I affirm that I have not given or received any unauthorized help on this assignment, and that this work is my own."

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Signature _____

1. Chapter 4, Problem 1 (page 120).
2. Chapter 4, Problem 2 (page 120).
3. Chapter 4, Problem 38 (page 122).
4. Chapter 5, Problem 2 (page 169).
5. Chapter 5, Problem 15 (page 171).
6. **20 points extra credit:** Use Mathematica to solve the following differential equation for the harmonic oscillator:

$$\frac{d^2\psi(x)}{dx^2} = \frac{2m}{\hbar^2}\left[\frac{1}{2}Cx^2 - E\right]\psi(x)$$

Make the assumption that

$$\frac{(Cm)^{1/4}}{\hbar^{1/2}} = 1$$

It is found that the energy E is quantized and can only take on the following values:

$$E_n = \left(n + \frac{1}{2}\right)\hbar\sqrt{\frac{C}{m}} \quad \text{where } n = 0,1,2,3,.....$$

Calculate and show the probability density function for n = 0, 13, and 50. Compare these distributions with the classical distribution shown in 5-3.

In order to receive the extra credit, you should create a Mathematica Notebook, showing on the relevant calculations and graphs, and submit it electronically to Prof. Wolfs at wolfs@pas.rochester.edu. The name of the file should be hw04p06XXYYYYYYYY.nb where XX are your initials and YYYYYYYY is your student id number. The subject of the email should start with hw04p06XXYYYYYYYY.