

**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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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:

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

Calculate and show the probability density function for  $n = 0, 13, \text{ and } 50$ . 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](mailto: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.