Please provide your solutions on a separate sheet of paper provided.
Write your name down first, on that sheet!
You can keep this sheet.

1 problem, 15 minutes.

Problem 1 Consider the following potential energy.

$$V(x) = \begin{cases} \infty & \text{if } x < 0 \\ \frac{1}{2}kx^2 & \text{if } x > 0 \end{cases}$$

(a) Apply the Bohr-Sommerfeld quantization rule

$$\oint dx\, p \;=\; (n+\gamma)h \qquad\qquad n = 0, 1, 2, \ldots \text{ but } n \gg 1$$

to find the quantized energy level E_n for this problem in terms of n and $\hbar\omega$, where $\omega = \sqrt{k/m}$.

(b) It happens that $\gamma = 3/4$ according to the WKB approximation. Compare your result in part (a) with the exact quantum mechanical result: $E_n = \left((2n+1) + \frac{1}{2}\right)\hbar\omega$, $n = 0, 1, 2, \ldots$.

(c) Explain the meaning of the condition "$n = 0, 1, 2, \ldots$ but $n \gg 1$."

(d) (Extra credit) Derive the exact quantum mechanical result for E_n stated in part (b), from the known result, $E_n = \left(n + \frac{1}{2}\right)\hbar\omega$, of a *full* simple harmonic oscillator ($V(x) = \frac{1}{2}kx^2$ for any x), and the boundary condition imposed at $x = 0$ for this problem.

Your name: