2. Consider a 3-dimensional, spherically symmetric, isotropic harmonic oscillator with a potential energy of $V(r) = \frac{1}{2}\mu\omega^2 r^2$. The Hamiltonian in this case is:

$$\hat{\mathbf{H}} = -\frac{\hbar^2}{2\mu r^2}\frac{d}{dr}\left(r^2\frac{d}{dr}\right) + \frac{1}{2}\mu\omega^2 r^2$$

a. Use the trial function $\varphi_a = e^{-ar}$ and find the value of the parameter a that minimizes the energy, and find that minimum energy.

b. Repeat the process for the trial function $\varphi_b = e^{-br^2}$ and find the parameter b and the minimum energy.

c. The actual minimum energy turns out to be $E_0 = \frac{3}{2}\hbar\omega$ (i.e. each dimension contributes the usual $\frac{1}{2}\hbar\omega$). Compare the values you calculated in parts a and b to this value. Which is closer? Why do you think that is the case?