

### Special Problem 7.3

Use the variational method with trial wave functions

$$\psi_{\alpha,k}(r) = N_{\alpha,k} r^k e^{-r^2/\alpha^2} \quad (1)$$

to estimate the ground-state energy and wave-function for the two-dimensional system described by the hamiltonian

$$H = \frac{\mathbf{p}^2}{2m} + \frac{m\omega^2}{8b^2} (\mathbf{r}^2 - b^2)^2 \quad (2)$$

in which  $\mathbf{r}$  and  $\mathbf{p}$  are 2-vectors, and  $r = \sqrt{\mathbf{r}^2}$ . What is the normalization constant  $N_{\alpha,k}$ ?