A particle in the harmonic oscillator potential has the initial wave function
\[ \Psi(x,0) = A[u_0(x) + u_1(x)] \]
for some constant, A.

(a) Normalize \( u_0(x) \).
(b) Use the raising operator to get \( u_1(x) \).
(c) Normalize \( \Psi(x,0) \).
(d) Find \( \Psi(x,t) \) and \( |\Psi(x,t)|^2 \).
(e) Find the expectation value of x as a function of time. Notice that it oscillates sinusoidally. What is the amplitude of oscillation? What is the (angular) frequency?
(f) Use your result in (e) to determine \( \langle p \rangle \). Check that Ehrenfest’s equation,
\[ \frac{d\langle p \rangle}{dt} = -\langle \frac{dV}{dx} \rangle, \]
holds for this wave function.
(g) Graph/animate \( |\Psi(x,t)|^2 \) from \( t = 0 \) to \( t = (4\pi/\omega) \) using Maple. You can use the one for the double well as a template.