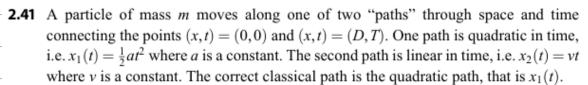
dimensional simple harmonic oscillator potential $V(x) = m\omega^2 x^2/2$.



- a. Find the acceleration a for the correct classical path. Use freshman physics to find the force F = ma = -dV/dx and then the potential energy function V(x) in terms of m, D, and T. Also find the velocity v for the linear (i.e. incorrect classical) path.
- b. Calculate the classical action $S[x(t)] = \int_0^T \left[\frac{1}{2}m\dot{x}^2 V(x)\right]dt$ for each of the two paths $x_1(t)$ and $x_2(t)$. Confirm that $S_1 \equiv S[x_1(t)] < S_2 \equiv S[x_2(t)]$, and find $\Delta S = S_2 S_1$.
- c. Calculate ΔS/ħ for a particle which moves 1 mm in 1 ms for two cases. The particle is a nanoparticle made up of 100 carbon atoms in one case. The other case is an electron. For which of these would you consider the motion "quantum mechanical" and why?
- 2.44 a. Write down an expression for the classical action for a simple harmonic oscillator for a finite time interval.
 - b. Construct $\langle x_n, t_n | x_{n-1}, t_{n-1} \rangle$ for a simple harmonic oscillator using Feynman's prescription for $t_n t_{n-1} = \Delta t$ small. Keeping only terms up to order $(\Delta t)^2$, show that it is in complete agreement with the $t t_0 \to 0$ limit of the propagator given by (2.290).