$$\text{Rest} = \int dx\, \psi^* \frac{1}{2m}\frac{\hbar}{i}\frac{\partial}{\partial x}\left(\frac{\hbar}{i}\frac{\partial \psi}{\partial x}\right) \cancel{+ \psi^* \cdot \_\_}^{\to 0}$$

$$+ \frac{\hbar^2}{2m}\int dx\, \psi \frac{\partial^2 \psi^*}{\partial x^2} \cancel{- \psi\, \partial^2}^{\to 0}$$

$$= \frac{-\hbar^2}{2m}\left[\int \psi^* \frac{\partial}{\partial x}\frac{\partial \psi}{\partial x}\,dx - \int \psi \frac{\partial}{\partial x}\frac{\partial \psi^*}{\partial x}\,dx\right]$$

$$= \frac{-\hbar^2}{2m}\left[-\int \psi^* \frac{\partial \psi}{\partial x}dx + 0 + \int \psi \frac{\partial \psi^*}{\partial x}dx \pm 0\right]$$

$$= \frac{-\hbar^2}{2m}\left(\cancel{\int \psi^* \psi\, dx} - \cancel{\psi^* \psi} - \cancel{\int \psi \psi^* dx} + \cancel{\psi \psi^*}\right)$$

$$= 0$$

$$\Rightarrow \boxed{\frac{d\langle p\rangle}{dt} = -\left\langle \frac{\partial V}{\partial x}\right\rangle} \quad \text{Proved.}$$

Problem 1.8. Suppose you add a constant V_0 to the ~~point~~ potential energy. (by constant: independent of x, t) In classical mechanics this doesn't change anything. but what about quantum mechanics? Show that the wave-function picks up a time dependent phase factor: $\exp(-iV_0 t/\hbar)$. What effect does this have on expectation values of dynamic variables?

Solution: ~~Solve~~ Use Schrodinger's eqn for $\phi = \psi e^{-iV_0 t/\hbar}$

and use $V \Rightarrow V_0 + V$

expectation value remains same as its a phase factor and its complex conjugate cancels.