Expectation Value

Sunday, September 18, 2016 7:40 PM

Question: Mathematically, how does one write the expectation value of distance, $\hat{x}$, in the 1D case?

$$\langle x \rangle = \frac{\langle \psi | \hat{x} | \psi \rangle}{\langle \psi | \psi \rangle} \leftarrow 1$$

$$= \frac{\langle \psi | x | \psi \rangle}{\langle \psi | \psi \rangle} \leftarrow 1$$

$$= \frac{\int \psi^* (\hat{x} \psi) \, dx}{\int \psi^* \psi \, dx}$$

Approach To Solve:

1. Normalize ψ $\therefore \int N^* \psi^* N \psi \, dx = 1$
2. Solve $\hat{x}\psi = x \cdot \psi$
3. Solve $\psi^* (x \cdot \psi)$
4. Solve $\int \psi^* (x \cdot \psi) \psi \, dx$