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Assume that a particle is confined to a box of length a, and that the system wave function is $\psi(x) = \sqrt{2/a}\, \sin(\pi x/a)$.

a. Is this state an eigenfunction of the position operator?

b. Calculate the average value of the position $\langle x \rangle$ that would be obtained for a large number of measurements. Explain your result.

Using the standard integral $\displaystyle \int x(\sin bx)^2\, dx = \frac{x^2}{4} - \frac{\cos 2bx}{8b^2} - \frac{x \sin 2bx}{4b}$