$$\int |a_- \psi|^2 \, dx =$$

$$\int (a_- \psi)^* (a_- \psi) \, dx =$$

$$\int \left(\left(\frac{1}{\sqrt{2\hbar m \omega}} \left(+ i\hat{p} + m\omega \hat{x} \right) \right) \psi \right)^* \left(\frac{1}{\sqrt{2\hbar m \omega}} \left(+ i\hat{p} + m\omega \hat{x} \right) \right) \psi \, dx$$