$$1 - P(\langle x\rangle \pm \sigma) = 1 - \int_{-\sigma}^{\sigma} |\Psi(x,t)|^2 dx$$

$$= 1 - \int_{-\sigma}^{\sigma} \lambda \cdot e^{-2\lambda|x|} dx$$

$$= 1 - \left[\int_{-\sigma}^{0} \lambda e^{+2\lambda x} dx + \int_{0}^{\sigma} \lambda e^{-2\lambda x} dx\right]$$

$$= 1 - \lambda\left(\frac{1}{\lambda} - \frac{e^{-2\lambda\sigma}}{\lambda}\right)$$

$$= e^{-2\lambda\sigma}$$

Problem 1.6 Why can't you do integration by parts directly on middle expression in equation 1.29 — pull the time derivative over onto x, note that $\partial x/\partial t = 0$, and conclude that $d\langle x\rangle/dt = 0$?

1.29: $\frac{d\langle x\rangle}{dt} = \int x \frac{\partial}{\partial t} |\Psi|^2 dx = \frac{i\hbar}{2m}\int x \frac{\partial}{\partial x}\left(\Psi^* \frac{\partial \Psi}{\partial x} - \frac{\partial \Psi^*}{\partial x}\Psi\right) dx$

Answer. $\frac{d\langle x\rangle}{dt} = \int \underbrace{x}_{\frac{\partial f}{\partial x}} \underbrace{\frac{\partial}{\partial t} |\Psi|^2}_{g} dx$, as $\langle x\rangle = \int_{-\infty}^{\infty} x|\Psi(x,t)|^2 dx$

$$= -\int_{-\infty}^{\infty} \frac{\partial}{\partial t} |\Psi|^2 \frac{1}{2} x^2 dx + \frac{x^2}{2} \frac{\partial}{\partial t} |\Psi|^2 \Big|_{-\infty}^{\infty}$$