(a) $\int_{-\infty}^{\infty} |\psi|^2 dx = 1$ or $A^2 \int_{-\infty}^{\infty} e^{-2\lambda|x|} dx = 1$

or $2A^2 \int_0^{\infty} e^{-2\lambda x} dx = 1$ put $2\lambda x = y$.

$\Rightarrow 2\lambda dx = dy$

$x=0, y=0$, $x=\infty, y=\infty$

Our integral is $2A^2 \cdot \int_0^{\infty} \frac{e^{-y}}{2\lambda} dy = 1$ or

$\frac{A^2}{\lambda}\left(-e^{-y}\right)_0^{\infty} = 1$ or

$-\frac{A^2}{\lambda}(0-1) = 1$ or $\boxed{A^2 = \lambda}$

(b) $\langle x \rangle = \int_{-\infty}^{\infty} (\sqrt{\lambda})^2 x \cdot e^{-2\lambda|x|} \cancel{e^{-i\omega t}} dx$

$= (\sqrt{\lambda})^2 \cancel{e^{-i\omega t}} \left[\int_{-\infty}^{\infty} x e^{-2\lambda|x|} dx\right]$

$= (\sqrt{\lambda})^2 \cancel{e^{-i\omega t}} \left[\int_{-\infty}^{0} x e^{+2\lambda x} dx + \int_0^{\infty} x e^{-2\lambda x} dx\right]$

A correction made.

$\sqrt{\lambda} \to (\sqrt{\lambda})^2$

$\exp(-\lambda|x|) \to \exp(-2\lambda|x|)$

The [ ] vanish as the 2 integrals are negative of each other.

$\langle x \rangle = 0$

(c) $\langle x^2 \rangle = (\sqrt{\lambda})^2 \cancel{e^{-i\omega t}} \left[\int_{-\infty}^{0} x^2 e^{2\lambda x} dx + \int_0^{\infty} x^2 e^{-2\lambda x} dx\right]$

$= (\sqrt{\lambda})^2 \cancel{e^{-i\omega t}} \left[-\int_{\infty}^{0} y^2 e^{-2\lambda y} dy + \int_0^{\infty} x^2 e^{-2\lambda x} dx\right]$

$= 2(\sqrt{\lambda})^2 \cancel{e^{-i\omega t}} \int_0^{\infty} x^2 e^{-2\lambda x} dx$