Hint Problem 3.11

Start with Eq.(3.136) the top version and use Eq.(3.128a).

Make the following substitutions:

$$\alpha = \frac{1}{\sqrt{2}}(q + ip) \qquad \lambda = \frac{1}{\sqrt{2}}(x + iy)$$

$$\hat{a} = \frac{1}{\sqrt{2}}(\hat{q} + i\hat{p}).$$

Evaluate the trace with respect to the coordinate basis:

$$Tr\{\bullet\} = \int_{-\infty}^{\infty} dq' \langle q' | \{\bullet\} | q' \rangle$$

where $\{\bullet\}$ is the stuff you are tracing over. Beware that none of $\hat{q}, \hat{p}, \hat{\rho}$ commute with each other.

You will also need to recall from Merzbacher the 1D displacement operator from Chapter 4, from which you get:

$$e^{-i\frac{x}{2}\hat{p}} |q'\rangle = \left| q' - \frac{x}{2} \right\rangle$$

whose conjugate is

$$\langle q' | Exp[-i\frac{x}{2}\hat{p}] = \langle q' + x/2 |$$

Then you will need Yang Gao's favorite formula:

$$\delta(q' - q) = \frac{1}{2\pi^2} \int dy e^{iy(q'-q)}$$

That ought to do it.