1. Brain-warmer.

Show that in a coherent state $|\phi\rangle$ the particle number statistics

$$P(n) \propto \langle n|\phi\rangle$$

are given by the Poisson distribution. Find the mean and variance.

2. Chiral anomaly in two dimensions.

Consider a massive relativistic Dirac fermion in 1+1 dimensions, with

$$S = \int dx dt \bar{\psi} (i \gamma^\mu (\partial_\mu + e A_\mu) - m) \psi.$$ 

By heat-kernel regularization of its expectation value, show that the divergence of the axial current $j_5^\mu \equiv i \bar{\psi} \gamma^m u \gamma^5 \psi$ is

$$\partial_\mu j_5^\mu = 2im\bar{\psi} \gamma^5 \psi + \frac{e}{2\pi} \epsilon_{\mu\nu} F^{\mu\nu}.$$