Solve the heat equation in a disk,

$$\nabla^2 u = \frac{\partial u}{\partial t}$$

for $0 < r < 1$, $0 \leq \theta < 2\pi$, $0 < t < \infty$,

$$u(1, \theta, t) = 100, \quad u(r, \theta, 0) = f(r) \sin \theta.$$