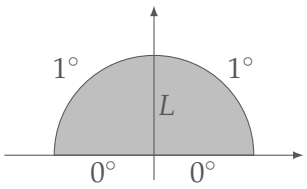
Math 344 Quiz 5

Names: _____

1. The base of a semicircular plate of radius L is held at 0° while the top arc is held at 1°:



a. Let $u(r,\theta)$ be the steady state temperature in the plate at the polar coordinates r,θ. In polar, the steady state heat equation $u_{xx}+u_{yy}=0$ becomes

$$r^2u_{rr}+ru_r+u_{\theta\theta}=0.$$

Assuming $u(r,\theta)=R(r)\Theta(\theta)$, turn this PDE into two DE's with boundary conditions.

b. Solve for Θ.

c. Solve for R. (Since $\lim_{r \to 0} R(r) < \infty$, one of the two answers for R can be disregarded.)

d. What is $u(r, \theta)$? (Give a formula for the constants in the solution.)