

Alternate Version of Problem 3:

If you are stuck on #3, you can do this alternate instead.

If you have already made good progress on (or sunk too much time into) #3, write up what you have and hand it in.

Alternate #3. (40 pts.) A uniform cylinder has radius  $\rho = 1$  and height  $h = 4$  sits upright atop the origin of the horizontal x-y plane. The cylinder had been sitting in boiling water, so it has initial temperature  $u(r, z, 0) = 100$ . Starting at time  $t = 0$ , the entire surface of the cylinder is put in contact with an ice bath held at temperature  $u = 0$ ; i.e.  $u(1, z, t) = 0$ ,  $u(r, 0, t) = 0$  and  $u(r, 4, t) = 0$ . Solve the heat equation in cylindrical coordinates to determine the evolution of the temperature,  $u(r, z, t)$ .