Exam 1 redo **PH361** Name .....

1. Please DO NOT use Mathematica in answering the questions about the following restatement of the take home exam problem. I want all discussion to appear on the Forum. Due date is March 15 at the beginning of class. This is to be turned in separately from the homework due that day.

   Consider a solution of the heat diffusion equation ($(\kappa\nabla^2 T = c_v \partial T/\partial t\ c_v)$ using separation of variables. Take a spherical material (say a potato) and assume it is of radius 1 meter (grown in Idaho) and the temperature is fixed forever to be zero at this boundary (winter time in Idaho). The general solution is given at

   http://www.astro.cf.ac.uk/undergrad/module/PX3104/tp4/node14.html

   Now, by some unknown means (a microwave pulse, for example, is focused into the potato) we generate a temperature distribution in the potato given by $T(r, t = 0) = T_0(r)$. Choose $c_v = 1$, and $\kappa = 1$.

   (a)Derive an integral expression for an arbitrary coefficient in the separation of variables solution. Make sure you explain each step. You can start from the end result given in the link above.

   (b)Explain why equal time increments in the animated graphs look so different.

   (c)Explain why the temperature increases at r=0 for the time increments chosen in the problem. What will happen at times later than this?