Partial Differential Equations - Homework Day 7

Professor:
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Read and Take Notes

1. *Farlow* - REVIEW - Chapters 5-8. Make sure you are comfortable with these ideas. This week we are focusing on our understanding of separation of variables.
2. *Additional Chapter Online* - SOV for Laplace's Equation - On Thursday we will discuss separation of variables for Elliptic Problems, Laplace's Equation: $\nabla^2 u = 0$ where $u = u(x, y)$.

Homework
Totally not additional, mandatory, skip at your own risk!! :)

1. *Homework Problems*

   1. Heat conduction in a thin circular ring of length 2 units allowing for lateral heat losses:

$$
\begin{aligned}
&u_t = \alpha^2 u_{xx} - u \\
&u(-1, t) = u(1, t) \\
&u_x(-1, t) = u_x(1, t) \\
&u(x, 0) = 1 + \cos(\pi x)
\end{aligned}
$$

   2. Convection in a thin rod with non-homogeneous boundary conditions. Transform to a PDE with homogeneous boundary condition and without convection. Is your final transformed PDE homogeneous? (Just transform)

$$
\begin{aligned}
&u_t = \alpha^2 u_{xx} - u_x \\
&u(0, t) = 1 \\
&u(1, t) = 0 \\
&u(x, 0) = \phi(x)
\end{aligned}
$$

   3. Write a flow chart for how you think about solving PDEs using Separation of Variables and Transforming hard problems into easier ones. Include all of the steps that you take and all of the reminders you might need. Imagine that you are writing yourself an information sheet to be used on an exam.

Other Notes:

1. Keep up the good work!!