1. Solve the boundary value problem
\[
\frac{\partial}{\partial t} \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}, \quad 0 < x < \pi, \quad t > 0,
\]
subject to
\[
u_x(0, t) = 0, \quad u_x(\pi, t) = 0, \quad t > 0
\]
\[
u(x, 0) = f(x), \quad 0 < x < \pi,
\]
where
\[
f(x) = \begin{cases} 
0, & \text{if } 0 \leq x < \pi/2; \\
2, & \text{if } \pi/2 \leq x < \pi;
\end{cases}
\]
(You may use the ready-made formula)