Q1) Solve the initial value problem

\[ y'' + y = f(t); \quad y(0) = 0, \ y'(0) = 0 \]

where

\[ f(t) = \begin{cases} 
0, & 0 \leq t < \pi \\
1, & \pi \leq t < 2\pi \\
0, & t \geq 2\pi
\end{cases} \]

(Hint: Write f(t) in terms of unit step function)