Original Problem	Steady-state Problem	Transient Problem
$\frac{\partial^2 u}{\partial x^2} = \frac{1}{k}\frac{\partial u}{\partial t}, \quad 0 < x < a, 0 < t$ $u(0,t) = T_0, u(a,t) = 0, \quad 0 < t$ $u(x,0) = T_0 x / a, \quad 0 < x < a$	$v'' = 0, 0 < x < a$ $v(0) = T_0, v(a) = 0$ **S:** $v(x) = T_0(1 - x/a)$	
$\frac{\partial^2 u}{\partial x^2} + H = \frac{1}{k}\frac{\partial u}{\partial t}, 0 < x < a, 0 < t$ $u(0,t) = 0, u(a,t) = U_0, \quad 0 < t$ $u(x,0) = U_0, 0 < x < a$	$v'' + H = 0, 0 < x < a$ $v(0) = 0, v(a) = U_0$ **S:** $v(x) = U_0 x / a + H(ax - x^2)/2$	
$\frac{\partial^2 u}{\partial x^2} - \gamma^2 u = \frac{1}{k}\frac{\partial u}{\partial t}, 0 < x < a, 0 < t$ $u(0,t) = U_0, u(a,t) = U_1, \quad 0 < t$ $u(x,0) = U_0 \sin(\pi x / 2a), 0 < x < a$	$v'' - \gamma^2 v = 0, 0 < x < a$ $v(0) = U_0, v(a) = U_1$ **S:** $v(x) = U_0 \cosh(\gamma x) +$ $(U_1 - U_0 \cosh(\gamma a))\sinh(\gamma x)/\sinh(\gamma a)$	
$\frac{\partial^2 u}{\partial x^2} = \frac{1}{k}\frac{\partial u}{\partial t}, \quad 0 < x < a, 0 < t$ $\frac{\partial u}{\partial x}(0,t) = 0, \frac{\partial u}{\partial x}(a,t) = 0, \quad 0 < t$ $u(x,0) = Tx / a, \quad 0 < x < a$	$v'' = 0, 0 < x < a$ $v(0)' = 0, v'(a) = 0$ **S:** $v(x) = \text{const}$ (undetermined)	
$\frac{\partial^2 u}{\partial x^2} = \frac{1}{k}\frac{\partial u}{\partial t}, \quad 0 < x < L, 0 < t$ $u(0,t) = T_0, \frac{\partial u}{\partial x}(L,t) = 0, \quad 0 < t$ $u(x,0) = T_0 \quad 0 < x < L$	$v'' = 0, 0 < x < L$ $v(0) = T_0, v'(L) = 0$ **S:** $v(x) = T_0$	
$\frac{\partial^2 u}{\partial x^2} = -\gamma^2 (T - u) + \frac{1}{k}\frac{\partial u}{\partial t}, 0 < x < a, 0 < t$ $\frac{\partial u}{\partial x}(0,t) = 0, u(a,t) = U_0, \quad 0 < t$ $u(x,0) = -U_0 \cos(\pi x / a), 0 < x < a$	$v'' = -\gamma^2 (T - v), 0 < x < a$ $v'(0) = 0, v(a) = U_0$ **S:** $v(x) = T + (U_0 - T)\frac{\cosh(\gamma x)}{\cosh(\gamma a)}$	