

4. (*Separation*) Seeking a solution $u(x, t) = X(x)T(t)$ for the given PDE, carry out steps analogous to equations (3)–(6), and derive ODE's analogous to (7a,b). Take the separation constant to be $-\kappa^2$, as we do in (6). Obtain general solutions of those ODE's (distinguishing any special κ values, as necessary) and use superposition to obtain a solution analogous to the solution (13) of (1a). If the PDE cannot be separated, state that.

(a) $u_{xx} = u_t + 3u$

(b) $u_{xx} + 2u_x = u_t$ HINT: In this case you should find that the value of κ that needs to be distinguished [as we distinguished the case $\kappa = 0$ in (9) and (10)] is $\kappa = 1$, not $\kappa = 0$.

(c) $u_{xx} + 2u_{xt} = u_t$

(d) $u_{xx} + 2u_{xt} = u_{tt}$

(Please solve for only part (b). Thank you.)

(The problem is from Separation of Variables in Diffusion Equation.)

(I tried to provide all the information in other attachments.)