4. a) 

![Graph showing a function with t=0.5 and T=1.5 on the x-axis and y-axis.]

b) We begin with the proposed solution \( f(x,t) = A e^{-B(x-ut)^2} \)

\[
\frac{\partial f}{\partial x} = -2AB(x-ut)e^{-B(x-ut)^2}
\]

\[
\frac{\partial^2 f}{\partial x^2} = [-2AB + 4AB^2(x-ut)^2]e^{-B(x-ut)^2}
\]

\[
\frac{\partial f}{\partial t} = 2ABu(x-ut)e^{-B(x-ut)^2}
\]

\[
\frac{\partial^2 f}{\partial t^2} = \left[2AB^2u^2 + 4AB^2(x-ut)^2\right]e^{-B(x-ut)^2}
\]

\[
= \nu^2 \frac{\partial^2 f}{\partial x^2}
\]

\[
\therefore \frac{\partial^2 f}{\partial x^2} = \frac{1}{\nu^2} \frac{\partial^2 f}{\partial t^2}
\]