Math. 415 -- Quiz 1

PROBLEM 1 (10 points)

\[ u_t = \frac{-x^2}{2} u_{xx} \]  \hspace{1cm} (1)

(i) Determine the order of (1)

(ii) State whether (1) is linear or nonlinear

(iii) Verify that \( u = x^2 e^{-t} \) is a solution of (1).

(i) \( U_t \) is 1st order derivative

\( U_{xx} \) is 2nd order derivative

The highest order derivative is 2nd order, so (1) is 2nd order

(ii) Linear

(iii) Let \( U = x^2 e^{-t} \)

Then \( U_t = -x^2 e^{-t} \)
\[ U_x = 2x e^{-t} \]
\[ U_{xx} = 2 e^{-t} \]

So \( U_t = -\frac{x^2}{2} U_{xx} \)

Therefore this given function is a solution of (1).