Find the Laplace transforms of:

1. \( f(t) = t^4 e^{3t} \) (use the translation theorem)
2. \( f(t) = e^{-t} \sin 3\pi t \) (use the translation theorem)

Find the inverse Laplace transforms of

3. \( f(s) = \frac{k^2}{s(s^2 + k^2)} \) using the convolution theorem

4. Consider the equation
   \[
   u_{tt} + e^{-t}u_t = u_{xx} + \cosh(x)u_x
   \]
   (a) Is the equation hyperbolic, parabolic, or elliptic?
   (b) Find the canonical form of the equation.

5. Consider the equation
   \[
   u_{xx} + 2u_{xy} + u_{yy} = \sin(x)u_x + u_y
   \]
   (a) Is the equation hyperbolic, parabolic, or elliptic?
   (b) Find the canonical form of the equation

6. Consider the equation
   \[
   x^2u_{xx} - 2xyu_{xy} + y^2u_{yy} + xu_x + yu_y = 0
   \]
   (a) Is the equation hyperbolic, parabolic, or elliptic?
   (b) Find the canonical form of the equation.
   (c) Find the general solution on the half-plane \( x > 0 \).

7. Consider the equation
   \[
   u_{xx} - 2\sin x u_{xy} - \cos^2 x u_{yy} - \cos x u_y = 0
   \]
   (a) Is the equation hyperbolic, parabolic, or elliptic?
   (b) Find the canonical form of the equation.
   (c) What is its general solution?