1. Using the provided table of Laplace transforms, show

\[
\mathcal{L}\left\{\frac{1}{2}(\sin 3t - 3t \cos 3t)\right\} = \frac{27}{(s^2 + 9)^2}.
\]

2. Determine the inverse Laplace transform of the following.

(a) \(G(s) = \frac{3}{2s + 1}\)  
   (d) \(K(s) = \frac{7}{(s - 3)^6}\)

(b) \(F(s) = \frac{6}{4 - s}\)  
   (e) \(M(s) = \frac{2s + 3}{s^2 + 2}\)

(c) \(N(s) = \frac{s}{s^2 + 6s + 8}\)  
   (f) \(P(s) = \frac{3s}{s^2 - 6s + 13}\)
3. Applying the Laplace transform to the initial value problem

\[ y'' - 6y' + 9y = e^{2t}, \quad y(0) = 3, y'(0) = 4 \]

gives the following

\[ Y(s) = \frac{3s^2 - 20s + 29}{(s - 2)(s^2 - 6y + 9)}. \]

Determine \( y(t) = \mathcal{L}^{-1}\{Y(s)\} \), the solution to the given initial value problem.

4. Applying the Laplace transform to the initial value problem

\[ y'' + 2y' + 10y = -20e^{-2t}, \quad y(0) = 1, y'(0) = 7 \]

gives the following

\[ Y(s) = \frac{s^2 + 11s - 2}{(s + 2)(s^2 + 2s + 10)}. \]

Determine \( y(t) = \mathcal{L}^{-1}\{Y(s)\} \), the solution to the given initial value problem.