1. Given the differential equation $3y' = 4x/y^2$.

   (1) Determine if the given differential equation is separable.

   (2) Determine if the given differential equation is linear.

   (3) Give the order and degree of the equation.

   (4) Find the general solution.

2. Solve the following initial value problem.
   $$y' - y = 2e^{4x}; \quad y(0) = -4$$

3. Given the following differential equation $xy' = -(y + e^x)$.

   (1) Show that above equation is exact.

   (2) Find a potential function and the general solution.

4. Given the following differential equation $y - xy' = 0$.

   (1) Show that the given differential equation is not exact.

   (2) Find an integrating factor $\mu(x)$ that is a function of x only.

   (3) Find its general solution.

5. Given: $y'' - 10y' + 25y = 0; \quad y_1(x) = e^{5x}$.

   (1) Prove that the given function $y_1(x)$ is a solution of the equation.

   (2) Find a second solution $y_2(x)$ by "reduction of order".

   (3) Show that solutions $y_1(x)$ and $y_2(x)$ are linearly independent.

   (4) Write the general solution $y(x)$.

6. Given: $y'' + 4y' + 4y = 5xe^{-2x} + 7x$

   (1) Find the general homogeneous solution $y_h(x)$.

   (2) Find the particular solution $y_p(x)$.

   (3) Find the general solution $y(x)$.