**Problem Definition**

Problem 41. Verify that the general solution satisfies the differential equation. Then find the particular solution that satisfies the initial condition.

**General Solution:** \( y = Ce^{-2x} \)

**Differential Equation:** \( y' + 2y = 0 \)

**Initial Condition:** \( y = 3 \) and \( x = 0 \)

**Solution Step 1:**

We start by testing the general solution to see if the function satisfies the differential equation. We need to compute the derivative as follows.

\[
y = Ce^{-2x} \quad \rightarrow \quad y' = Ce^{-2x}(-2) = -2Ce^{-2x}
\]

Now, we substitute these into the left hand side of the ordinary differential equation.

\[
y' + 2y = -2Ce^{-2x} + 2 \left( Ce^{-2x} \right) = -2Ce^{-2x} + 2Ce^{-2x} = 0
\]

Since this makes the left hand side zero which matches the right hand side of the differential equation, the function satisfies the differential equation.

**Solution Step 2:**

Now, we want the function to satisfy the initial condition. This means

\[
y = Ce^{-2(0)} = Ce^0 = C = 3
\]

So, the particular solution must be

\[
y = 3e^{-2x}
\]