1. Solve the ODE for the so-called logistic growth model
   \[ y' = y(1 - y). \]

2. Find a function \( y: \mathbb{R} \to \mathbb{R} \) such that
   \[ y' = 3y^{2/3} \quad \text{and} \quad y(0) = 0. \]

3. Let \( \alpha > 0 \) and define
   \[ y(x) = \begin{cases} 
   0 & \text{for } x < \alpha, \\
   (x - \alpha)^3 & \text{for } x \geq \alpha.
   \end{cases} \]
   Show this is a solution to problem 2. Is it the solution you found earlier?
   *Hint: If the definition of a function makes you uncertain, try to make a rough sketch of its graph.*

4. Solve the ODE
   \[ y' = x - y. \]

5. Solve the ODE
   \[ y'' + 2y' + 2y = 0. \]
   Express your answer without using complex exponential functions.

6. Solve the ODE
   \[ y'' + 3y' + 2y = \sin x. \]
   Express your answer without using complex exponential functions.

7. Solve the ODE
   \[ y'' + 4y' + 4y = e^{-2x}. \]
   Express your answer without using complex exponential functions.

8. (Optional) Solve the ODE
   \[ y' = \frac{y + x}{\sqrt{1 - x^2}}. \]