1. Is $y = \frac{1}{2}e^{-3t} + \frac{1}{2}\sin t + \frac{3}{2}\cos t$ a solution to $y' + 3y = 5\cos t$?

2. $y' + 3y = 5\cos t,\ y(0) = 2$ is an **initial value problem**, meaning it consists of

   - a differential equation, and
   - one or more **initial values** that come from **initial conditions**.

   A function is a solution to an initial value problem if it satisfies *BOTH* the differential equation and all initial values.

   Is $y = \frac{1}{2}e^{-3t} + \frac{1}{2}\sin t + \frac{3}{2}\cos t$ a solution to the initial value problem

   $$y' + 3y = 5\cos t, \qquad y(0) = 2?$$

3. Is $y = e^{-5t} + \frac{1}{5}t - \frac{1}{25}$ a solution to $y' + 5y = t, \qquad y(0) = 1$?

4. $y = C_1 \sin 2t + C_2 \cos 2t + \frac{1}{13} e^{-3t}$ *IS* a solution to $y'' + 16y = e^{-3t}$.

Determine values of C_1 and C_2 for which

$$y = C_1 \sin 2t + C_2 \cos 2t + \tfrac{1}{13} e^{-3t}$$

is a solution to

$$y'' + 16y = e^{-3t}, \qquad y(0) = 0,\ y'(0) = 1$$

5. $y = C_1 e^{-3t} + C_2 e^{-t} + \frac{1}{2}\sin t - \cos t$ is a solution to $y'' + 4y' + 3y = 5\sin t$.

Determine values of C_1 and C_2 for which

$$y = C_1 e^{-3t} + C_2 e^{-t} + \frac{1}{2}\sin t - \cos t$$

is a solution to

$$y'' + 4y' + 3y = 5\sin t, \qquad y(0) = 1,\ y'(0) = -2$$

6. Determine values of C_1 and C_2 for which $y = C_1 \sin \frac{1}{2}x + C_2 \cos \frac{1}{2}x$ is a solutions to the boundary value problem

$$y'' + \tfrac{1}{4}y = 0, \qquad y'(0) = -1,\ y(\pi) = 3$$