These problems concern driven second-order linear differential equations with constant coefficients.

The following problems are intended to be solved by algebra and the laws of logarithms. Decimal approximations are unacceptable for this assignment.

**Algebra Warmups:**

(a) \( \ln(e^6) = 6 \)

(b) \( e^{\ln(6)} = 6 \)

(c) Algebra: \( \cosh(\ln(5)) = \frac{13}{5} \) and \( \sinh(\ln(5)) = \frac{12}{5} \).

Solve the following initial-value problems. Show your steps and “display” salient intermediate results.

1. \( y'' + 4y = -36 \sin(4t) \) with \( y(\pi) = 1 \) and \( y'(\pi) = 0 \).
2. \( y'' + 4y = 16t^3 - 36 \sin(4t) \) with \( y(0) = 2 \) and \( y'(0) = 14 \).
3. \( y'' - y = \text{Step}(t, \ln(2)) \) with \( y(0) = 0 \) and \( y'(0) = 1 \).
4. \( y'' + 4y' + 4y = e^{3t} \) with \( y(1) = 2 \) and \( y'(1) = 0 \).