Part I Problems and Solutions

Problem 1: *Find a particular solution to the DE*

$$x''' + x' = 2\cos t$$

Solution: Characteristic polynomial: $p(s) = s^3 + s$;
Complex replacement: $z''' + z' = 2e^{it}, \quad x = \mathrm{Re}(z)$
Resonant Response formula: $p(i) = i^3 + i = -i + i = 0$;
$p'(s) = 3s^2 + 1$, $p'(i) = 3i^2 + 1 = -3 + 1 = -2$
$z_p = \frac{2}{p'(i)}\, t\, e^{it} = -t\, e^{it}$
$x_p \;=\; \mathrm{Re}(z_p) \;=\; -t\cos t.$

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