I need to plug the solution

$$x(t) = A\, e^{-\frac{\gamma}{2} t} \cos\left(\omega_1 t + \phi\right)$$

into the differential equation

$$\frac{d^2x}{dt^2} + \gamma \frac{dx}{dt} + \omega_1^2 x = 0$$

to get an identity

NOTE: $w_1 = \sqrt{w_0^2 - \frac{\gamma^2}{4}}$