Damped Harmonic Oscillator

$T := 2$ Period of the oscillator if the friction is zero

$\gamma := 0.35$ Measure of the friction

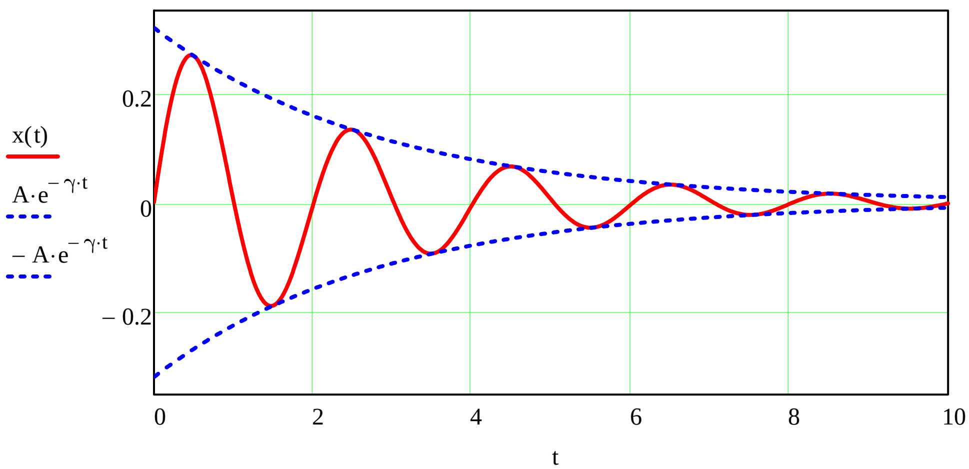
$\omega := \frac{2\cdot\pi}{T} = 3.142$

$\omega_1 := \sqrt{\omega^2 - \gamma^2} = 3.122$

$A := \frac{1}{\omega_1}$ $\varphi := \frac{-\pi}{2}$ Constants of integration (follow from the initial conditions)

$x(t) := A\cdot e^{-\gamma\cdot t}\cdot\cos(\omega_1\cdot t + \varphi)$

Underdamped Oscillation



The critically damped case:

$\gamma_2 := \omega$

$B := 0$ $C := 1$ These follow from the initial conditions

$x_c(t) := (B + C\cdot t)\cdot e^{-\gamma_2\cdot t}$

The overdamped case:

$\gamma_3 := 2\cdot\omega$ $\omega_2 := \sqrt{\gamma_3^{\,2} - \omega^2} = 5.441$

$A_2 := \frac{1}{2\cdot\omega_2} = 0.092$ $A_1 := -A_2$

$x_o(t) := \left(A_1\cdot e^{-\omega_2\cdot t} + A_2\cdot e^{\omega_2\cdot t}\right)\cdot e^{-\gamma_3\cdot t}$

Examples starting from equilibrium