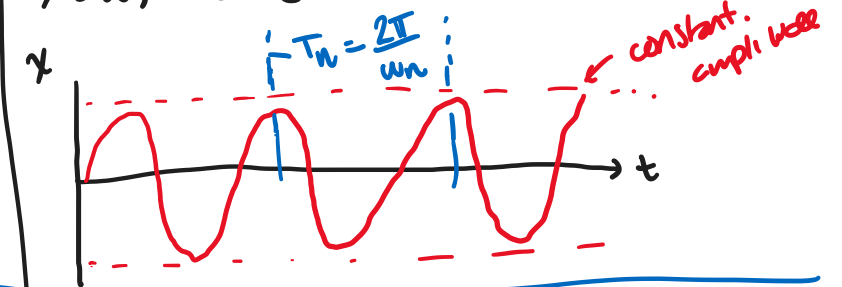
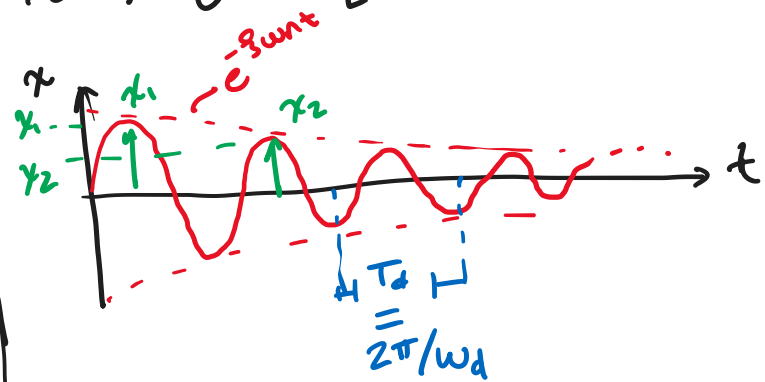
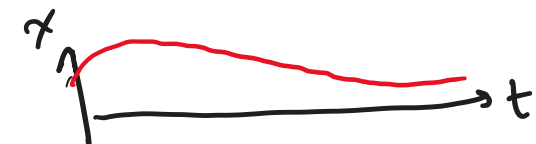


• Free Vibrations : Summary Solutions

$$x_c(t) = A e^{\pi_1 t} + B e^{\pi_2 t}$$

$$e^{i\theta} = \cos \theta + i \sin \theta$$

Solution & Plot

Case	ξ	π_1, π_2	Solution & Plot
Undamped	0	$\pm i \omega_n$	$x_c(t) = C \cos \omega_n t + D \sin \omega_n t$  constant amplitude
Underdamped	$0 < \xi < 1$	$-\xi \omega_n \pm i \omega_d$ $\omega_d = \omega_n \sqrt{1 - \xi^2}$	$x_c(t) = e^{-\xi \omega_n t} [C \cos \omega_d t + D \sin \omega_d t]$  $\xi = \frac{1}{2\pi} \ln(x_1/x_2)$
Critically Damped	$\xi = 1$	$-\omega_n$	
Overdamped	$\xi > 1$	$-\xi \omega_n \pm \omega_d$	