Undamped Free Vibration System Response	$$x = C \sin(\omega_n t + \psi)$$
Underdamped Free Vibration System Response	$$x = Ce^{-\zeta\omega_n t} \sin(\omega_d t + \psi)$$
Critically damped Free Vibration System Response	$$x = (A_1 + A_2 t)e^{-\omega_n t}$$
Overdamped Free Vibration System Response	$$x = A_1 e^{\lambda_1 t} + A_2 e^{\lambda_2 t}$$ $$\lambda_1 = \omega_n(-\zeta + \sqrt{\zeta^2 - 1}) \qquad \lambda_2 = \omega_n(-\zeta - \sqrt{\zeta^2 - 1})$$
Undamped Forced Vibration System Steady-State Amplitude	$$X = \frac{F_0/k}{1 - (\omega/\omega_n)^2}$$
Underdamped Forced Vibration System Steady-State Amplitude	$$X = \frac{F_0/k}{\{[1 - (\omega/\omega_n)^2]^2 + [2\zeta\omega/\omega_n]^2\}^{1/2}}$$ $$\phi = \tan^{-1}\left[\frac{2\zeta\omega/\omega_n}{1 - (\omega/\omega_n)^2}\right]$$
Underdamped Forced Vibration System Response	$$x = Ce^{-\zeta\omega_n t} \sin(\omega_d t + \psi) + X \sin(\omega t - \phi)$$