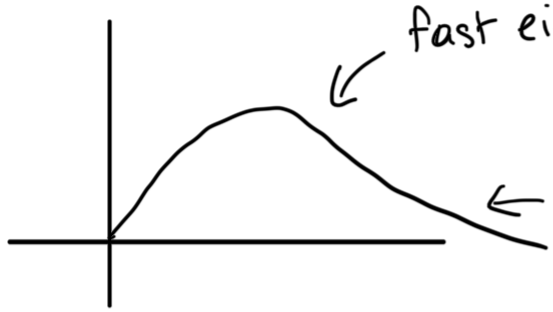
Warm Up

$$\frac{d^2y}{dt^2} + B\frac{dy}{dt} + 25y(t) = \frac{dx}{dt} + 23x(t)$$



fast eigen value ⇒ quickly rises but quickly dies out

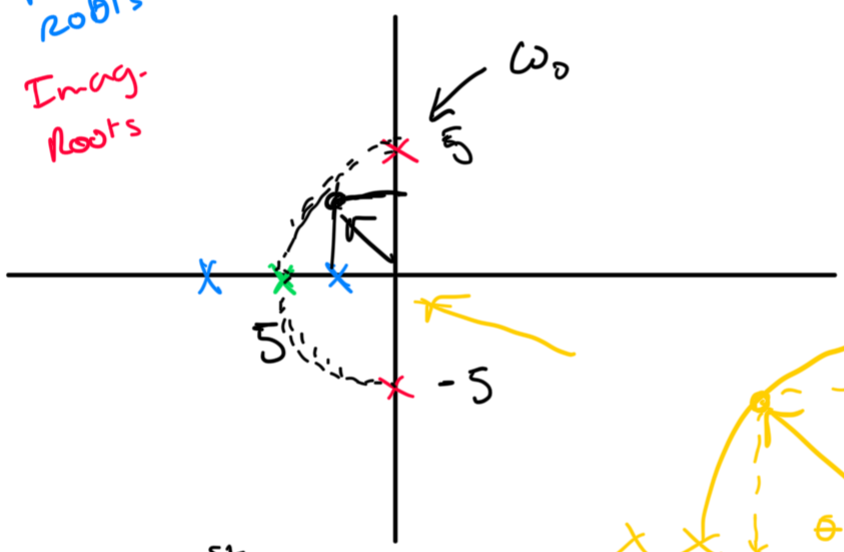
slow eigen value ⇒ lasts longer but slower rise

$s = j\omega$

Real roots

1 Real Root

Imag. Roots



$y \sim e^{st}$

$\frac{dy}{dt} = se^{st}$

$\frac{d^2y}{dt^2} = s^2e^{st}$

$$s^2e^{st} + Bse^{st} + 25e^{st} = 0$$

$$\tan\theta = \frac{\omega_d}{\alpha}$$

in general ↳ $s^2 + Bs + 25 = 0$

$$\alpha = \frac{-B}{2}$$

$$s = \frac{-B \pm \sqrt{B^2 - 100}}{2} \Rightarrow s = -5$$

critically damped $\Rightarrow$ $\boxed{B=10}$

eigenvalues:

$$\lambda = \frac{-B}{2} \pm j\omega_d = -\alpha \pm j\omega_d$$