## Rules for sketching Bode plots

Factor	Magnitude, $M^{dB}$	Phase, $\phi^{deg}$	Sketch
$\frac{K}{s^n}$	• straight line • $M^{dB} _{\omega=1}=K^{dB}$ • $\omega _{M^{dB}=0}=K^{1/n}$ • slope: $-20n~\mathrm{dB/dec}$		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
$T \cdot s + 1$	<ul> <li>Low frequency asymptote at 0dB</li> <li>High frequency asymptote: slope = 20dB/dec</li> <li>Corner frequency ω<sub>c</sub> = ½</li> </ul>	<ul> <li>arctangent</li> <li>φ ∈ (0, 90°)</li> <li>inflection (ω<sub>c</sub>, 45°)</li> </ul>	$0$ $0$ $\omega_{c} = \frac{1}{T}$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$
$\frac{1}{T \cdot s + 1}$	<ul> <li>Low frequency asymptote at 0dB</li> <li>High frequency asymptote: slope = -20dB/dec</li> <li>Corner frequency ω<sub>c</sub> = ½</li> </ul>	<ul> <li>arctangent</li> <li>φ ∈ (0, -90°)</li> <li>inflection (ω<sub>c</sub>, -45°)</li> </ul>	$M^{dB}$ $0$ $\omega_{C} = \frac{1}{T}$ $\omega_{rad/sec}$ $\omega_{C} = \frac{1}{T}$ $\omega_{rad/sec}$ $\omega_{C} = \frac{1}{T}$ $\omega_{rad/sec}$ $\omega_{C} = \frac{1}{T}$ $\omega_{rad/sec}$ $\omega_{C} = \frac{1}{T}$ $\omega_{C} = \frac{1}{$
$\frac{1}{\omega_n^2} s^2 + \frac{2\zeta}{\omega_n} s + 1$	<ul> <li>Low frequency asymptote at 0dB</li> <li>High frequency asymptote: slope = 40dB/dec</li> <li>Corner frequency ω<sub>c</sub> = ω<sub>n</sub></li> </ul>	<ul> <li>arctangent</li> <li>φ ∈ (0, 180°)</li> <li>inflection (ω<sub>c</sub>, 90°)</li> </ul>	$M^{dB}$ $A0dB/dec$ $O$
$\frac{1}{\frac{1}{\omega_n^2}s^2 + \frac{2\zeta}{\omega_n}s + 1}$	<ul> <li>Low frequency asymptote at 0dB</li> <li>High frequency asymptote: slope = -40dB/dec</li> <li>Corner frequency ω<sub>c</sub> = ω<sub>n</sub></li> </ul>	• arctangent	$M^{dB}$ $0$ $0$ $0$ $0$ $0$ $0$ $0$