

Approximation formulae & thumb rules vary across books/papers.
hence this page with some formulae that you should use.

(a) For 2nd order systems: 2% settling time

– underdamped, $0 < \zeta < 0.9$: $\frac{4}{\zeta \omega_n}$

– for $0.9 \leq \zeta < 3$: $\frac{8}{\zeta \omega_n}$

– for $\zeta \geq 3$, use real, dominant pole only
and use 1st order rule.

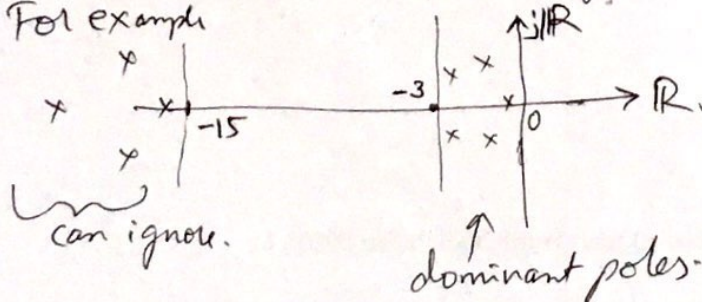
(b) For 1st order ^(stable) systems, 2% settling time:

$$\frac{4}{|\text{dominant pole}|}$$

(only one pole \equiv dominant pole).

(c) If a few poles are "sufficiently left" of some other stable poles, then can ignore them (after rescaling to equalize steady state gain): "sufficiently left" \equiv 5 times.

For example



(d) % OS for underdamped systems: use exact formula.
(without zero). (no approximation).