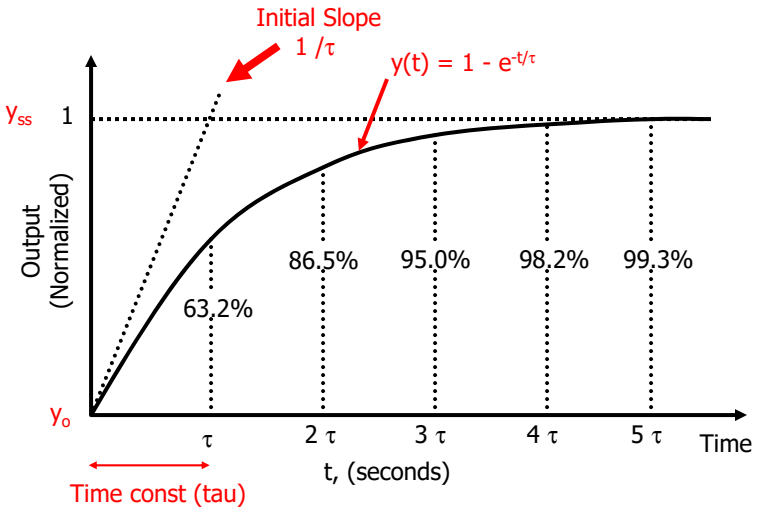
3.3 Normalized First Order Step Response

Response of system to a step input



Non-normalized: $y(t) = y_{ss} + (y_0 - y_{ss})e^{-\frac{t}{\tau}}$

3.3 RC Circuit Model Specifics

i.e., step input of 10 volts at time = 0

- If we closed a switch at t = 0 with V_{in} =10 volts and R = 1kΩ, C = 1mF
  - Draw plot of V_{in} and V_c with respect to time from -1 sec to 10 sec
    - x axis: time
    - y axis: voltage

$V_{in} - V_R - V_C = 0$

$V_R = R\,I$

$I = C\,dV_C/dt$

$RC\frac{dV_c}{dt} + V_c = V_{in}$

$V_c(t) = 10(1 - e^{-t/\tau})$

General Parameters:
τ dc/dt + c = Unit step input
Output = c(t) = 1 - e-t/τ
Time Constant = τ = RC

- Time constant τ = 1 second (R·C = 1)
- V_o = 0 volts, V_{ss} = 10 volts
- At t = 1 sec, V_c = 6.3 volts; t = 3 sec, V_c = 9.5 volts, etc.