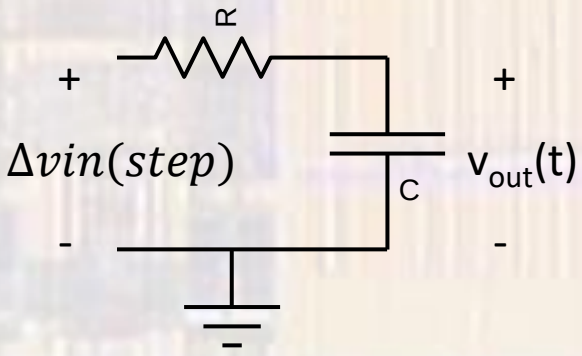
# RC Circuits

Last updated 1/6/25

# RC Circuits

- RC Configuration
  - Step inputs - transient
  - R*C ≡ RC product ≡ time constant ≡ τ (tau)

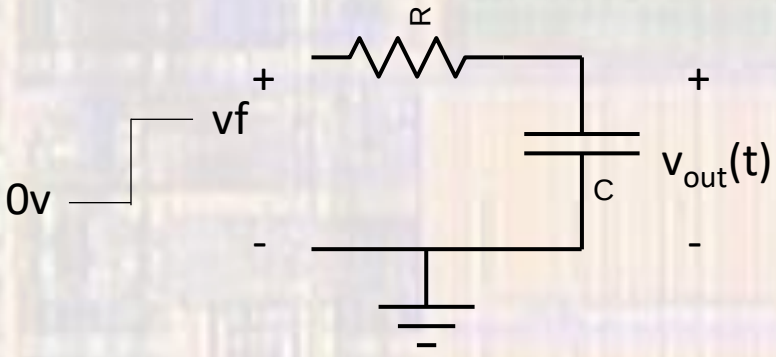



$$v_{out}(t) = v_{final} + (v_{initial} - v_{final})e^{(\frac{-t}{RC})}$$

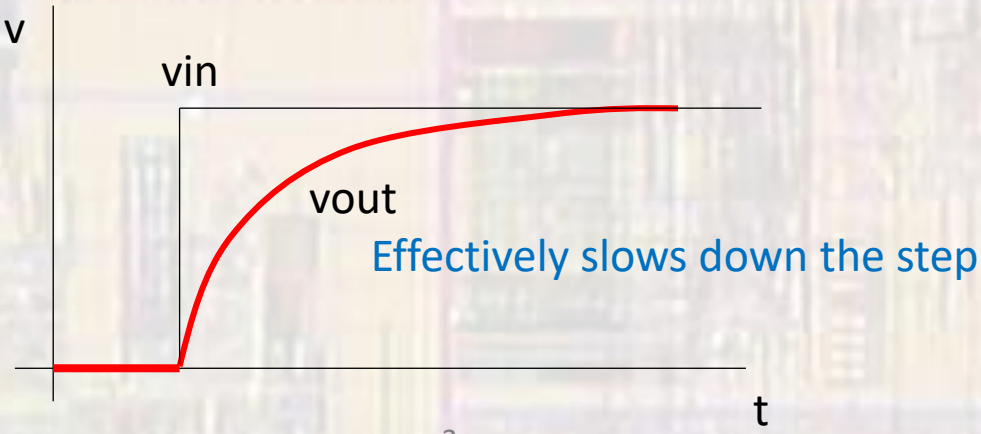
$$v_{out}(t) = v_{final} + (v_{initial} - v_{final})e^{(\frac{-t}{\tau})}$$

# RC Circuits

- RC Response
  - Step up in voltage - charging



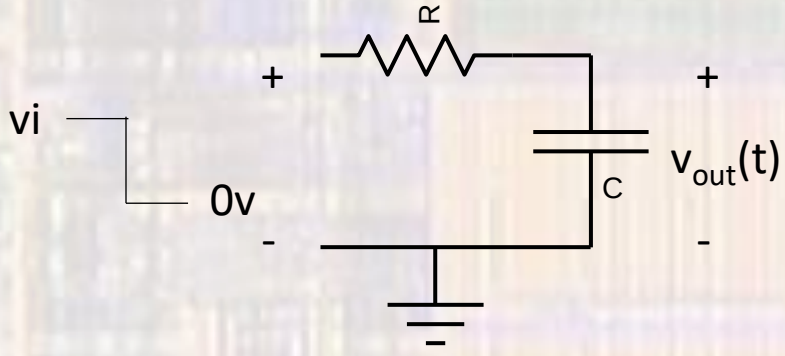

$$v_{out}(t) = vf(1 - e^{\left(\frac{-t}{RC}\right)})$$



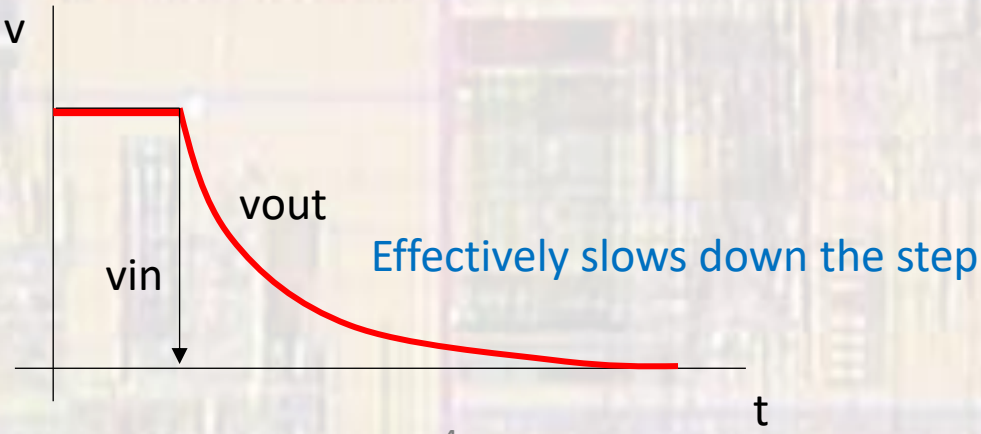

Effectively slows down the step

# RC Circuits

- RC Response
  - Step down in voltage - discharging



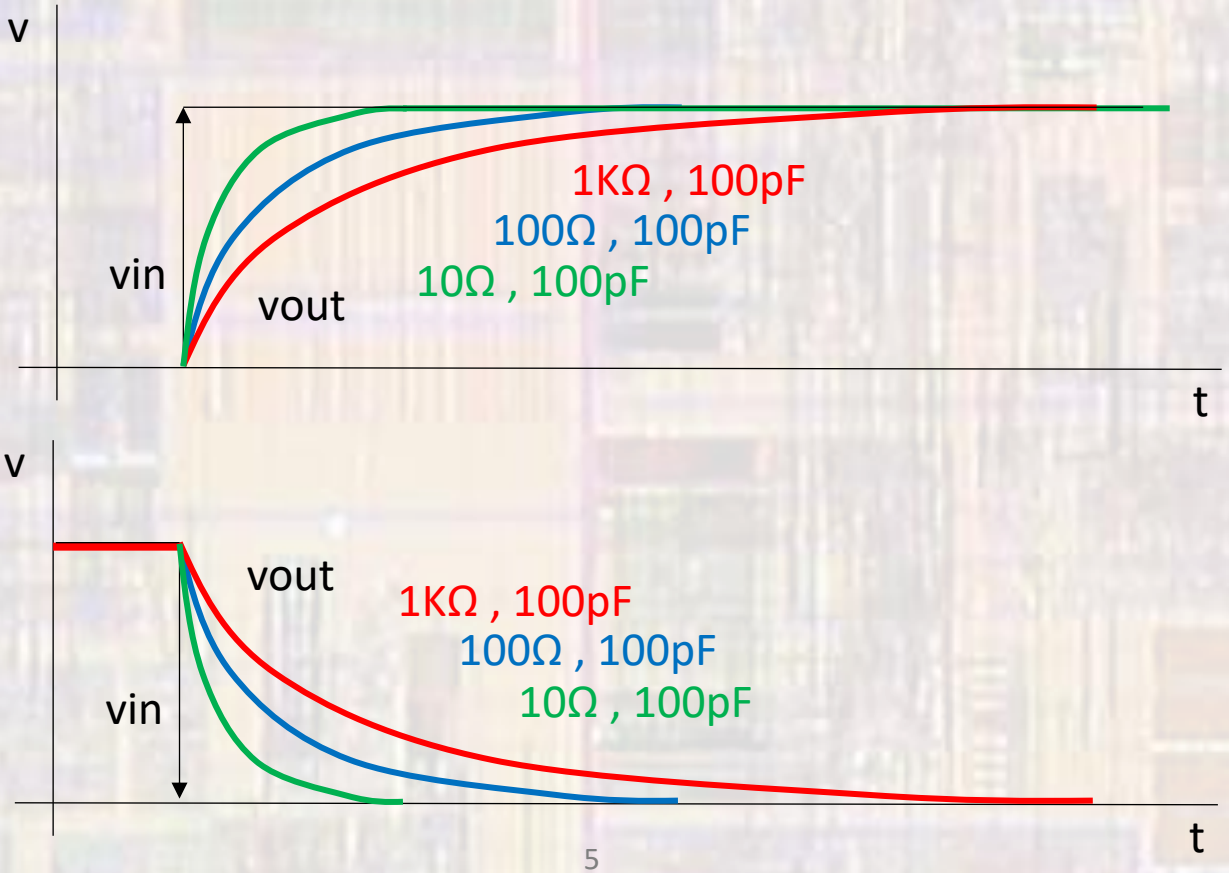

$$v_{out}(t) = vi\, e^{\left(\frac{-t}{RC}\right)}$$




Effectively slows down the step

# RC Circuits

- RC Response
  - RC time-constant impact
    - Increasing R, for a given C → slower response



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- RC Response
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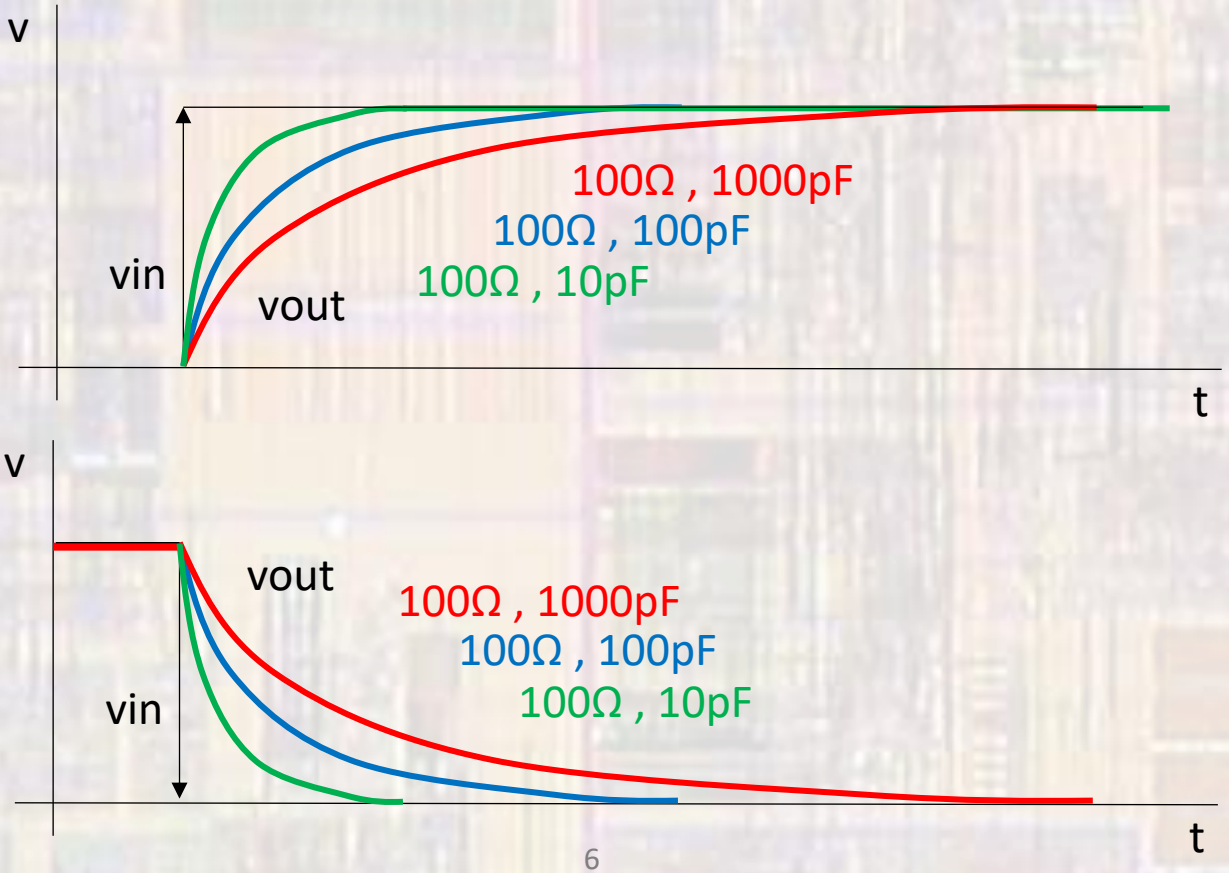
    - Increasing C, for a given R → slower response



# RC Circuits

- RC Response
  - This was one of our digital signal abstractions