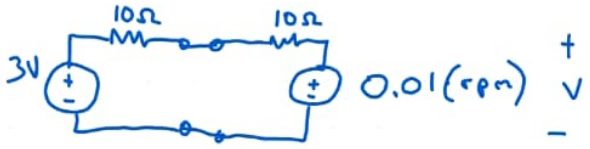
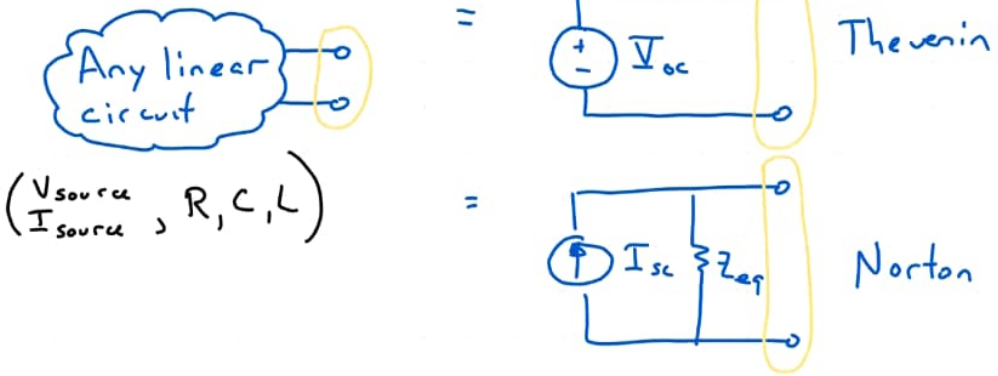
Phasors & Thevenin / Norton

1. Review
2. Example (complex)
3. Collaborative problem

Why?



Concept

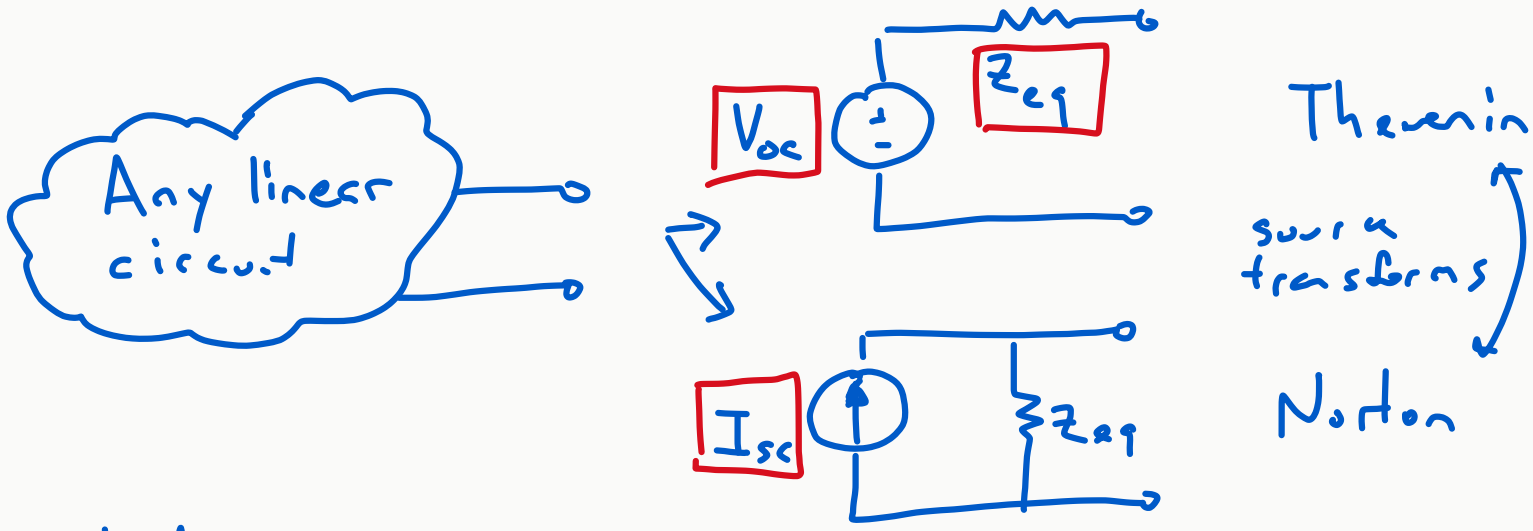


How to find

1. Experimental
   - (a) ckt, $+ V_{oc} -$ open circuit voltage $\Rightarrow$ V_{oc} in Thev
   - (b) ckt, I_{sc} closed circuit current $\Rightarrow$ I_{sc} in Nort.

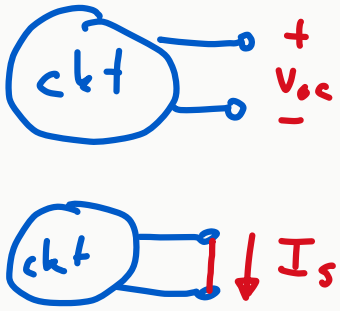
   Source Transform

2. Theory
   - (c) $Z_{eq} = \frac{V_{oc}}{I_{sc}}$

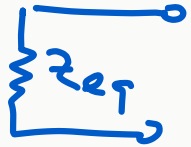


Method

A
1. V_{oc} and I_{sc}
2. $Z_{eq} = V_{oc} / I_{sc}$

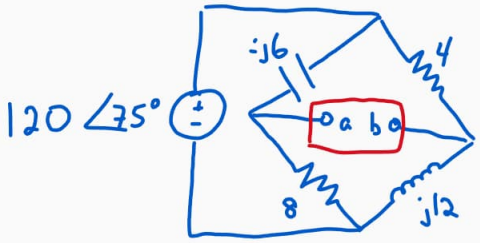


B
1. V_{oc} or I_{sc}
2. Z_{eq} by zeroing sources & R simplification
3. V_{oc} or I_{sc} by Ω's Law

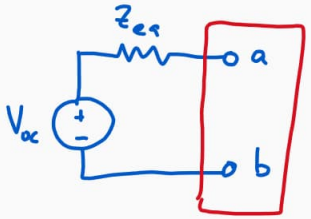
C must use {impedances and all dependent sources} ⇒ entire circuit looks like 

1. 1 V test voltage or 1A test current at output
2. Measure resulting I or V
3. Z_{eq} by Ω's Law.

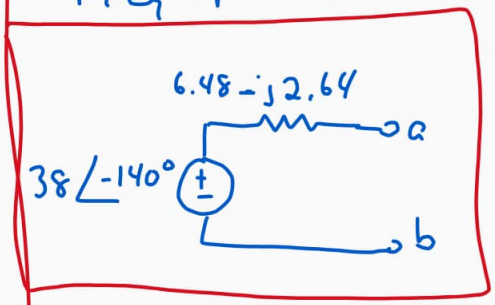
Example



Thevenin Equiv



Freq (phasor) domain



Time domain

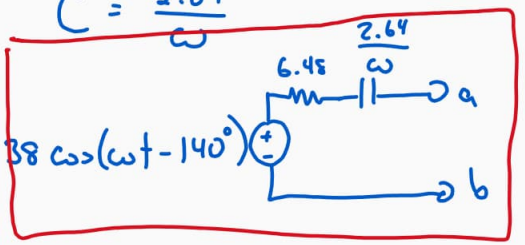
6.48 | $-j2.64$

R C

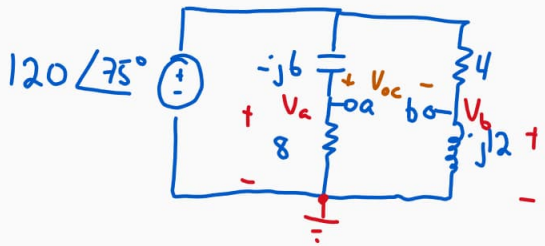
$$Z_c = \frac{1}{j\omega C} = \frac{-j}{\omega C} = -j2.64$$

$$\omega C = 2.64$$

$$C = \frac{2.64}{\omega}$$



① Find V_{oc} or Isc



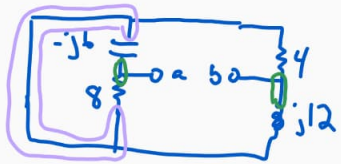
$$V_a = 120\angle 75° \frac{8}{8-j6} = 96\angle 112°$$

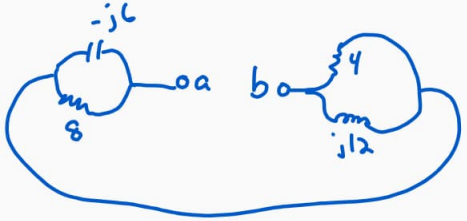
$$V_b = 120\angle 75° \frac{j12}{4+j12} = 114\angle 93°$$

$$V_{oc} = V_a - V_b = 96\angle 112° - 114\angle 93°$$

$$V_{oc} = \boxed{38\angle -140°} \quad \text{polar}$$

② Find Z_{eq}





$$Z_{eq} = (8 \,//\, -j6) + (4 \,//\, j12)$$

$$= \frac{-j48}{8-j6} + \frac{j48}{4+j12}$$

$$Z_{eq} = \boxed{6.48 - j2.64} \quad \text{rectangular}$$