

# Lecture 26

From Sections 9.1 - 9.3 of Text

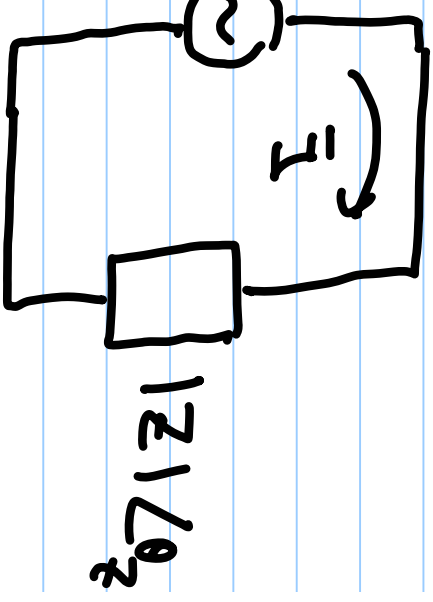
Solve E9.1 - E9.6, 9.3, 9.8, 9.11,  
9.15, 9.21, 9.28, 9.32, 9.34

## Instantaneous Power

$$\vec{V} = A_v \angle \theta_v$$

$$v(t) = A_v \cos(\omega t + \theta_v) \quad A_v \angle \theta_v$$

$$\vec{I} = \frac{\vec{V}}{Z} = \frac{A_v}{|Z|} \angle \theta_v - \theta_z$$



$$\vec{I} = A_i \angle \theta_i, \quad A_i = \frac{A_v}{|Z|}, \quad \theta_i = \theta_v - \theta_z$$

$$i(t) = A_i \cos(\omega t + \theta_i)$$

$$P(t) = v(t) i(t)$$

## Instantaneous Power (Cont'd)

$$p(t) = A_g \cos(\omega t + \theta_g) \times A_i \cos(\omega t + \theta_i)$$

$$p(t) = \frac{A_v A_i}{2} (\cos(\theta_g - \theta_i) + \cos(2\omega t + \theta_g + \theta_i))$$

$$p(t) = P_{av} + \frac{A_v A_i}{2} \cos(2\omega t + \theta_g + \theta_i)$$

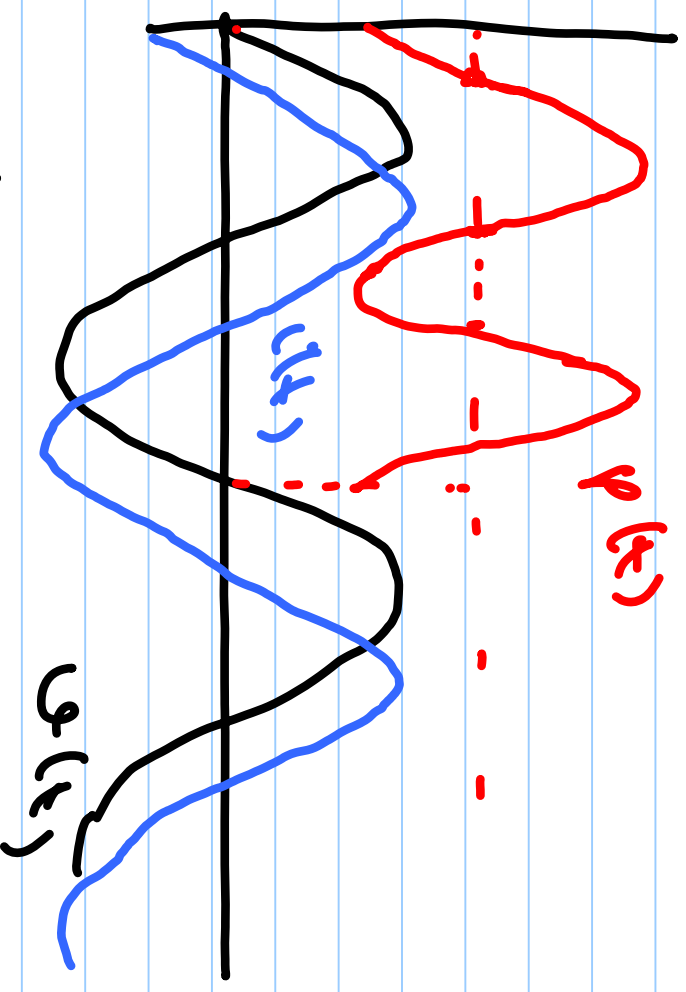
$$P_{av} = \frac{A_v A_i}{2} \cos(\theta_g - \theta_i)$$

## Power (cont'd)

$$\text{KIF } \theta_v - \theta_i = \frac{\pi}{2}$$

$$P_{av} = 0$$

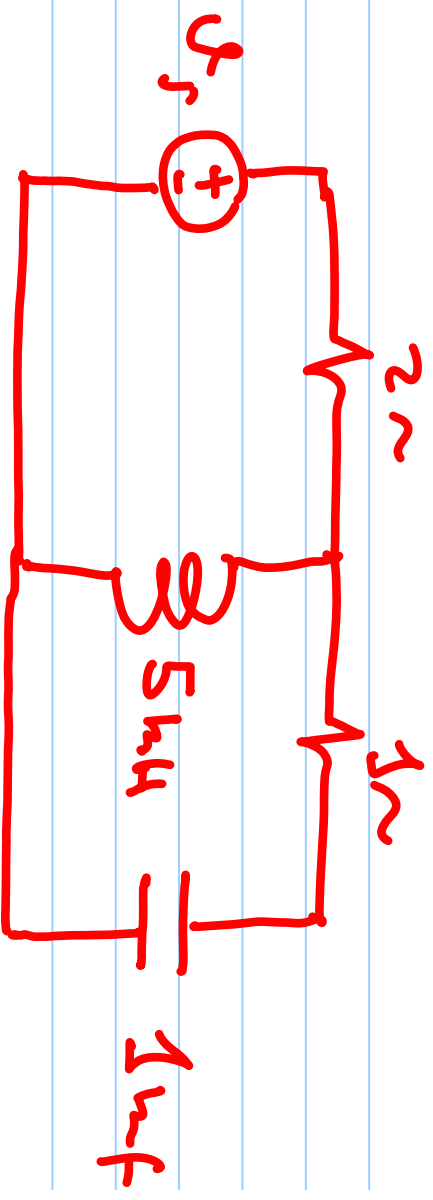
(Reactive load)



\* IF  $\theta_v = \theta_i$  (Resistive load)

$$P_{av} = \frac{1}{2} A_v A_i$$

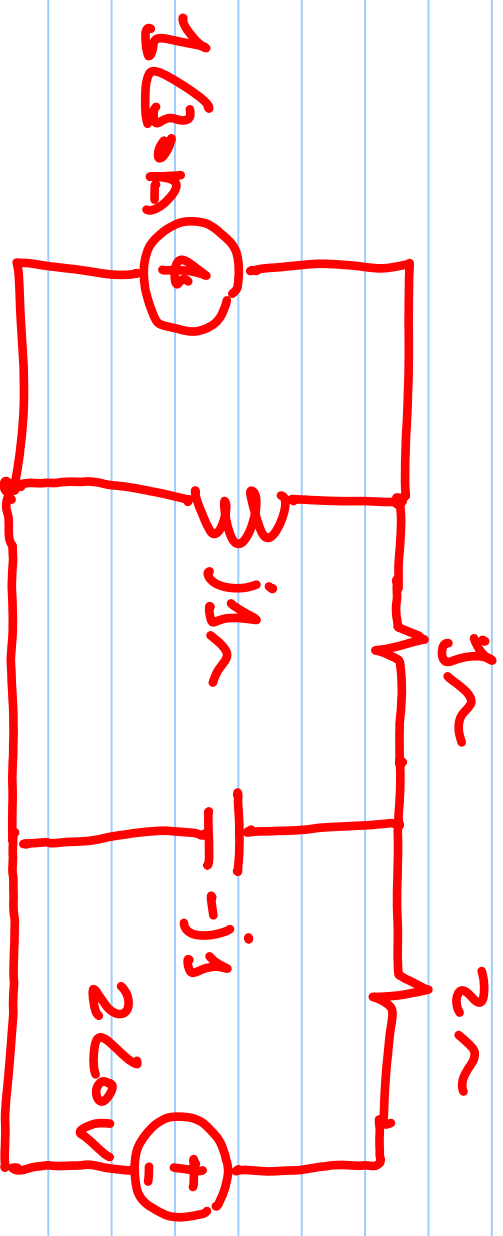
## Example



If  $v_s(t) = 120 \cos(377t + 30^\circ) \text{ V}$ , find

- Instantaneous supplied power
- Average supplied power
- Average dissipated power

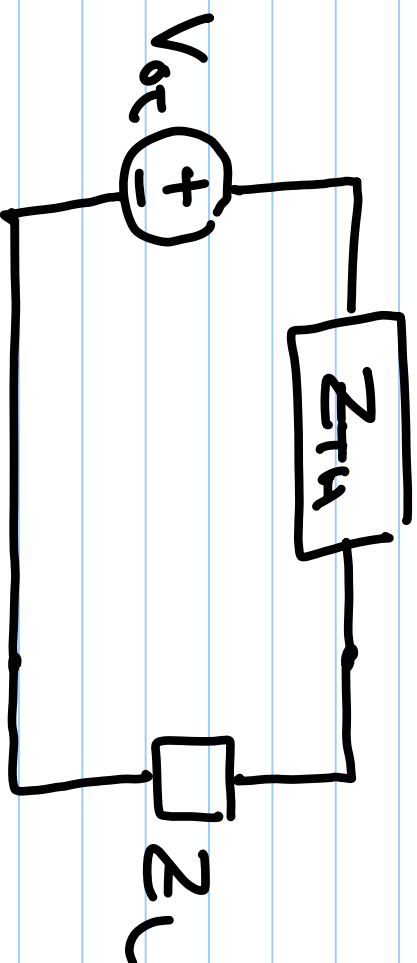
## Example



a) Find Average power supplied

b) Find Average power dissipated

## Maximum Power Transfer

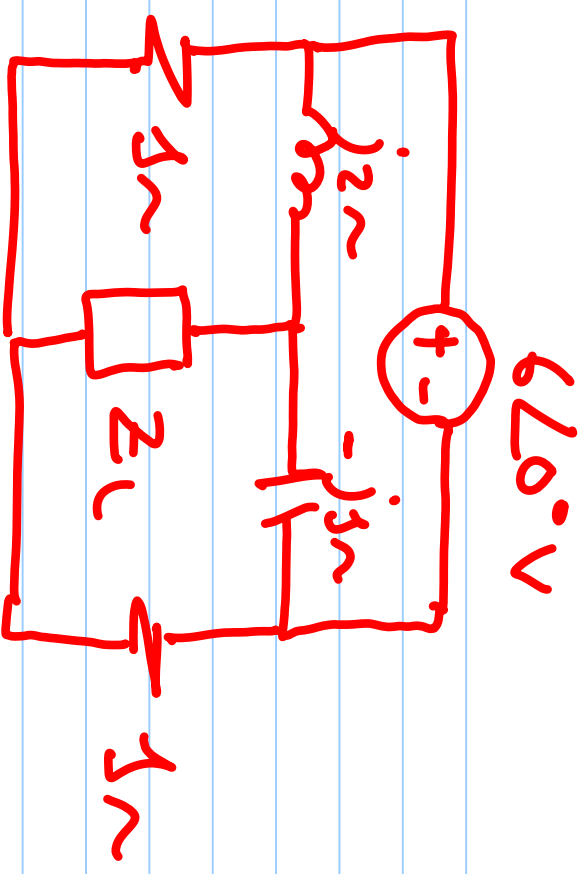


$$\text{If } Z_{TH} = R_{TH} + jX_{TH}$$

Maximum power transfer is achieved

$$\text{if } Z_L = Z_{TH}^* = R_{TH} - jX_{TH}$$

## Example



Find  $Z_L$  for maximum average power transfer. What is the maximum average power absorbed by the load?



