



The Ohio State University
Department of Electrical and Computer Engineering

ECE 205
Spring 2009

Quiz #4

June 3, 2009

Name (print) _____

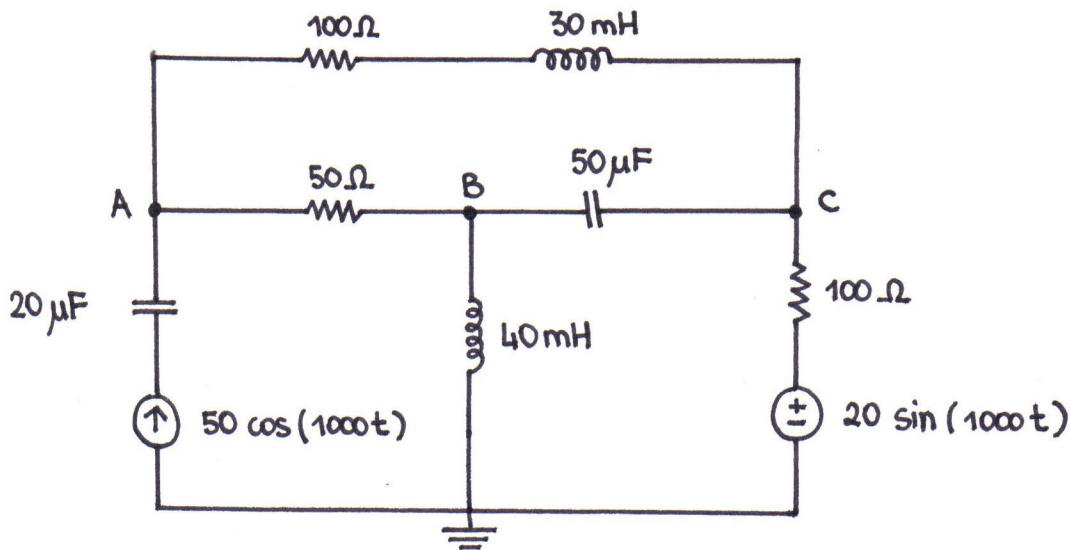
Grade _____

- Note -

- There is 1 problem on the following pages.
- Please read the questions carefully.

“No aid is given, received or observed”

Signature _____



- (1) Derive the phasor model of the circuit. That is, redraw the circuit considering
- for R, L, C the corresponding impedances
 - for the AC sources the corresponding phasors
- (2) Apply node voltage analysis to set up the 3 KCL equations at nodes A, B and C. You do NOT have to solve them to determine V_A, V_B and V_C .

SOLUTION

$$\omega = 1000 \text{ rad/s}$$

$$50 \cos(1000t) \quad \Leftrightarrow \quad 50 \angle 0^\circ$$

$$20 \sin(1000t) = 20 \cos(1000t - 90^\circ) \quad \Leftrightarrow \quad 20 \angle -90^\circ$$

$$Z_C = \frac{-j}{\omega C}$$

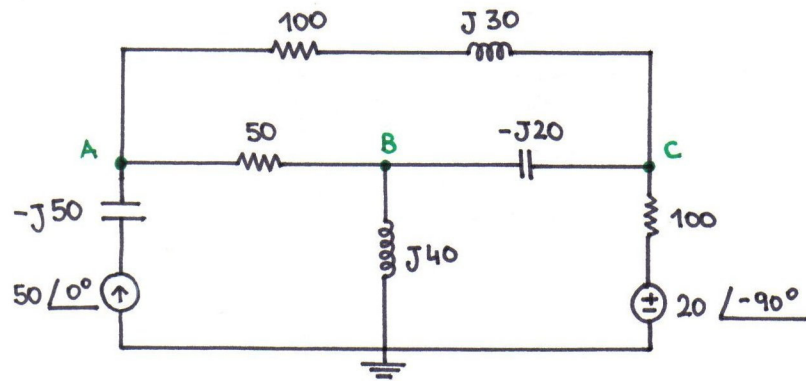
$$C = 50 \mu\text{F} \quad \Leftrightarrow \quad Z_C = \frac{-j}{50 \cdot 10^{-6} \cdot 10^3} = -j20$$

$$C = 20 \mu\text{F} \quad \Leftrightarrow \quad Z_C = \frac{-j}{20 \cdot 10^{-6} \cdot 10^3} = -j50$$

$$Z_L = j\omega L$$

$$L = 30 \text{ mH} \quad \Leftrightarrow \quad Z_L = j \cdot 30 \cdot 10^{-3} \cdot 10^3 = j30$$

$$L = 40 \text{ mH} \quad \Leftrightarrow \quad Z_L = j \cdot 40 \cdot 10^{-3} \cdot 10^3 = j40$$



$$\frac{V_A - V_C}{100 + j30} + \frac{V_A - V_B}{50} = 50 \angle 0^\circ$$

$$\frac{V_B - V_A}{50} + \frac{V_B - V_C}{-j20} + \frac{V_B}{j40} = 0$$

$$\frac{V_C - V_A}{100 + j30} + \frac{V_C - V_B}{-j20} + \frac{V_C - 20 \angle -90^\circ}{100} = 0$$