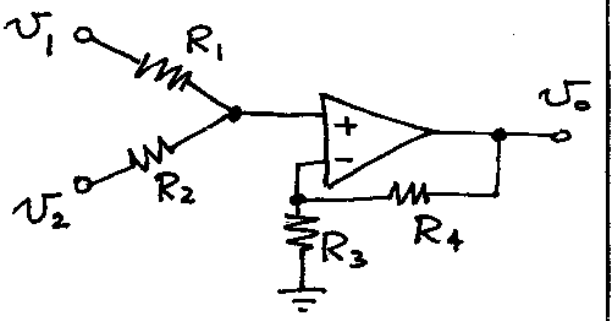
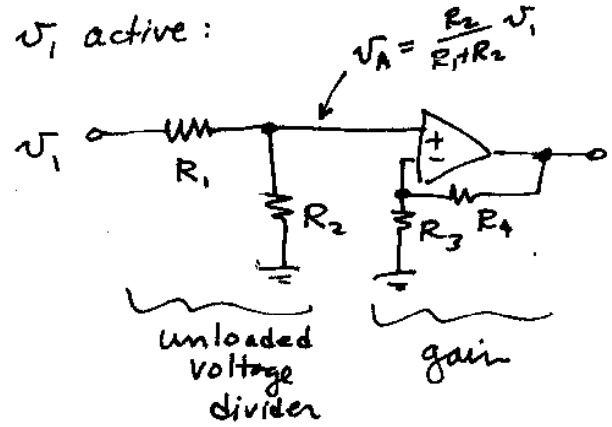
① Analyze the circuit to determine v_o.



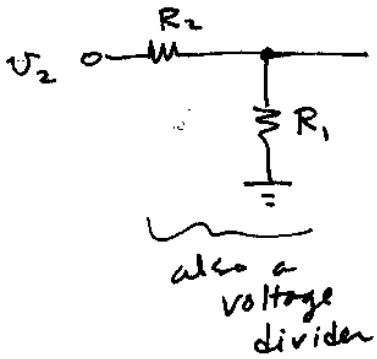
* v_1 active:



$$v_{o_1} = \left(1+\frac{R_4}{R_3}\right) v_A$$

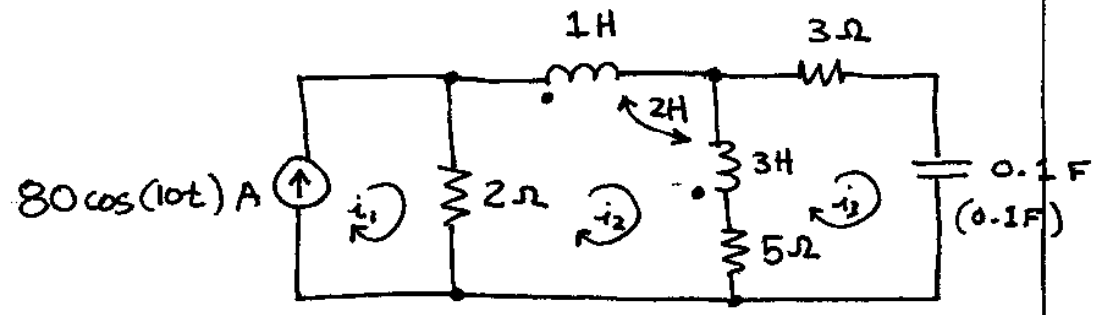
$$v_{o_1} = \left(1+\frac{R_4}{R_3}\right)\left(\frac{R_2}{R_1+R_2}\right) v_1$$

* v_2 active:



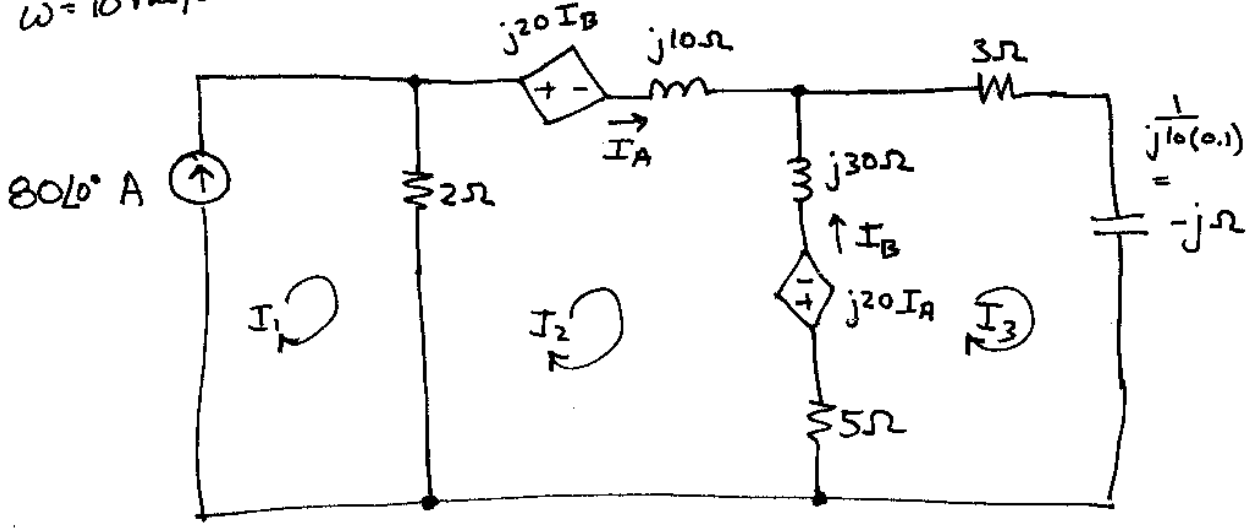
$$\Rightarrow v_{o_2} = \left(1+\frac{R_4}{R_3}\right)\left(\frac{R_1}{R_1+R_2}\right) v_2$$

$$\boxed{v_o = \left(1+\frac{R_4}{R_3}\right)\left(\frac{R_2}{R_1+R_2} v_1 + \frac{R_1}{R_1+R_2} v_2\right)}$$



② Write a complete set of equations in the phasor domain that could be solved to find the defined mesh currents.

$\omega = 10$ rad/s



#1: $I_1 = 80$

#2: $2(I_2 - I_1) + j20I_B + j10I_2 + j30(I_2 - I_3)$

$-j20I_A + 5(I_2 - I_3) = 0$

#3: $5(I_3 - I_2) + j20I_A + j30(I_3 - I_2) + 3I_3 - jI_3 = 0$

Control currents: $I_A = I_2$ & $I_B = I_3 - I_2$