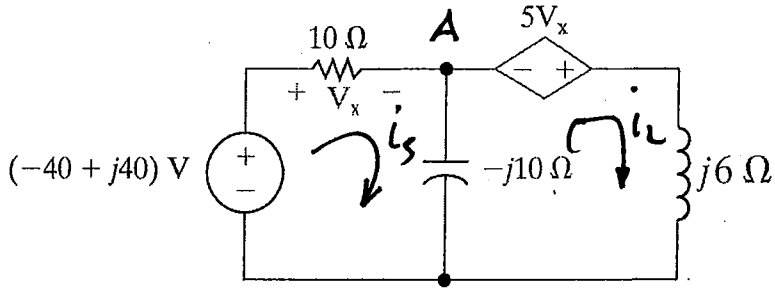
2. For the circuit to the right, calculate the current through the inductor (clockwise) as a phasor (magnitude and phase). (14)



Many possible approaches

Option #1: Use V_x as unknown

$$\sum_{\text{node A}} \text{I}_i = 0 = -\frac{V_x}{10\Omega} + \frac{V_s - V_x}{-j10\Omega} + \frac{V_s - V_x + 5V_x}{j6\Omega}$$

where $V_s = (-40 + j40)\text{V} = 40\sqrt{2}\angle 135°$

$$V_x\left[\frac{1}{10} + \frac{j}{10} + \frac{j4}{6}\right] = V_s\left[\frac{j}{10} - \frac{j}{6}\right]$$

Note, angle is not $-45°$ which is in wrong quadrant, but has same $\tan^{-1}\left(\frac{b}{a}\right)$

$$V_x = \frac{j3 - j5}{3 + j3 + j20} = \left(\frac{-j2}{3 + j23}\right) V_s$$

$$i_L = \frac{V_s + 4V_x}{j6} = \frac{-jV_s}{6}\left[1 + 4\left(\frac{-j2}{3+j23}\right)\right] = \frac{V_s[23 - j3 - 8]}{6(3+j23)}$$

$$= \frac{V_s[15 - j3]}{6(3+j23)} = \frac{40\sqrt{2}\angle 135°\,(5-j)}{6 + j46} = \frac{40\sqrt{2}\sqrt{26}\angle 135° - 11.3°}{\sqrt{6^2 + 46^2}\ \angle 82.6°}$$

$$= 6.22\angle 41.1°$$

Option #2: Loop currents

$$V_x = 10\, i_s$$

Loop 1: $-(-40 + j40) + 10 i_s + (-j10)(i_s - i_L) = 0$

Loop 2: $-5V_x + j6\, i_L + (-j10)(i_L - i_s) = 0$

Eliminate V_x and i_s to get $i_L = 6.22\angle 41.1°$