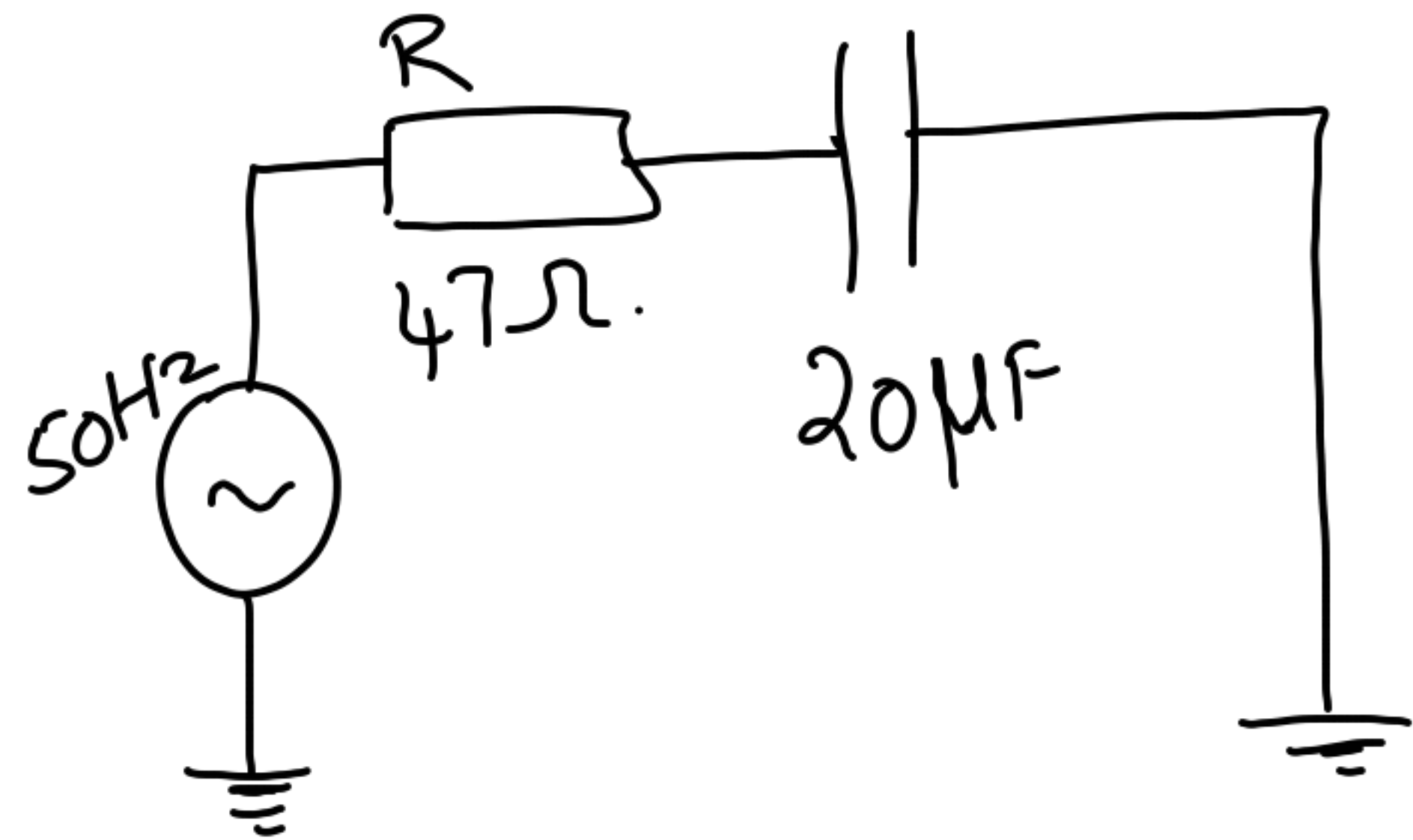


1) Determine the Capacitive Reactance, impedance and phase angle for the following circuit.



$$C = 20\mu F$$

$$R = 47\Omega$$

$$f = 50\text{Hz}$$

$$X_C = ?$$

$$Z = ?$$

$$\phi = ?$$

$$X_C = \frac{1}{2\pi fC}$$

$$= \frac{1}{2\pi \times 50 \times 20 \times 10^{-6}}$$

$$X_C = 159\Omega$$

$$Z = \sqrt{R^2 + X_C^2}$$
$$= \sqrt{(47)^2 + (159)^2}$$

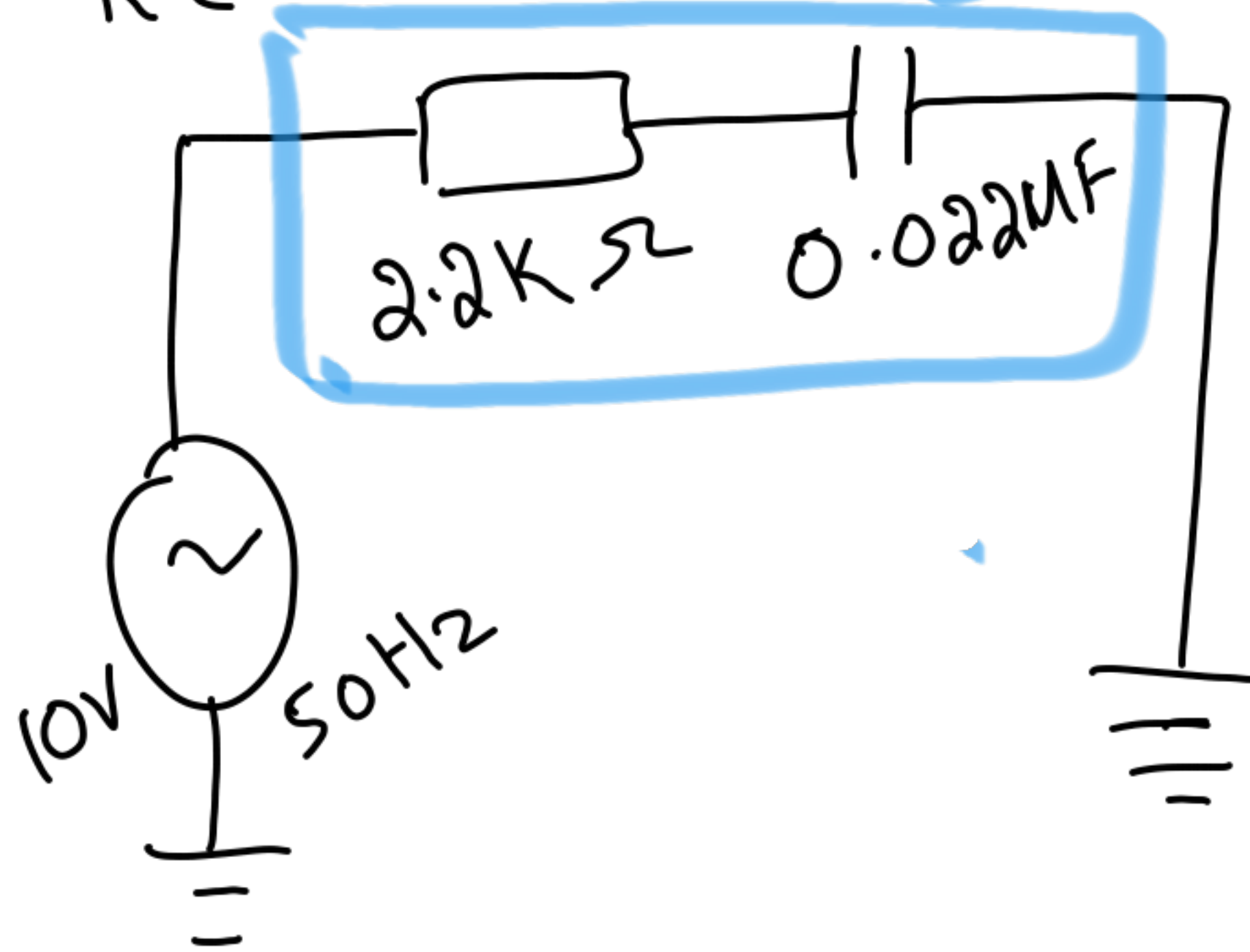
$$Z = 165.94\Omega$$

$$\phi = \tan^{-1}\left(\frac{X_C}{R}\right)$$

$$= \tan^{-1}\left(\frac{159}{47}\right)$$

$$\phi = 73.5^\circ$$

2) Determine the current in the RC circuit.



Soln.

$$R = 2.2k\Omega$$

$$C = 0.022\mu F$$

$$V = 10V$$

$$f = 50Hz$$

$$I = ?$$

$$\hat{I} = \frac{V}{Z}$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 50 \times 0.022 \times 10^{-6}}$$

$$X_C = 144.69 \text{ k}\Omega$$

$$Z = \sqrt{R^2 + X_C^2}$$

$$Z = \sqrt{(2.2 \times 10^3)^2 + (144.69 \times 10^3)^2}$$

$$Z = 144.7 \text{ k}\Omega$$

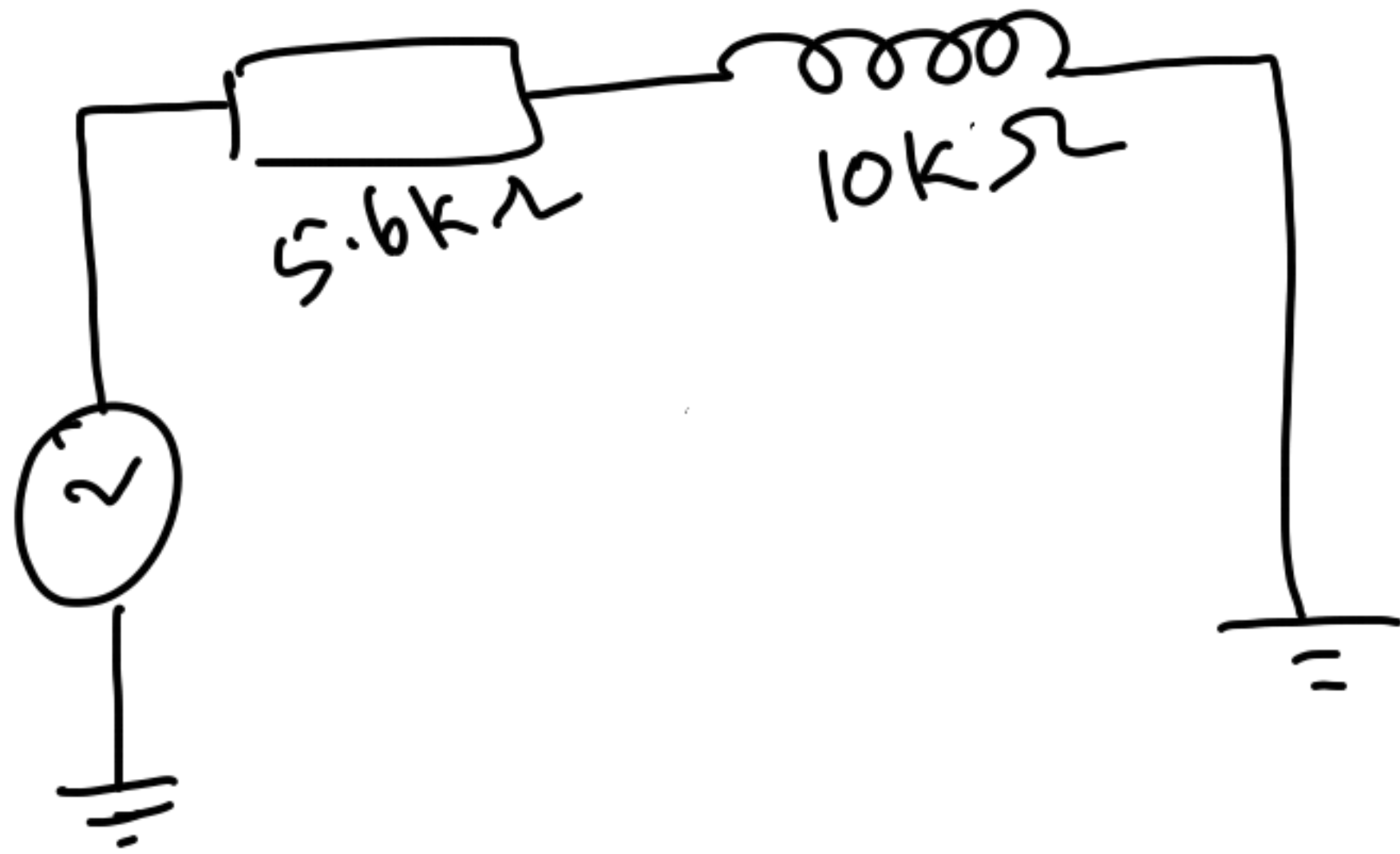
$$\hat{I} = \frac{V}{Z} = \frac{10}{144.7 \times 10^3}$$

$$= 6.9 \times 10^{-5}$$

$$= 69 \times 10^{-6}$$

$$\hat{I} = 69 \mu\text{A}$$

3) Determine the impedance and phase angle for the circuit.



Soln:

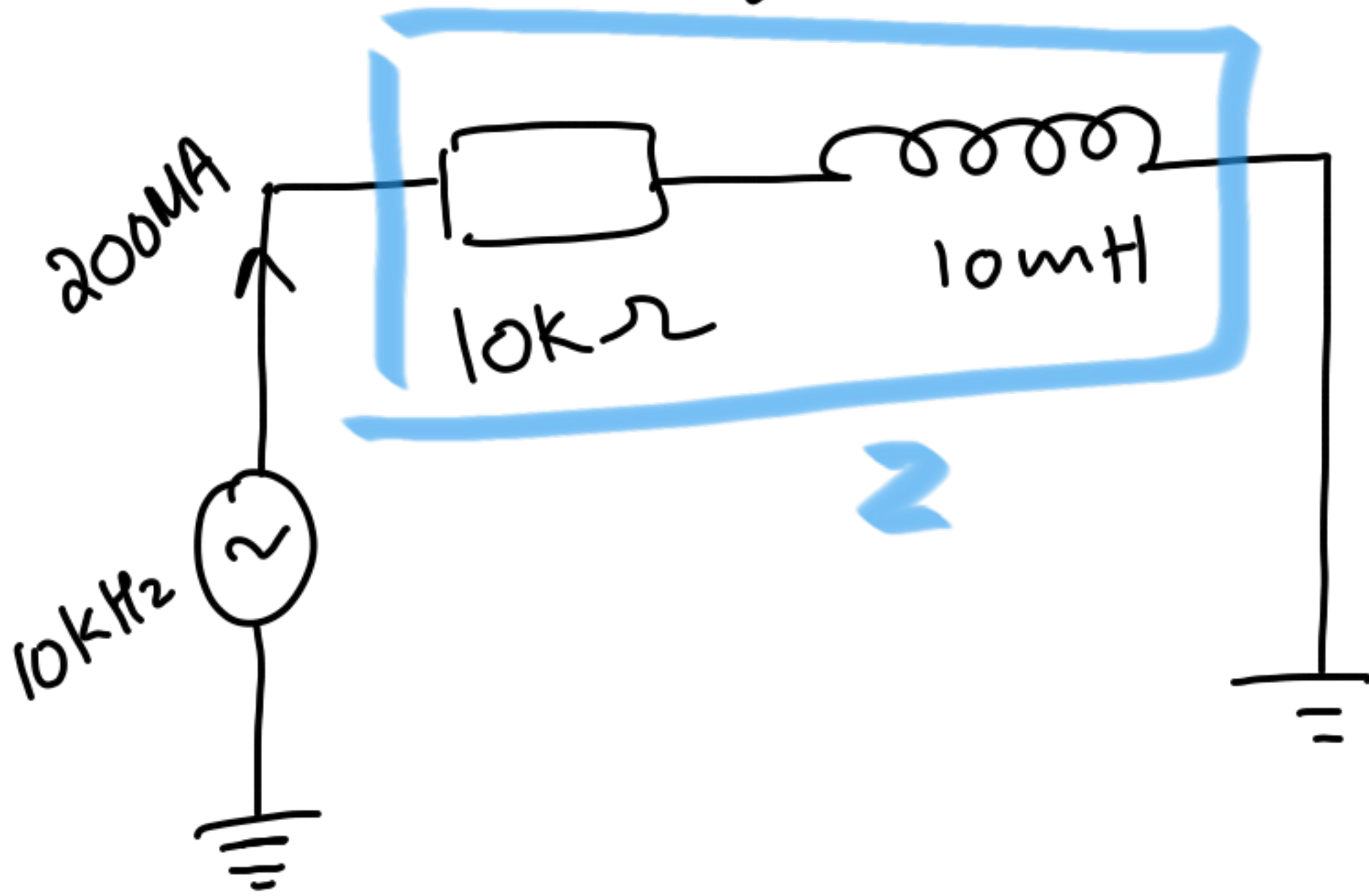
$$Z = \sqrt{R^2 + X_L^2}$$
$$= \sqrt{(5.6 \times 10^3)^2 + (10 \times 10^3)^2}$$

$$Z = 11.5 k\Omega$$

$$\phi = \tan^{-1}\left(\frac{X_L}{R}\right)$$
$$= \tan^{-1}\left(\frac{10 \times 10^3}{5.6 \times 10^3}\right)$$

$$\phi = 60.75^\circ$$

4) Determine the supply voltage for the following circuit.



$$V = I Z$$

$$X_L = 2\pi fL$$

$$X_L = 2\pi \times 10 \times 10^3 \times 10 \times 10^{-3}$$

$$X_L = 628 \Omega$$

$$Z = \sqrt{R^2 + X_L^2}$$

$$= \sqrt{(10 \times 10^3)^2 + (628)^2}$$

$$Z = 10019$$

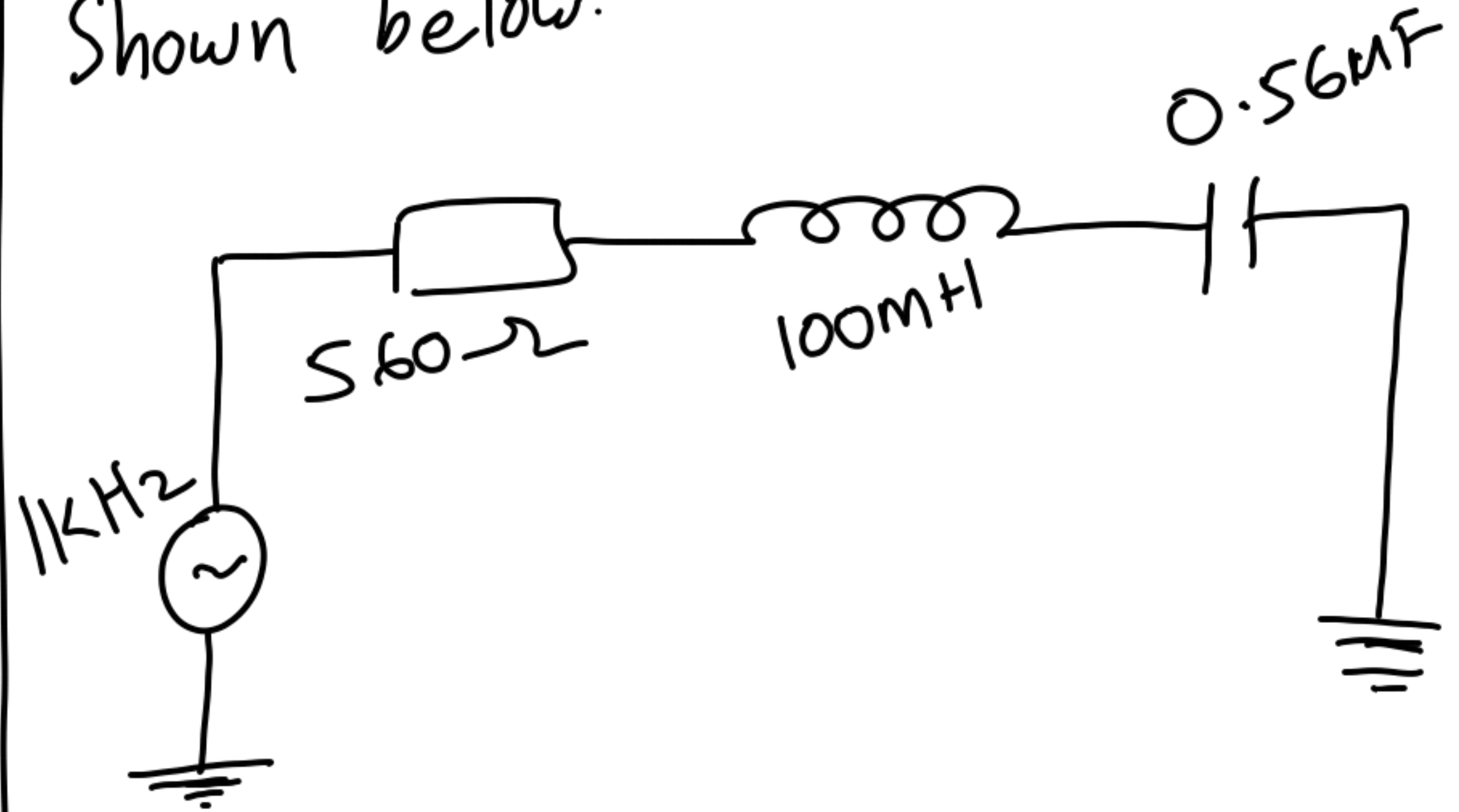
$$Z = 10.02 k\Omega$$

$$V = I Z$$

$$= 200 \times 10^{-3} \times 10.02 \times 10^3$$

$$V = 2 \text{ kV}$$

5) Calculate the total impedance and phase angle for the circuit shown below.



Soln:

$$R = 560 \Omega,$$

$$L = 100 \text{ mH}$$

$$f = 1 \text{ kHz}$$

$$C = 0.56 \mu\text{F}$$

$$Z = ?$$

$$X_L = 2\pi fL$$
$$= 2\pi \times 1000 \times 100 \times 10^{-3}$$

$$X_L = 628.3 \Omega$$

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 1000 \times 0.56 \times 10^{-6}}$$

$$X_C = 284.2 \Omega$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$Z = \sqrt{(560)^2 + (628.3 - 284.2)^2}$$

$$Z = 657.3 \Omega$$

$$\phi = \tan^{-1} \left(\frac{X_L - X_C}{R} \right)$$

$$= \tan^{-1} \left(\frac{628.3 - 284.2}{560} \right)$$

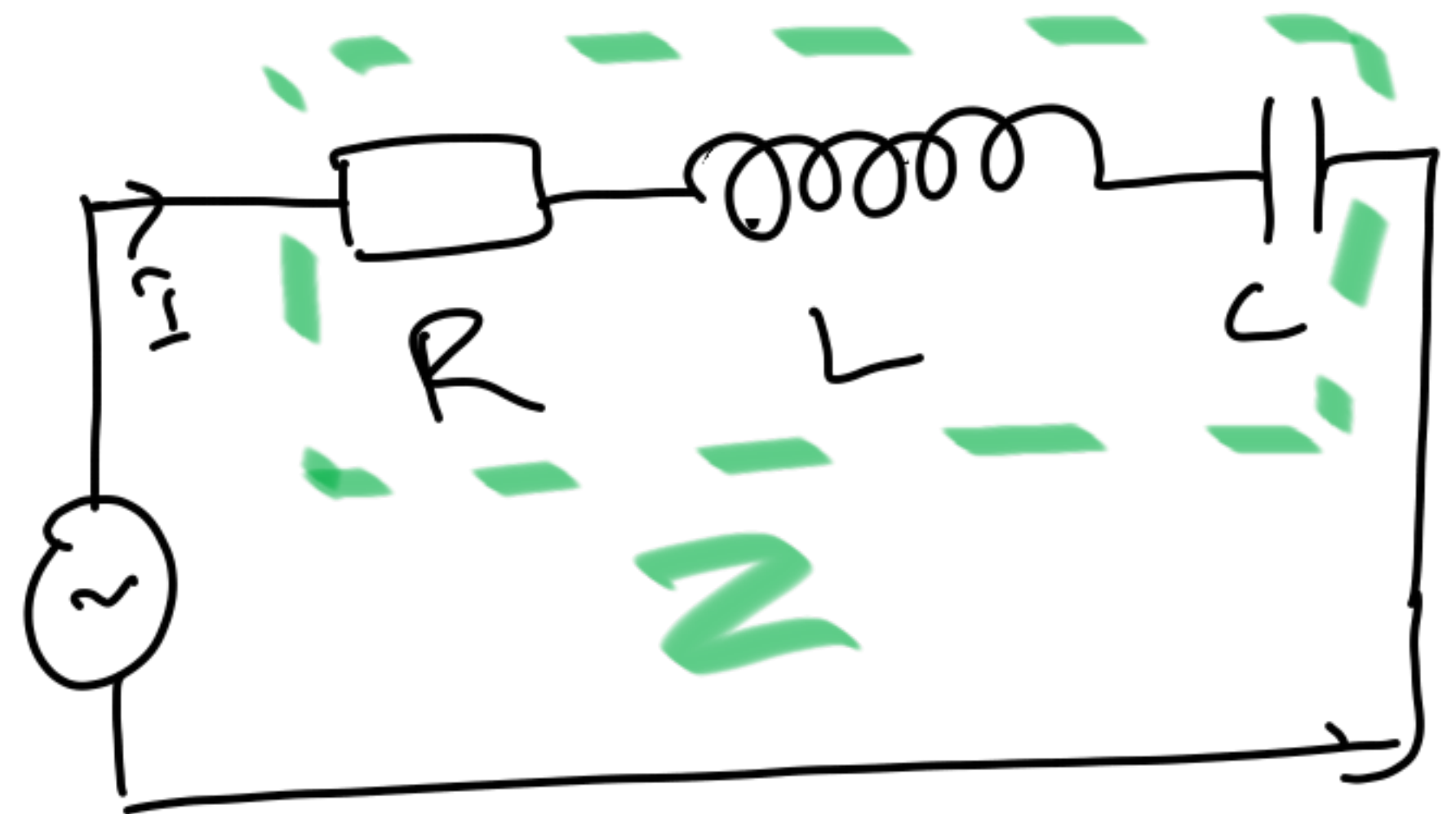
$$\phi = 31.6^\circ$$

6) A coil having an Resistance of 10Ω is connected to an inductance of 125mH in series with a $60\mu\text{F}$ capacitor across a 120V supply. At what frequency does Resonance occurs? Find the current flowing at the Resonant frequency.

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$f_r = \frac{1}{2\pi \times 125 \times 10^{-3} \times 60 \times 10^{-6}}$$

$$f_r = 58.12 \text{ Hz.}$$



$$I = \frac{V}{Z}$$

At Resonance, $X_L = X_C$

$$Z = R$$

$$\hat{I} = \frac{V}{R} = \frac{120}{10}$$

$$\hat{I} = 12 \text{ A}$$