Ex:

\[ v_s(t) = 50\cos(1\pi t) \text{V} \]

a) Find the phasor value for \( v_s(t) \).

b) Draw the frequency-domain circuit diagram, including the phasor value for \( v_s(t) \) and impedance values for components.

c) Find the phasor value for \( v(t) \).

**Sol’n:** a) Since there is no phase shift for the cosine, we have a real-valued phasor. It is helpful, to avoid confusion with DC signals, to include the zero-degrees phase shift in the phasor value even though it might be omitted and still be correct mathematically.

\[ V_s = 50\angle 0^\circ \text{ V} \]

b) To complete the frequency-domain diagram, we require impedance values. From the voltage source, we have that \( \omega = 1\text{M }\text{r/s} \).

\[ \frac{1}{j\omega C} = -j\frac{1}{1\text{M} \cdot 100\text{p}} \Omega = -j10\text{k}\Omega \]

and

\[ j\omega L = j(1\text{M})3\text{mH} = j3\text{k}\Omega \]

The resulting frequency-domain diagram is shown below.
c) We use a voltage-divider to find $V$.

$$V = V_s \frac{24 \text{k} \Omega}{24 \text{k} \Omega - j7 \text{k} \Omega} = 50 \angle 0^\circ \frac{24}{24 - j7}$$

or

$$V = 50 \angle 0^\circ \sqrt{24^2 + (-7)^2} \tan^{-1}\left(\frac{-7}{24}\right)$$

or

$$V = 50 \angle 0^\circ \frac{24}{25 \angle -16.3^\circ} = 48 \angle 16.3^\circ \text{ V}$$