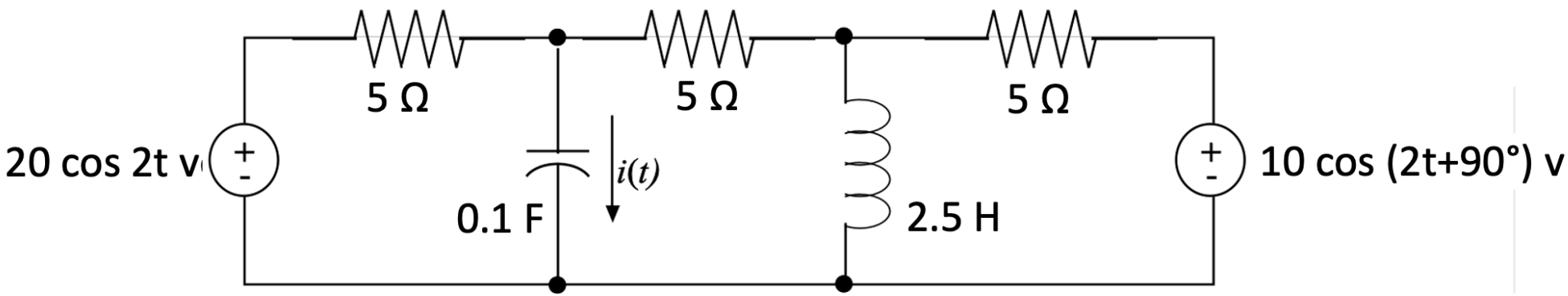
Lecture 19
Phasors – 5 of 9

examples

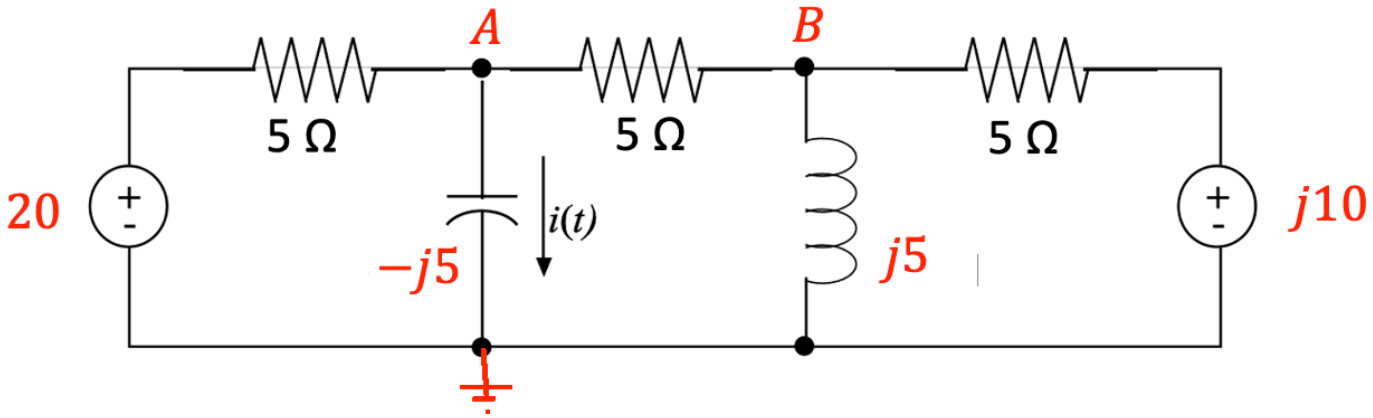
What Now?

- Have used seen that voltage division, series and parallel impedance, and simple analysis all work with phasors
- Let's practice analysis methods
  - Node analysis
  - Dependent sources
  - Super nodes
  - …

Example: Find the current *i*(t) (solved on next slides)

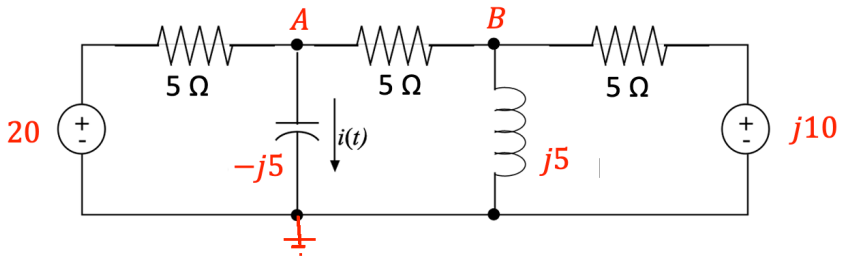


1 - Convert to phasors



2 – Write node equations

$$\begin{bmatrix} \frac{1}{5}+\frac{1}{5}+\frac{1}{-j5} & -\frac{1}{5} \\ -\frac{1}{5} & \frac{1}{5}+\frac{1}{5}+\frac{1}{j5} \end{bmatrix} \begin{bmatrix} A \\ B \end{bmatrix} = \begin{bmatrix} \frac{20}{5} \\ \frac{j10}{5} \end{bmatrix}$$



2 – Solve for A

$$A = \frac{\begin{vmatrix} 4 & -\frac{1}{5} \\ j2 & \frac{2-j}{5} \end{vmatrix}}{\begin{bmatrix} \frac{2+j}{5} & -\frac{1}{5} \\ -\frac{1}{5} & \frac{2-j}{5} \end{bmatrix}} = \frac{\frac{8}{5} - j\frac{4}{5} + \frac{j2}{5}}{\frac{1}{5} - \frac{1}{25}} = \frac{\frac{8}{5} - j\frac{2}{5}}{\frac{4}{25}} = 10 - j\frac{5}{2}$$

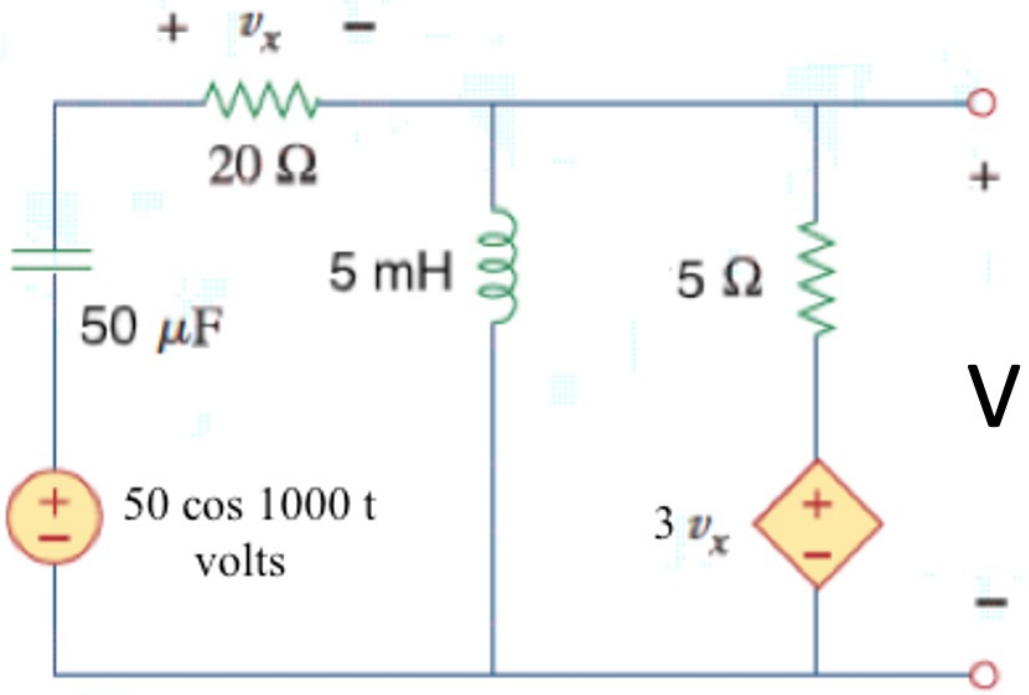
3 – Solve for I

$$I = \frac{A}{-j5} = \frac{10 - j\frac{5}{2}}{-j5} = \frac{1}{2} + j2 = 2.06\angle 76°$$

3 – Convert to time function

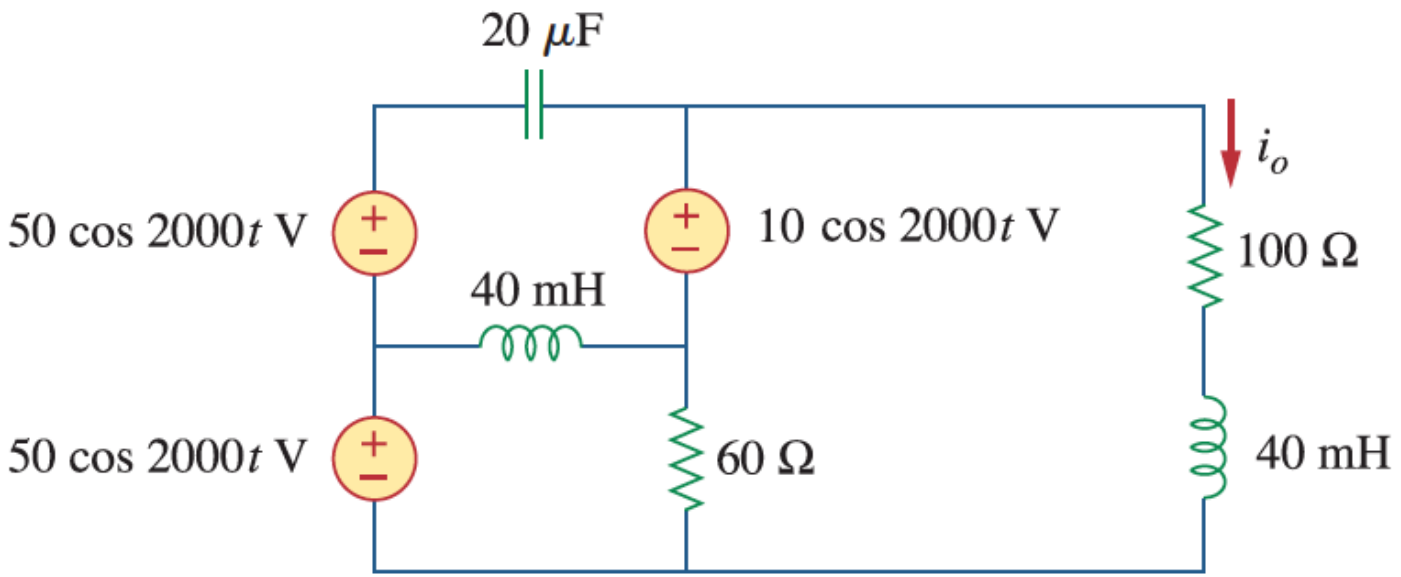
$$\mathrm{i(t)} = 2.06\cos(2t + 76°)\ A$$

Example: Find V



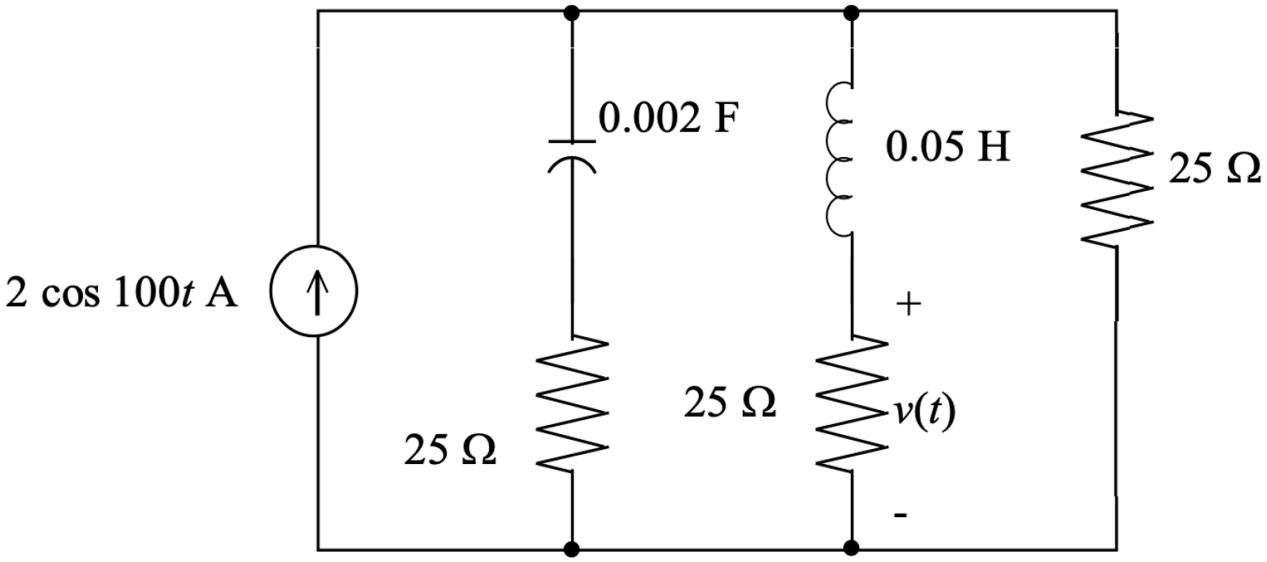
$5.24\cos(\,1000t + 31.6°)\ V$

Example: Find i_o



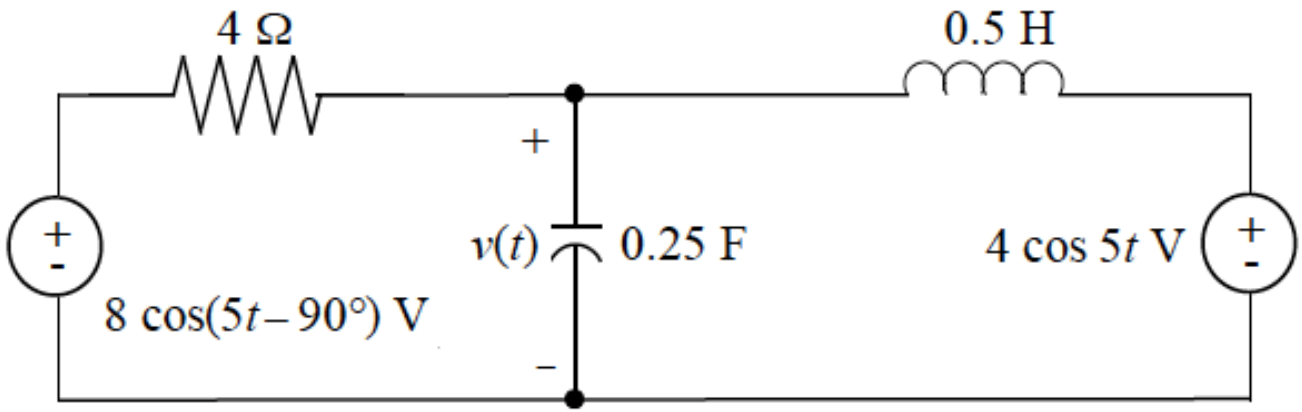
$822\cos(2000t + 3.69°)\ mA$

Example: Find $v(t)$



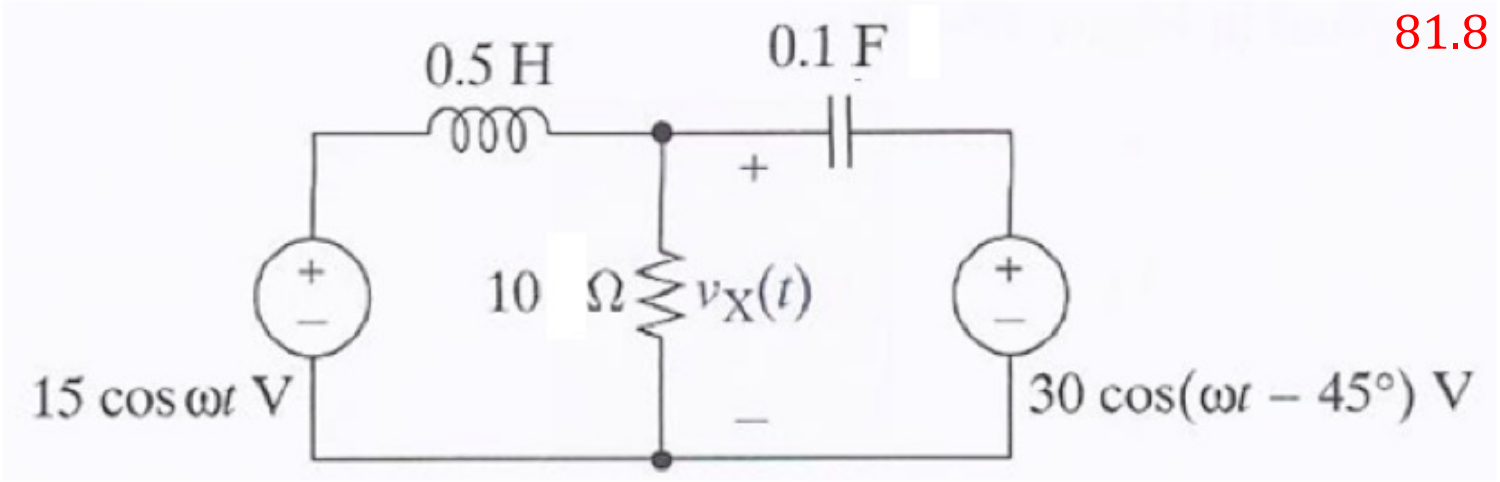
$16.8\cos(100t - 11.3°)\ V$

Example: find $v(t)$ – try node analysis



$4.06\cos(5t - 164°)\ V$

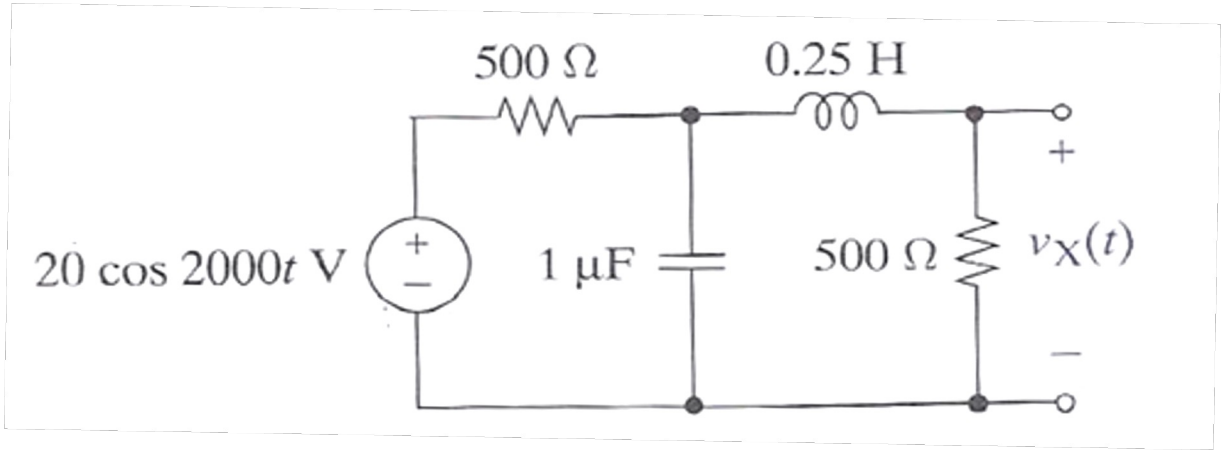
Practice problem: find $v(t)$ with $\omega = 5$ rad/sec



$81.8\cos(5t + 112°)$ V

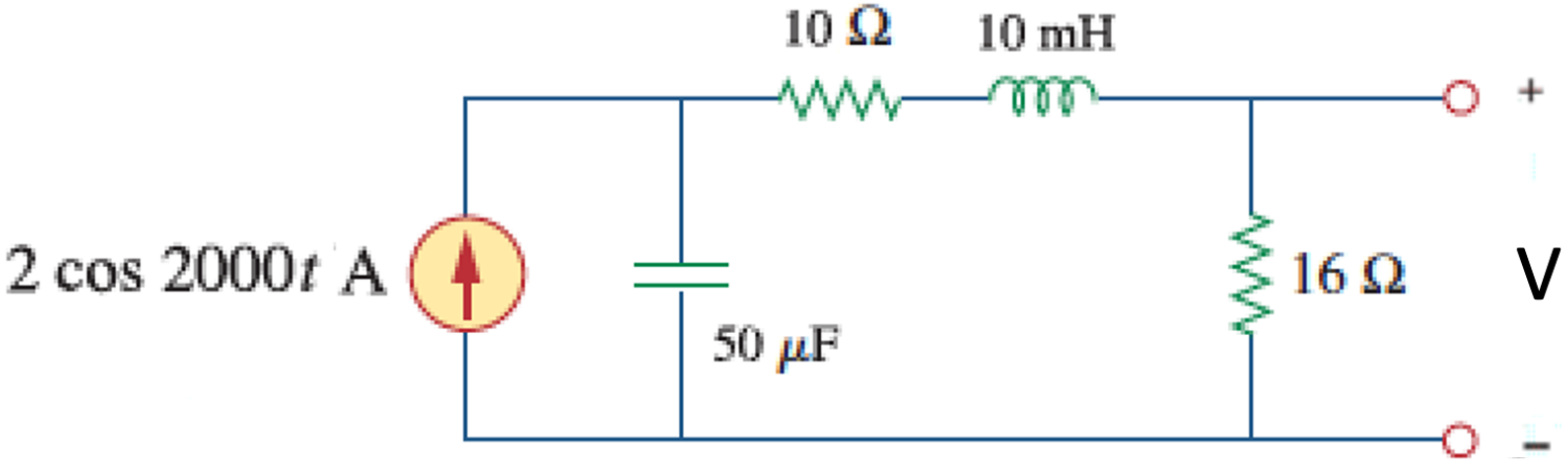
Practice problem: find $v_X(t)$

$6.67\cos(2000t - 90°)\ V$



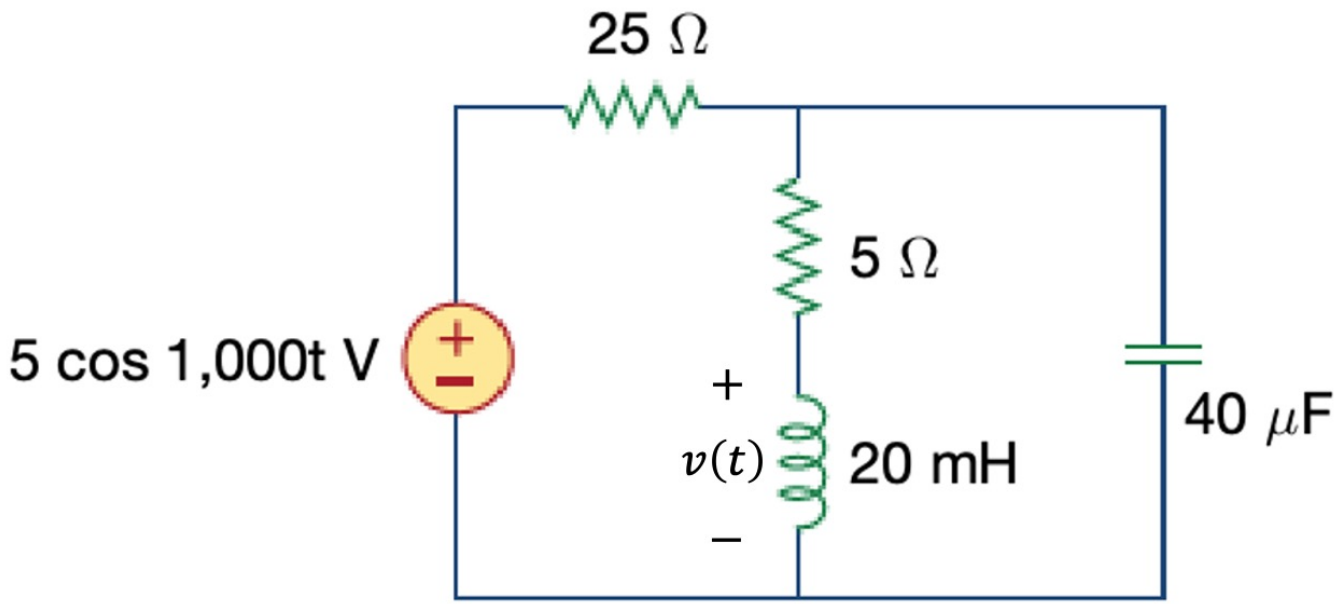
Practice problem: find $v(t)$

$13.8\cos(2000t - 115°)\ V$



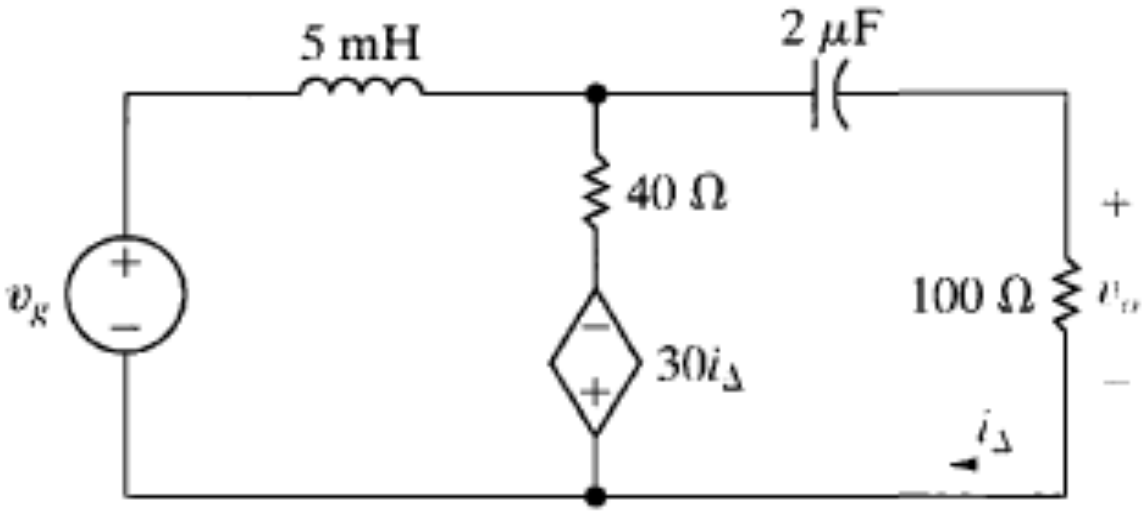
Practice problem: find $v(t)$

$3.71\cos(1000t + 21.8°)\ V$



Example: find $v(t)$ if $v_g(t) = 130 \cos 10{,}000\, t$ V,

f



$73.2 \cos(10{,}000t - 67.5°)\ V$