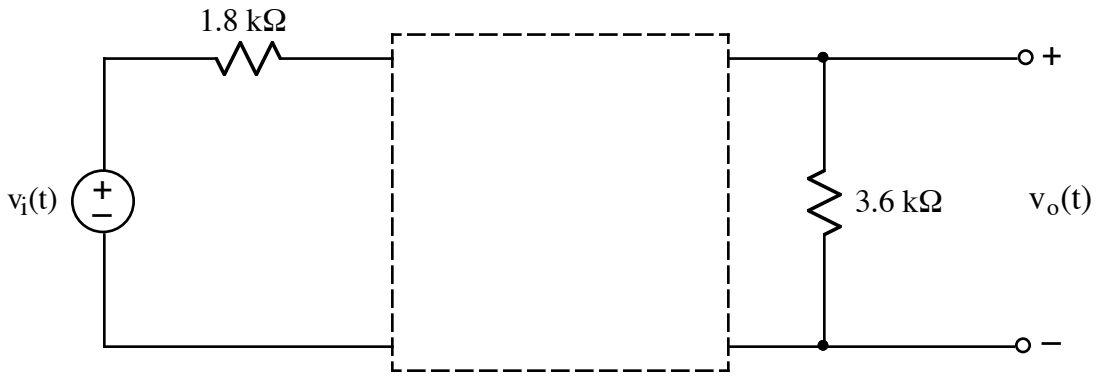
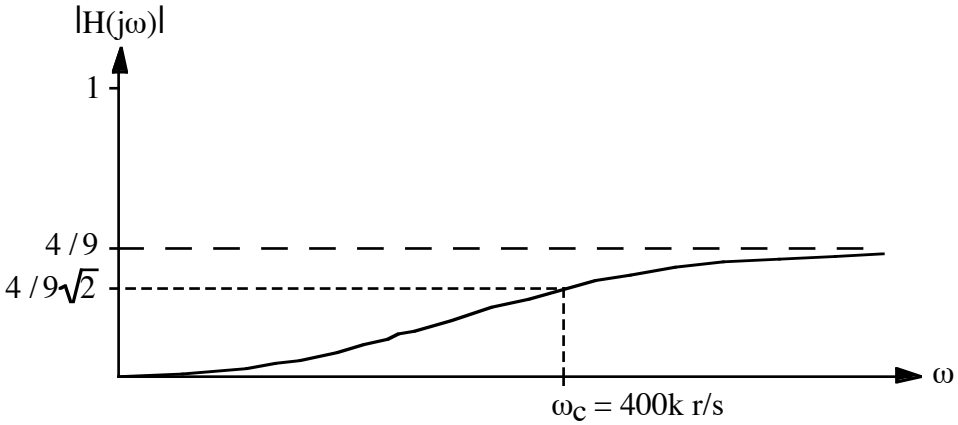
HOMEWORK #4

1.





After being open for a long time, the switch closes at t = 0.

The inductor carries no current at time $t = 0^-$.

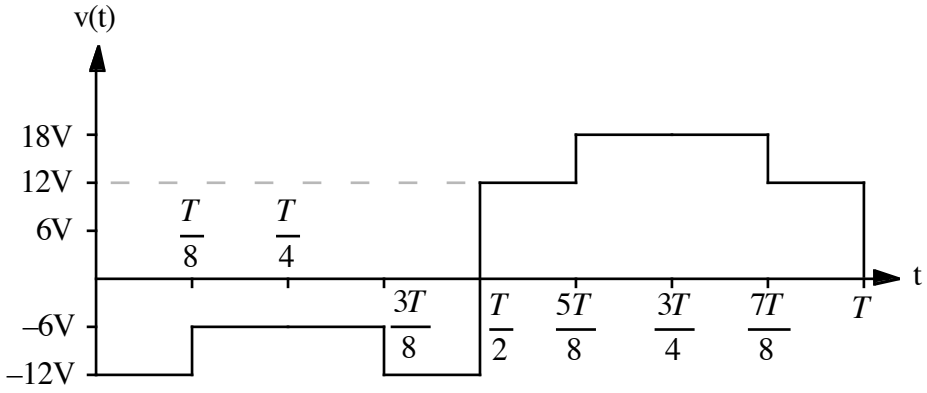
Using not more than one each R, L, and C, design a circuit to go in the dashed-line box that will produce the |H(jω)| vs. ω shown above, that is:

$$|H(j\omega)| = 0 \text{ at } \omega = 0$$

$$|H(j\omega)| = \frac{4}{9\sqrt{2}} \text{ at } \omega = 400 \text{ k rad/s}$$

$$|H(j\omega)| = \frac{4}{9} \text{ as } \omega \to \infty$$

2 – 4.



One period, T, of a function v(t) is shown above. The formula for v(t) is

$$v(t) = \begin{cases} -12\text{V} & 0 < t < T/8 \\ -6\text{V} & T/8 < t < 3T/8 \\ -12\text{V} & 3T/8 < t < T/2 \\ 12\text{V} & T/2 < t < 5T/8 \\ 18\text{V} & 5T/8 < t < 7T/8 \\ 12\text{V} & 7T/8 < t < T \end{cases}$$

Find the numerical value of the following coefficients of the Fourier series for v(t):

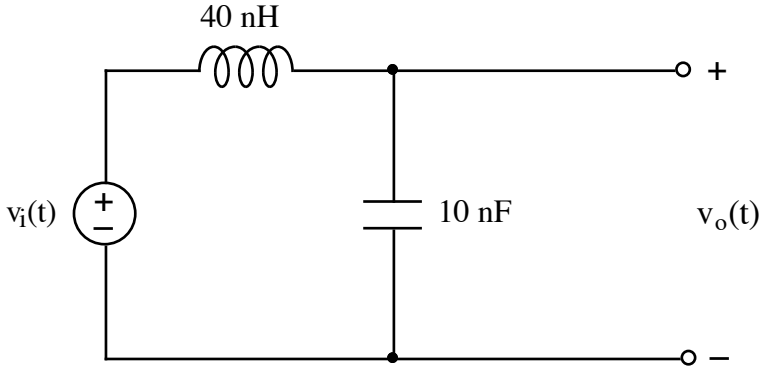
2. a_v

3. a_1

4. a) b_1

   b) b_2

5.



$$v_i(t) = \sum_{k=1}^{\infty} \left[a_k \cos(k\omega_o t) + b_k \sin(k\omega_o t) \right] \text{V}$$

where

$$a_k = -\frac{1}{\pi^2 k^2}$$

$$b_k = \frac{\cos\left(\frac{\pi}{2}k\right)}{k}$$

Write the time-domain expression of the fifth harmonic (i.e., k = 5) of $v_o(t)$.

Note: ω_o = 5M rad/s.