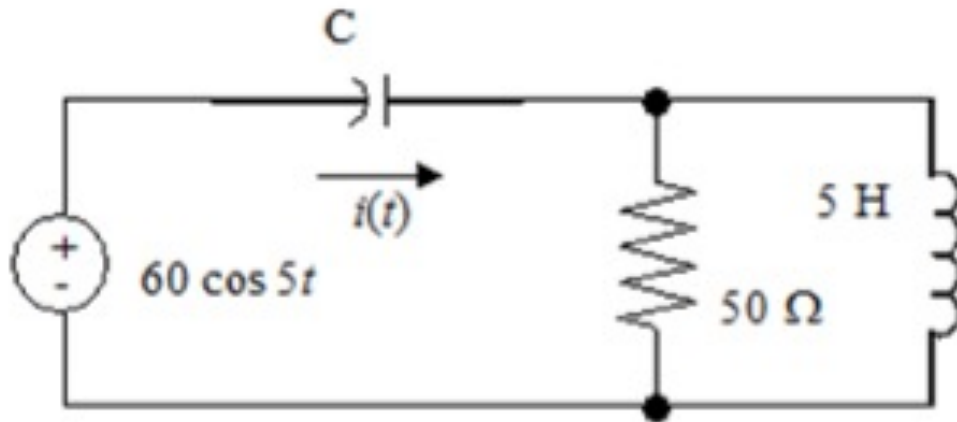# Phasors 9

design examples
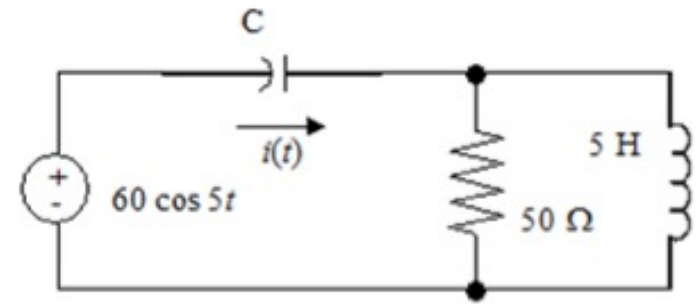
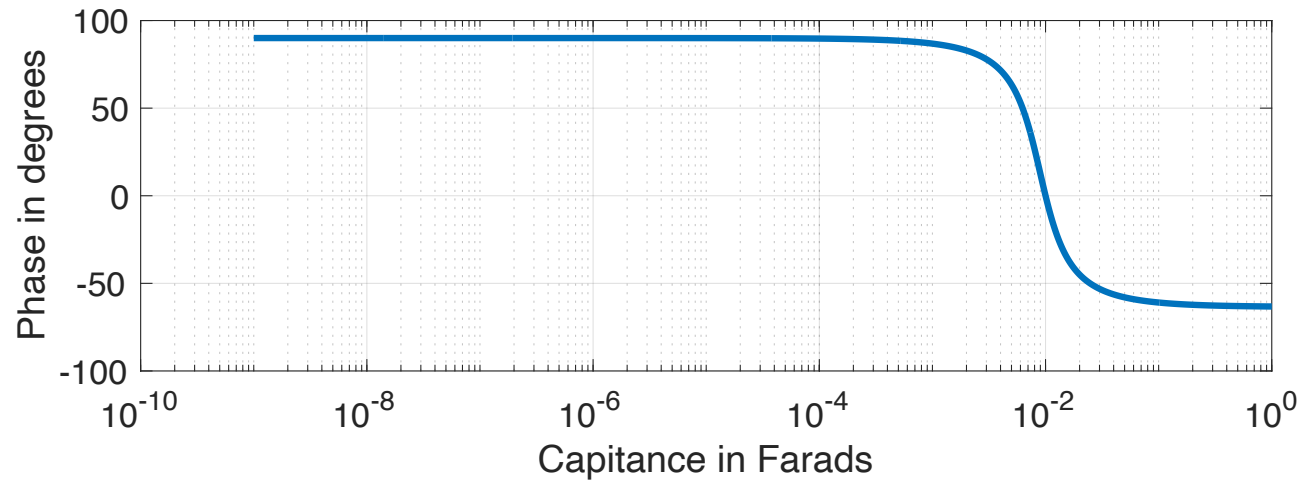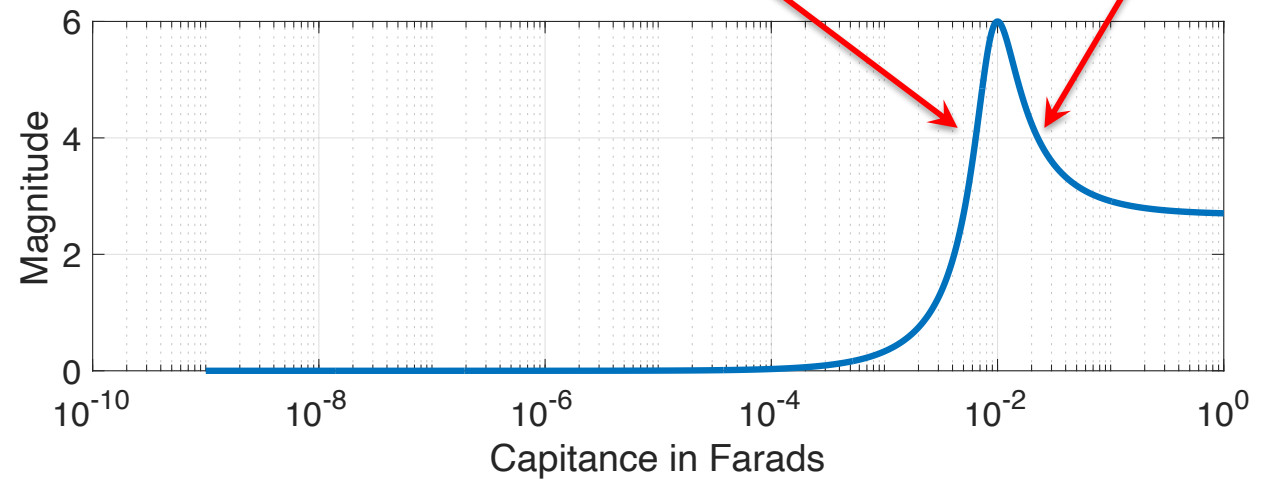**Example:** Find C so that the magnitude of $i(t)$ is 4 amps.

```
om = 5;
R = 50;
L = 5;
ZL = 1j*om*L;
C = logspace(-9,0,1000);
ZC = 1./(1j*om*C);
Z = ZC + 50*ZL/(50+ZL);
I = 60./Z;
```
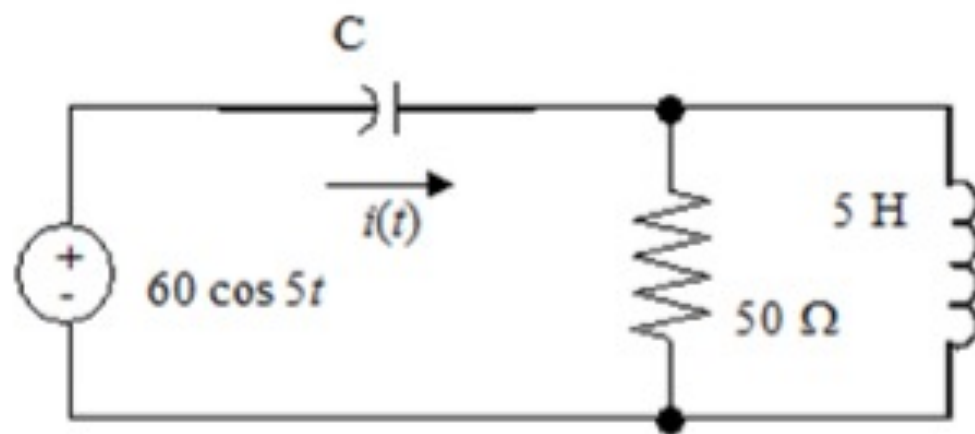

$|I| = 4$ occurs in two spots !!

Let's actually solve for C

$6.4 \ mF; \ 22.7 \ mF$

**Example:** The circuit shown is a low pass filter meaning that it passes lower frequency sinusoids and attenuates higher frequency sinusoids. Find a value for the capacitor C so that **all** sinusoids above 1000 Hz in frequency are attenuated by at least 90% (i.e. their amplitude scaling, $|Vo/Vs|$, is at most 0.1). Using your result what happens to a 60 Hz signal? How is its amplitude changed? How is its phase angle changed?

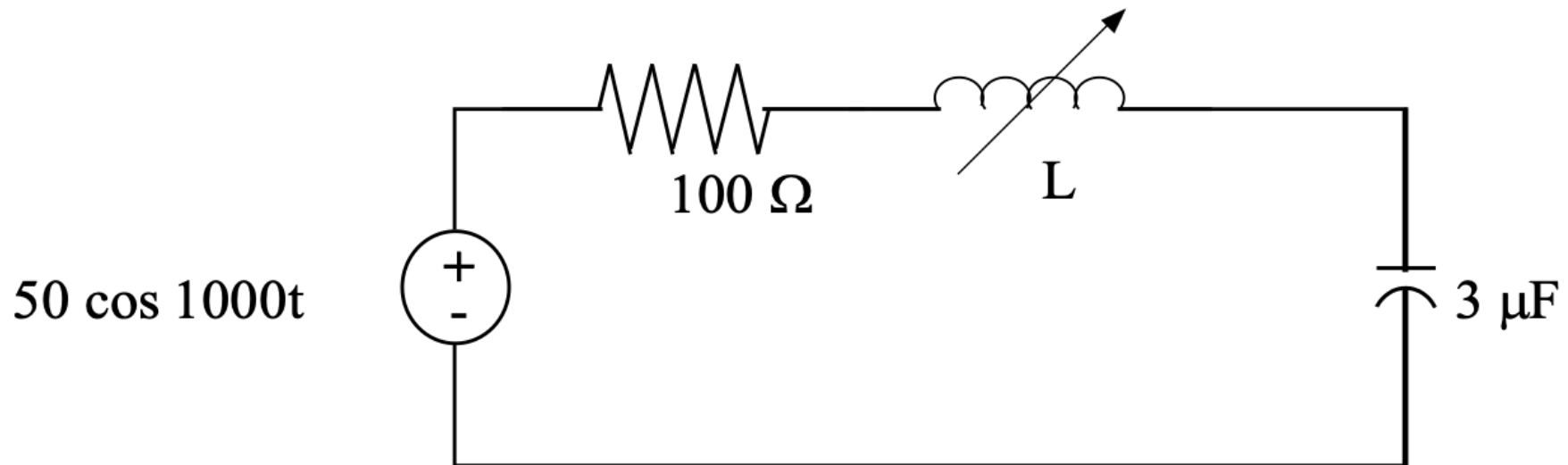$1 k\Omega$

V_s

C

$+$
V_o
$-$
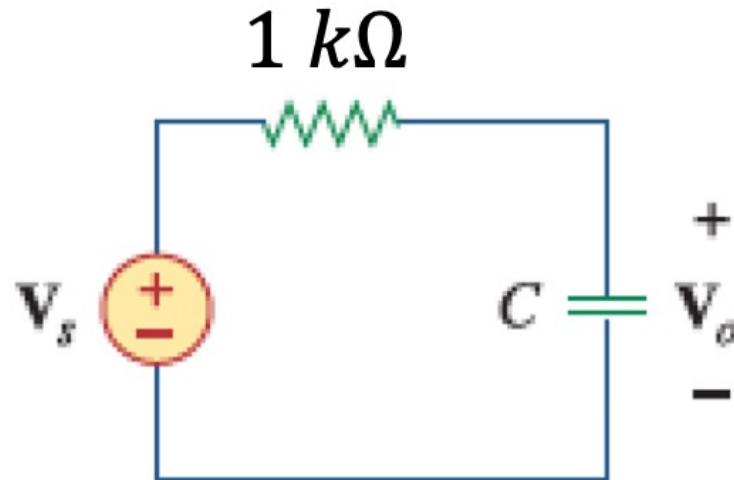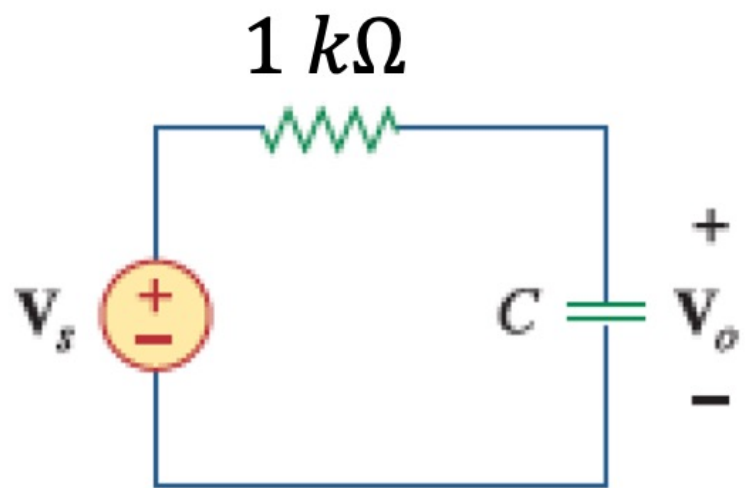
$1.58 \ \mu F; 85.9 \ \%; -20.8°$

Example: Find the resistor R* so that the magnitude of the current $i(t)$ is 1 A.

$i(t)$

R*

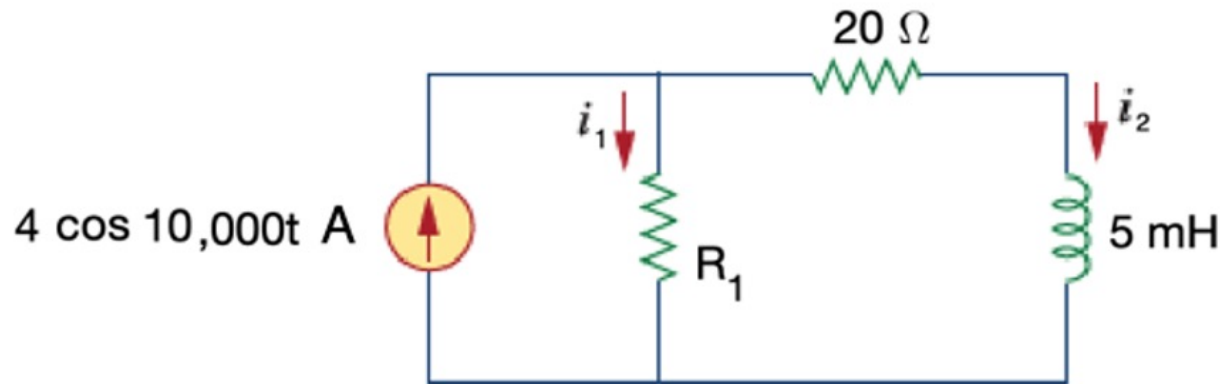$10 \cos 10t \ V$

$0.02 \ F$

$10 \ \Omega$
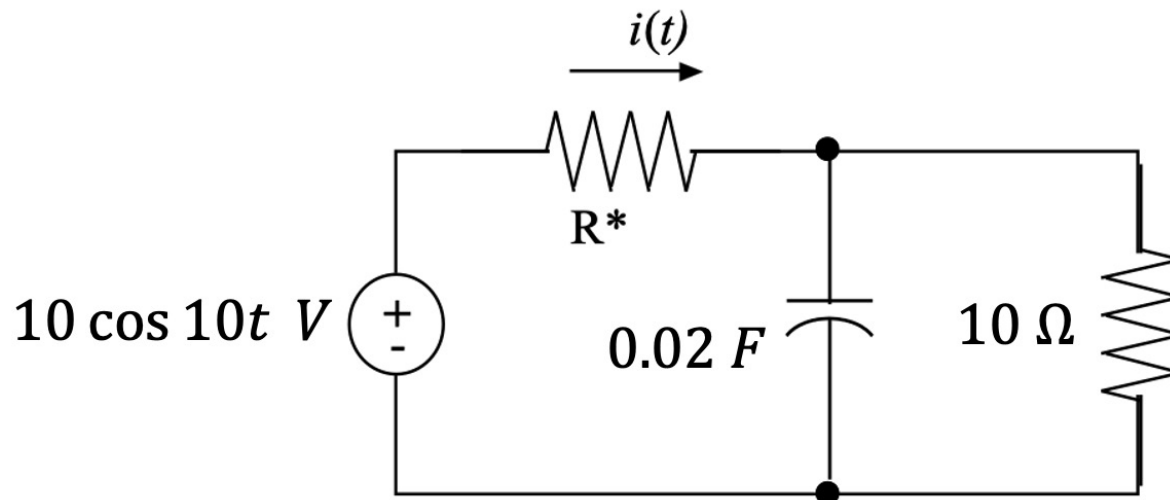
97.9 Ω

Example: Find the inductor value to maximize the magnitude of the voltage appearing across the capacitor. What is that magnitude?
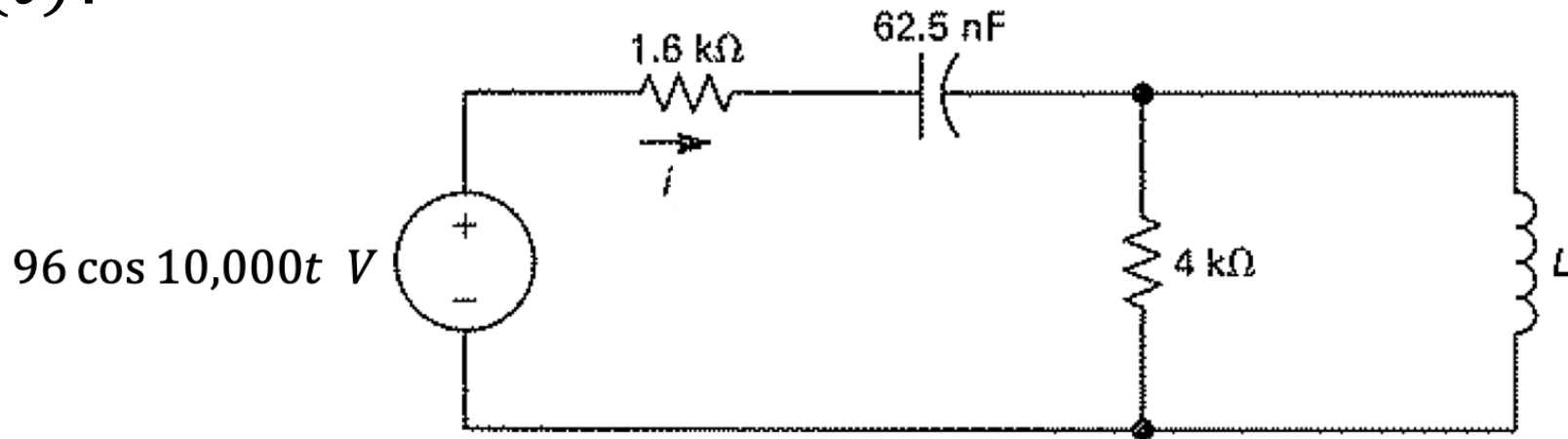
$$\frac{1}{3}H, \frac{10}{3}V$$

Example: what value for resistor R_1 results in the two currents, i_1 and i_2, having the same <u>magnitude</u> (but might be different phase angles)? What is that magnitude?

20 Ω

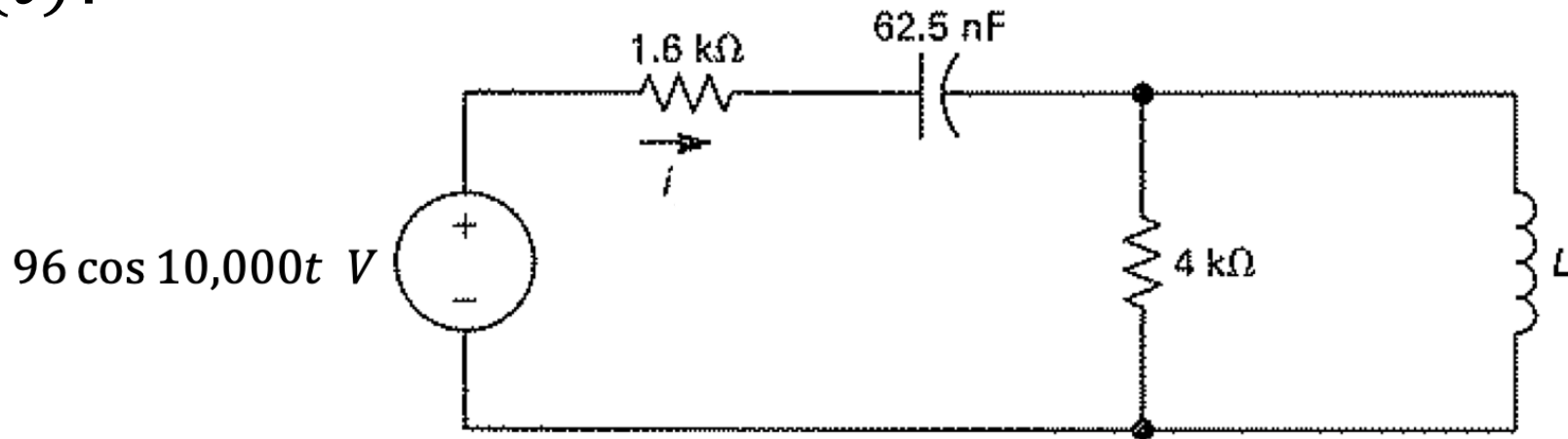i_1

4 cos 10,000t A

i_2

5 mH

R_1

53.9 Ω; 2.42 A

53.9 Ω; 2.42 *A*

Practice problem: find the inductor value so that the current i is "in phase" with the voltage source. What is $i(t)$?
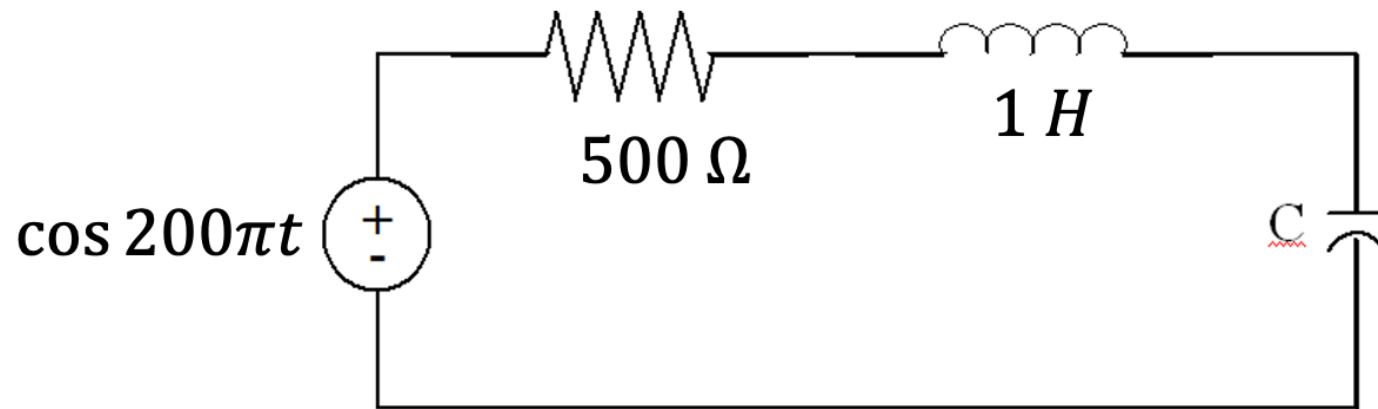

62.5 nF

1.6 kΩ

$96 \cos 10{,}000t \ V$

4 kΩ

L

$0.8 \ H, 20 \cos(10{,}000t) \ mA; \ \ 0.2 \ H, 405 \cos(10{,}000t) \ mA$

Practice problem: find the inductor value so that the current i is "in phase" with the voltage source. What is $i(t)$?

$96 \cos 10{,}000t \ V$

1.6 kΩ

62.5 nF

4 kΩ

L

0.8 H, 20 cos(10,000t) mA; 0.2 H, 405 cos(10,000t) mA

Practice problem: find the capacitor value to maximize the magnitude of the voltage appearing across the capacitor. What is that magnitude?

$1\,H$

$500\,\Omega$

$\cos 200\pi t$

C

$1.55\,\mu F, 1.61\,V$