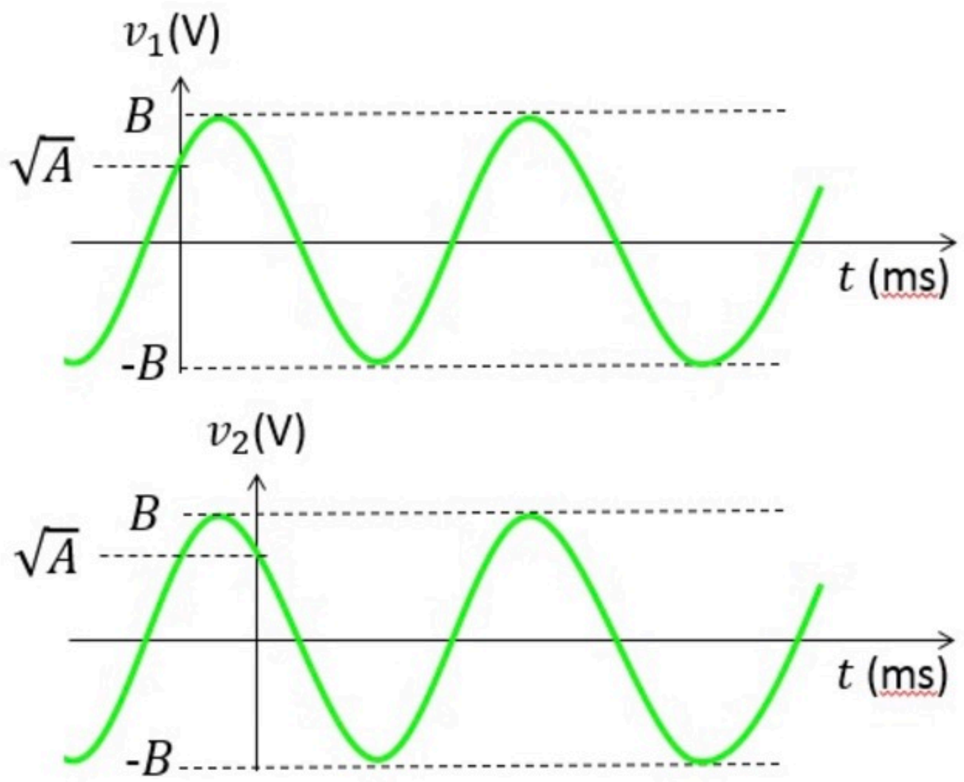
Phasors 001

Problem has been graded.

$v_1(t) = B\cos(200t + D_1)$ with $-180° \leq D_1 \leq 180°$

$v_2(t) = B\sin(200t + D_2)$ with $-180° \leq D_2 \leq 180°$

Find D_1 and D_2.



Given Variables:

A : 9 V^2

B : 6 V

Calculate the following:

D1 (degrees) :

-60 ✓

D2 (degrees) :

150 ✓

Hint: Look on the graph to disambiguate.

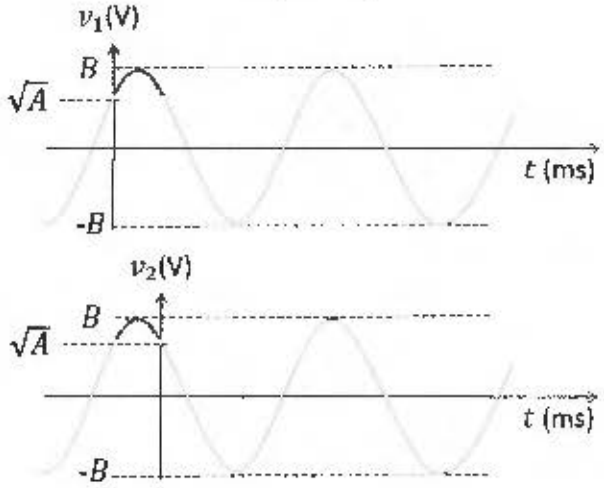
$v_1(t) = B\cos(200t + D_1)$ with $-180° \le D_1 \le 180°$

$v_2(t) = B\sin(200t + D_2)$ with $-180° \le D_2 \le 180°$

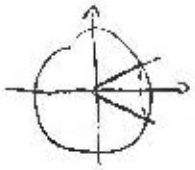
A : 3 V^2

B : 2 V

Find D_1 and D_2.



① PLUG IN $t = 0$ $\quad v_1(0) = 2\cdot\cos(D_1) = \sqrt{3} \Rightarrow \cos(D_1) = \frac{\sqrt{3}}{2}$



$D_1 = 30°$

or

$D_1 = -30°$

WE KNOW THAT $\cos(\omega t - t_0) = \cos(\omega t + \phi)$

$\phi = -\omega t_0$

HERE $t_0 > 0 \Rightarrow \phi < 0 \Rightarrow$ $D_1 = -30$ degrees

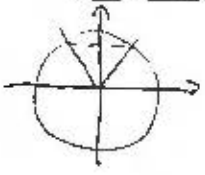
② ⊛ OPTION 1: WRITE AS COS() FIRST

$v_2(t) = B\cos(200t + \alpha) \Rightarrow v_2(0) = 2\cos(\alpha) = \sqrt{3}$

$\Rightarrow \quad \alpha = 30°$ or $-30°$ $\qquad$ HERE $t_0 < 0 \Rightarrow \phi > 0 \Rightarrow \alpha = 30°$

$v_2(t) = B\cos(200t + 30) = B\sin(200t + 30 + 90°) \Rightarrow$ $D_2 = 120°$

⊛ OPTION 2: $\quad v_2(0) = 2\sin(D_2) = \sqrt{3} \Rightarrow \sin(D_2) = \frac{\sqrt{3}}{2}$



$D_2 = 60°$

or

$D_2 = 180° - 60° = 120°$

$\Rightarrow$ LOOK AT THE GRAPH

SIN() SHIFTED MORE THAN 90°

$\Rightarrow$ $D_2 = 120°$

Phasors 002

Problem has been graded.

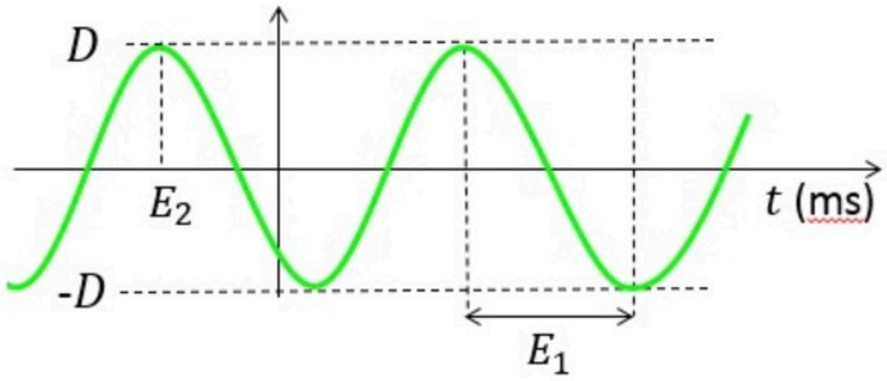
Express the current as a time waveform

$$i(t) = A_1 \cdot \cos(2\pi f_1 \cdot t + B_1)$$

with $0 \leq A_1$ and $-180° \leq B_1 \leq 180°$

and as a phasor

$$\mathbf{I} = A_2 \cdot e^{jB_2} \quad \text{with} \quad 0 \leq A_2 \quad \text{and} \quad -180° \leq B_2 \leq 180°$$



Given Variables:

D : 5 A

E1 : 1 ms

E2 : -0.7 ms

Calculate the following:

f1 (1/s) :

500 ✓

A1 (A) :

5 ✓

B1 (degrees) :

126 ✓

A2 (A) :

5 ✓

B2 (degrees) :

126 ✓

Hint: How does phase relate to time delay?

Express the current as a time waveform

$$i(t) = A_1 \cdot \cos(2\pi f_1 \cdot t + B_1)$$

with $0 \le A_1$ and $-180° \le B_1 \le 180°$

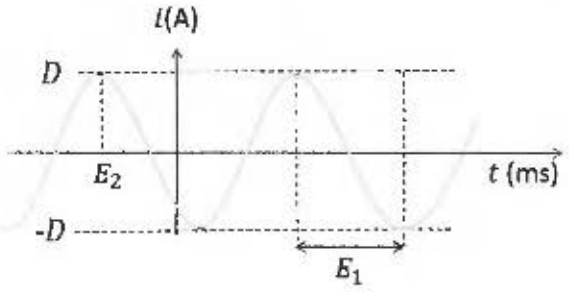
and as a phasor

$$\mathbf{I} = A_2 \cdot e^{jB_2} \quad \text{with} \quad 0 \le A_2 \quad \text{and} \quad -180° \le B_2 \le 180°$$

D : 6 A

E1 : 2 ms

E2 : -1.7 ms



$T = 2 \cdot E_1 = 4\ ms \Rightarrow f_1 = \frac{1}{T} = \frac{1000}{4} = 250$

$\boxed{f_1 = 250\ s^{-1}}$

$A_1 = A_2 = D \Rightarrow \boxed{A_1 = 6\ A} \quad \boxed{A_2 = 6\ A}$

$\varphi = -\omega t_0 = -\frac{2\pi}{T} \cdot E_2 = \frac{-2\pi}{4\ ms} \cdot (-1.7\ ms) = \frac{\pi \cdot 1.7}{2}\ rad$

$\varphi = \frac{180° \cdot 1.7}{2} = 90° \cdot 1.7 = (9.17)° = 153°$

$\boxed{B_1 = 153°} \quad \boxed{B_2 = 153°}$

Phasors 003

Problem has been graded.

Consider the sinusoids:

$$i_1(t) = 12\cos(10t + A_1)$$

$$i_2(t) = 12\sin(10t + A_2)$$

The corresponding phasors are:

$$\mathbf{I_1} = 12e^{jB_1} \quad \text{with } -180° \leq B_1 \leq 180°$$

$$\mathbf{I_2} = 12e^{jB_2} \quad \text{with } -180° \leq B_2 \leq 180°$$

Find B_1 and B_2.

Given Variables:

A1 : 35 degrees

A2 : 45 degrees

Calculate the following:

B1 (degrees) :

35 ✓

B2 (degrees) :

-45 ✓

Hint: Convert the sine to cosine first.

Consider the sinusoids:

$$i_1(t) = 12\cos(10t + A_1)$$
$$i_2(t) = 12\sin(10t + A_2)$$

A1 : 55 degrees

A2 : 20 degrees

The corresponding phasors are:

$$\mathbf{I}_1 = 12e^{jB_1} \quad \text{with } -180° \le B_1 \le 180°$$
$$\mathbf{I}_2 = 12e^{jB_2} \quad \text{with } -180° \le B_2 \le 180°$$

Find B_1 and B_2.

$i_1(t) = 12\cos(10t + 55°) \Rightarrow \mathbf{I}_1 = 12e^{j55°}$

$\boxed{B_1 = 55°}$

$i_2(t) = 12\sin(10t + 20°)$

$= 12\cos(10t + 20° - 90°)$

$= 12\cos(10t - 70°) \Rightarrow \mathbf{I}_2 = 12e^{-j70°}$

$\boxed{B_2 = -70°}$

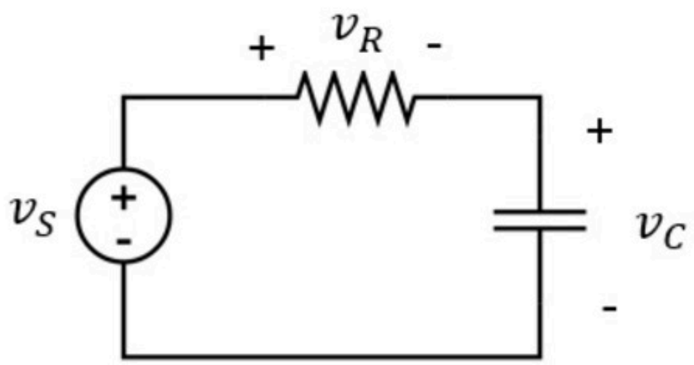
Phasors 004

Problem has been graded.

You are given $v_S = A_1 \cdot \sqrt{2} \cdot cos\,(100t + B_1)$

$v_C = A_2 \cdot cos\,(100t + B_2)$

Find $v_R = A_3 \cdot cos\,(100t + B_3)$ with $-180° \leq B_3 \leq 180°$



Solve without using a calculator.

Given Variables:

A1 : 4 V

B1 : 20 degrees

A2 : 4 V

B2 : -25 degrees

Calculate the following:

A3 (V) :

4 ✓

B3 (degrees) :

65 ✓

Hint: Convert to phasors. Multiply out the common exp(jB) factor.

You are given $v_S = A_1 \cdot \sqrt{2} \cdot \cos(100t + B_1)$

$v_C = A_2 \cdot \cos(100t + B_2)$

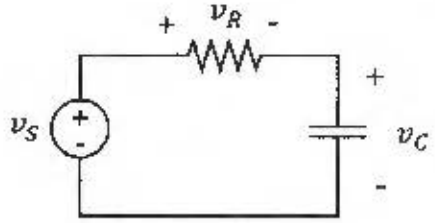
Find $v_R = A_3 \cdot \cos(100t + B_3)$ with $-180° \leq B_3 \leq 180°$

A1 : 2 V

B1 : 35 degrees

A2 : 2 V

B2 : -10 degrees



Solve without using a calculator.

$$V_S = 2\sqrt{2}\, e^{j35°} \qquad V_C = 2\, e^{-j10°}$$

KVL: $V_R = V_S - V_C = 2\sqrt{2}\, e^{j35°} - 2\, e^{-j10°}$

$$= 2\, e^{j35°}\left(\sqrt{2} - e^{-j45°}\right)$$

$$= 2\, e^{j35°}\left(\sqrt{2} - \left(\frac{\sqrt{2}}{2} - j\frac{\sqrt{2}}{2}\right)\right)$$

$$= 2\, e^{j35°}\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right)$$

$$= 2\, e^{j35°}\, e^{j45°}$$

$$= 2\, e^{j80°}$$

$$\Rightarrow v_R = 2\cos(100t + 80°)$$

$\boxed{A_3 = 2V}$ $\boxed{B_3 = 80°}$