Phasors

EE 206 Practice Problems

Give the phasor representation for the following voltages

1) $v(t) = 2\cos(3t) + 5\sin(3t)$

2) $v(t) = 8\cos(4t - 20^0)$

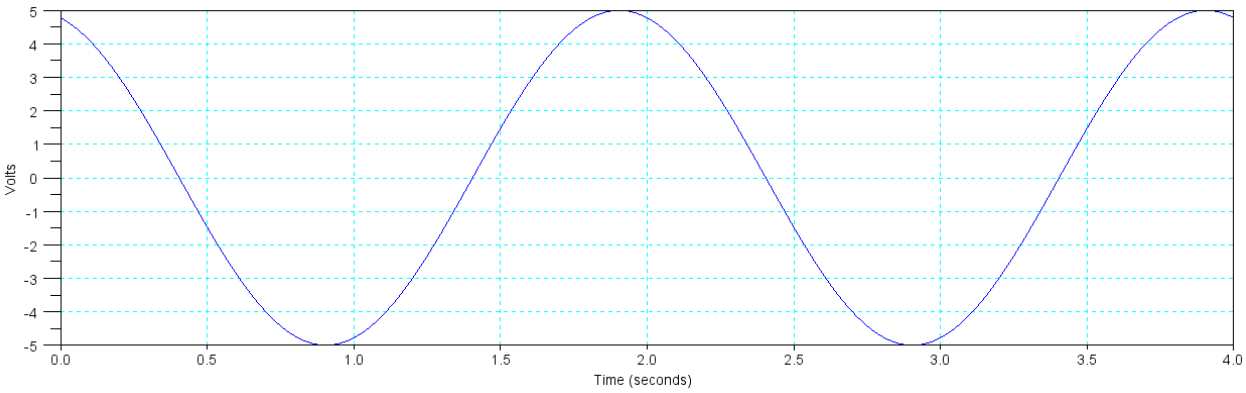
3) $v(t) = -3\cos(5t) + 6\sin(5t)$

4) $v(t) = 3\cos(2t - 10^0) + 4\sin(2t)$

5) $v(t) = 6\cos(3t - 40^0) + 2\cos(3t + 50^0)$

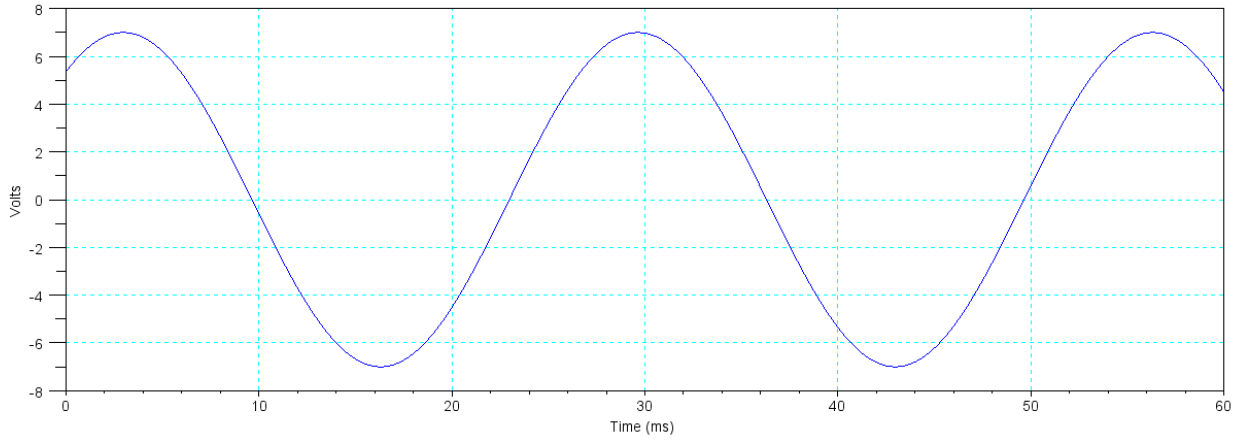
6a) Determine the frequency of the following waveforms in rad/sec, and

6b) Express the voltage in phasor form



7a) Determine the frequency of the following waveforms in rad/sec, and

7b) Express the voltage in phasor form



Solutions

Note that

$$a + jb \Leftrightarrow a\cos(\omega t) - b\sin(\omega t)$$

$$r\angle\theta \Leftrightarrow r\cos(\omega t + \theta)$$

1) $v(t) = 2\cos(3t) + 5\sin(3t)$

$V = 2 - j5$

$\omega = 3$

2) $v(t) = 8\cos(4t - 20^0)$

$V = 8\angle -20^0$

$\omega = 4$

3) $v(t) = -3\cos(5t) + 6\sin(5t)$

$V = -3 - j6$

$\omega = 5$

4) $v(t) = 3\cos(2t - 10^0) + 4\sin(2t)$

$V = (3\angle -10^0) + (0 - j4)$

$V = 2.954 - j4.521$

$\omega = 2$

5) $v(t) = 6\cos(3t - 40^0) + 2\cos(3t + 50^0)$

$V = (6\angle -40^0) + (2\angle 50^0)$

$V = 5.882 - j2.325$

$\omega = 3$

Problem 6)

The frequency is 1/period

Period = 2.00 seconds

$$f = \frac{1}{2\,\text{sec}} = 0.5Hz$$

$$\omega = 2\pi f = 3.14159\frac{rad}{\text{sec}}$$

Polar form is easier to use.

The peak is 5.00V. The amplitude of V is 5.00V (peak)

If the phase shift was zero degrees, the second peak should happen at 2.00 seconds. Instead, it happens at 1.85 seconds (approx). This is a shift of +0.15 second. Converting to degrees

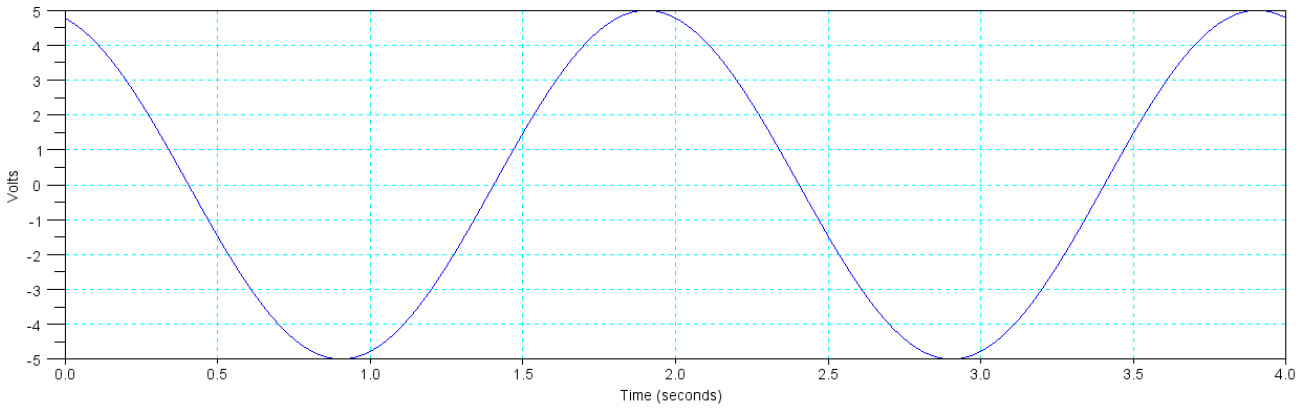
$$\theta = \left(\frac{0.15\,\text{sec}}{2.00\,\text{sec}}\right)360^0 = +27^0$$

The peak happens *before* it should with zero degree phase shift, so the phase shift is positive

answer

$$V = 5.00\angle +27^0$$

$$\omega = 3.14159\frac{rad}{\text{sec}}$$



7) The period is 26ms (approx)

$$f = \frac{1}{T} = \frac{1}{26ms} = 38.48Hz$$

$$\omega = 2\pi f = 241.67\frac{rad}{\sec}$$

The peak is 7.00V

The peak is delayed by 3ms at t=0. Converting to degrees

$$\theta = -\left(\frac{\text{delay}}{\text{period}}\right) \cdot 360^0$$

$$\theta = -\left(\frac{3ms}{26ms}\right) \cdot 360^0$$

$$\theta = -41.5^0$$

answer

$$\omega = 241.67\frac{rad}{\sec}$$

$$V = 7.00\angle -41.5^0$$