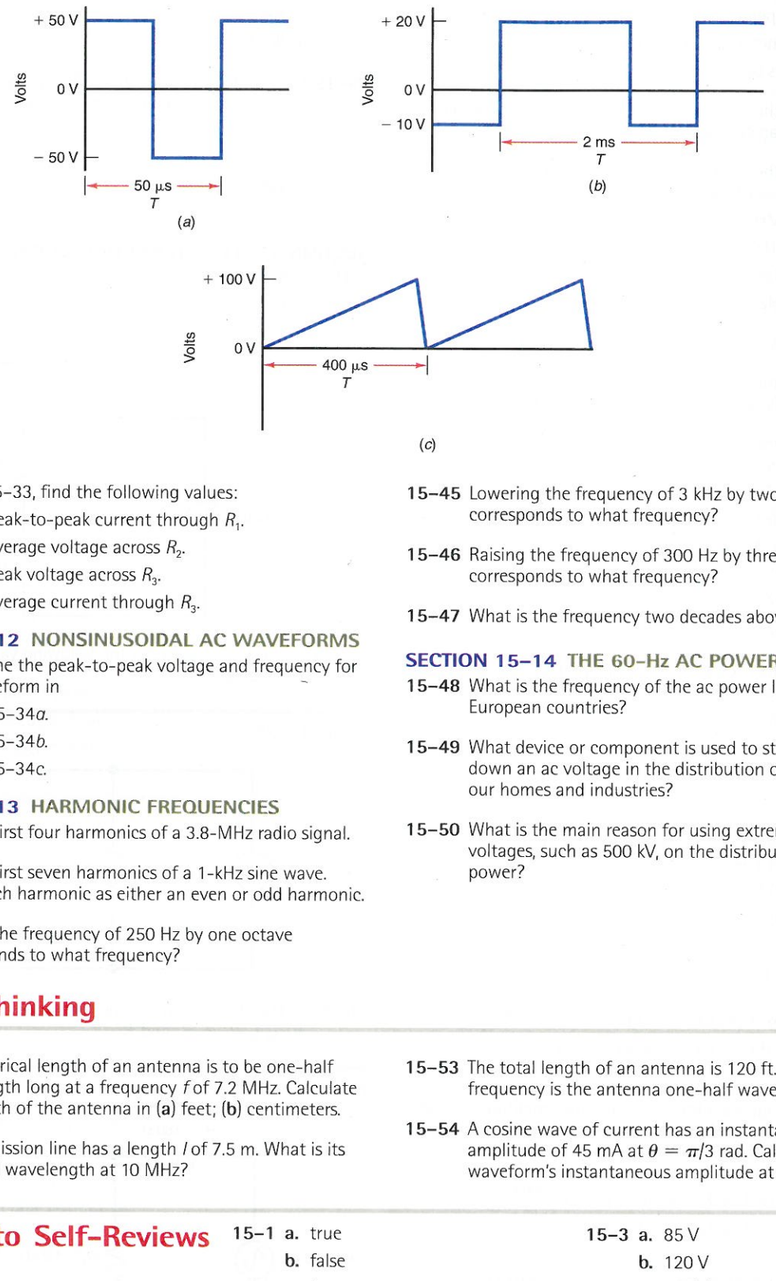
Figure 15–34



15–40 In Fig. 15–33, find the following values:
a. the peak-to-peak current through R_1.
b. the average voltage across R_2.
c. the peak voltage across R_3.
d. the average current through R_3.

SECTION 15–12 NONSINUSOIDAL AC WAVEFORMS

15–41 Determine the peak-to-peak voltage and frequency for the waveform in
a. Fig. 15–34*a*.
b. Fig. 15–34*b*.
c. Fig. 15–34*c*.

SECTION 15–13 HARMONIC FREQUENCIES

15–42 List the first four harmonics of a 3.8-MHz radio signal.

15–43 List the first seven harmonics of a 1-kHz sine wave. Label each harmonic as either an even or odd harmonic.

15–44 Raising the frequency of 250 Hz by one octave corresponds to what frequency?

15–45 Lowering the frequency of 3 kHz by two octaves corresponds to what frequency?

15–46 Raising the frequency of 300 Hz by three octaves corresponds to what frequency?

15–47 What is the frequency two decades above 1 kHz?

SECTION 15–14 THE 60-Hz AC POWER LINE

15–48 What is the frequency of the ac power line in most European countries?

15–49 What device or component is used to step up or step down an ac voltage in the distribution of ac power to our homes and industries?

15–50 What is the main reason for using extremely high voltages, such as 500 kV, on the distribution lines for ac power?

Critical Thinking

15–51 The electrical length of an antenna is to be one-half wavelength long at a frequency f of 7.2 MHz. Calculate the length of the antenna in (**a**) feet; (**b**) centimeters.

15–52 A transmission line has a length l of 7.5 m. What is its electrical wavelength at 10 MHz?

15–53 The total length of an antenna is 120 ft. At what frequency is the antenna one-half wavelength long?

15–54 A cosine wave of current has an instantaneous amplitude of 45 mA at $\theta = \pi/3$ rad. Calculate the waveform's instantaneous amplitude at $\theta = 3\pi/2$ rad.

Answers to Self-Reviews

15–1 **a.** true
b. false
c. true

15–2 **a.** 10 V
b. 360°

15–3 **a.** 85 V
b. 120 V
c. 170 V

15–4 **a.** 0.707 A
b. 0.5 A

15–5 **a.** 120 V rms
b. 14.14 V peak
c. 2.83 V p-p

15–6 **a.** 4 Hz
b. 1.605 MHz

15–7 **a.** 400 Hz
b. $^1/_{400}$ s

15–8 **a.** true
b. false
c. true

15–9 **a.** 90°
b. 60°
c. 0°

15–10 **a.** $^1/_{240}$ s
b. 0.1 μs

15–11 **a.** 30 Ω
b. 6.67 Ω
c. 30 Ω

15–12 **a.** 2 μs
b. 15 V

15–13 **a.** 48 MHz
b. 440 Hz

15–14 **a.** false
b. true
c. true
d. true

15–15 **a.** true
b. true
c. false

15–16 **a.** 120°
b. 208 V

Laboratory Application Assignment

In this lab application assignment you will use an oscilloscope to measure the amplitude, frequency, and period of a sine-wave ac voltage. You will also use a DMM to measure the voltage and current values in an ac circuit. As an aid in understanding the operation and use of the oscilloscope, refer to App. E. However, it is expected that your instructor will assist you with the operation of both the function generator and the oscilloscope when doing this experiment.

Equipment: Obtain the following items from your instructor.
- Function generator
- Assortment of carbon-film resistors
- Oscilloscope
- DMM

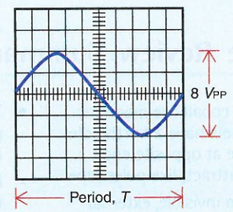
Using the Oscilloscope and Function Generator

Connect the channel 1 probe of the oscilloscope to the output of the function generator. Set the function generator to produce a sine-wave output. Next, while viewing the oscilloscope, adjust the function generator and oscilloscope controls to view one cycle of a 100-Hz, 8-V_{pp} sine wave. The displayed waveform should be similar to the one shown in Fig. 15–35. Have your instructor check the displayed waveform. If it is correct, proceed as follows.

What is the Volts/div. setting of the oscilloscope? Volts/div. = _____ How many vertical divisions does the displayed waveform occupy? _____
From this information, what is the measured peak-to-peak value of the displayed waveform? V_{pp} = _____

What is the peak value of the displayed waveform? V_p = _____ Using this value, calculate and record the waveform's rms value. V_{rms} = _____ With your DMM set to measure ac voltage, measure and record the rms voltage at the output of the function generator. V_{rms} = _____ How does this value compare to the calculated value? _____

Figure 15–35



What is the Sec./div. setting of the oscilloscope? Sec./div. = _____ How many horizontal divisions does one cycle occupy? _____
From this information, what is the measured period, T, of the displayed waveform? T = _____
Calculate and record the period, T, of the 100-Hz waveform as $T = 1/f$. T = _____
How do the calculated and measured values compare? _____

Adjust the Sec./div control of the oscilloscope until two cycles are displayed on the screen. What is the Sec./div. setting with two cycles displayed? Sec./div. = _____

Have either your instructor or lab partner adjust the function generator controls to change the frequency and amplitude of the sine wave. Determine the period, T, frequency, f, and peak-to-peak