443 HW #3 Sept. 17, 2008.

2-3 The voltage across a load is given by $v(t) = A_0 \cos \omega_0 t$, and the current through the load is a square wave,

$$i(t) = I_0 \sum_{n=-\infty}^{\infty} \left[\Pi\left(\frac{t - nT_0}{T_0/2}\right) - \Pi\left(\frac{t - nT_0 - (T_0/2)}{T_0/2}\right) \right]$$

where $\omega_0 = 2\pi/T_0$, $T_0 = 1$ sec, $A_0 = 10$ V, and $I_0 = 5$ mA.

(a) Find the expression for the instantaneous power and sketch this result as a function of time.

(b) Find the value of the average power.

2-4 The voltage across a 50-Ω resistive load is the positive portion of a cosine wave That is,

$$v(t) = \begin{cases} 10 \cos \omega_0 t, & |t - nT_0| < T_0/4 \\ 0, & t \text{ elsewhere} \end{cases}$$

where n is any integer.

(a) Sketch the voltage and current waveforms.

(b) Evaluate the dc values for the voltage and current.

(c) Find the rms values for the voltage and current.

(d) Find the total average power dissipated in the load.

2-5 For Prob. 2-4, find the energy dissipated in the load during a 1-hr interval if $T_0 =$ 1 sec.

2-6 Determine whether each of the following signals is an energy signal or a powe signal and evaluate the normalized energy or power, as appropriate.

(a) $w(t) = \Pi(t/T_0)$.

(b) $w(t) = \Pi(t/T_0) \cos \omega_0 t$.

(c) $w(t) = \cos^2 \omega_0 t$.

2-7 An average reading power meter is connected to the output circuit of a transmitte The transmitter output is fed into a 75-Ω resistive load and the wattmeter rea 67 W.

(a) What is the power in dBm units?

(b) What is the power in dBk units?

(c) What is the value in dBmV units?

2-8 Assume that a waveform with a known rms value, V_{rms}, is applied across a 50- load. Derive a formula that can be used to compute the dBm value from V_{rms}.

2-9 An amplifier is connected to a 50-Ω load and driven by a sinusoidal current sour as shown in Fig. P2-9. The output resistance of the amplifier is 10 Ω and the in resistance is 2 kΩ. Evaluate the true decibel gain of this circuit.

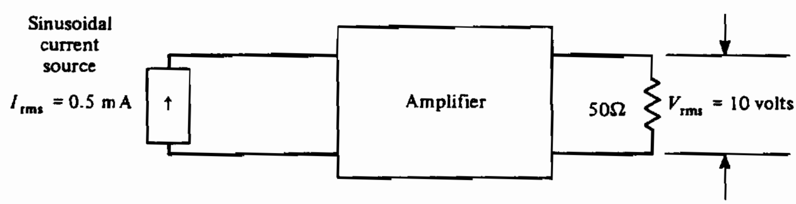

FIGURE P2-9

2-10 The voltage (rms) across the 300-Ω antenna input terminals of an FM receiver is 3.5 μV.
(a) Find the input power (watts).
(b) Evaluate the input power as measured in decibels below 1 mW (dBm).
(c) What would be the input voltage (in microvolts) for the same input power if the input resistance were 75 Ω instead of 300 Ω?

2-11 What is the value for the phasor that corresponds to the voltage waveform $v(t) = 12 \sin(\omega_0 t - 25°)$, where $\omega_0 = 2000\pi$?

2-12 A signal is $w(t) = 3 \sin(100\pi t - 30°) + 4 \cos(100\pi t)$. Find the corresponding phasor.

2-13 Evaluate the Fourier transform of

$$w(t) = \begin{cases} e^{-\alpha t}, & t \geq 1 \\ 0, & t < 1 \end{cases}$$

2-14 Find the spectrum for the waveform $w(t) = e^{-\pi(t/T)^2}$. What can we say about the width of $w(t)$ and $W(f)$ as T increases? [*Hint:* Use (A-75).]

✓ 2-15 Using the convolution property, find the spectrum for

$$w(t) = \sin 2\pi f_1 t \cos 2\pi f_2 t$$

2-16 Find the spectrum (Fourier transform) of the triangle waveform

$$s(t) = \begin{cases} At, & 0 < t < T_0 \\ 0, & t \text{ elsewhere} \end{cases}$$

in terms of A and T_0.

✓ 2-17 Find the spectrum for the waveform shown in Fig. P2-17.

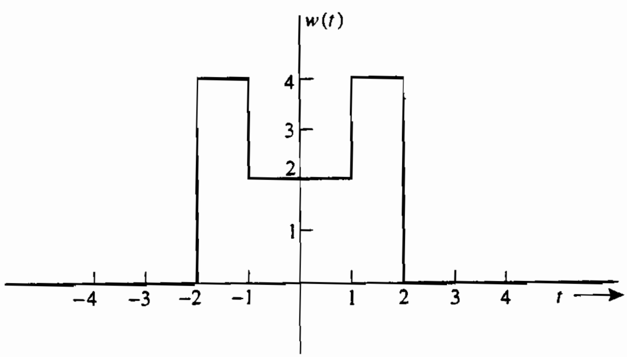

FIGURE P2-17

✓ 2-18 If $w(t)$ has the Fourier transform

(b) $x(t) = w(t-1)e^{-jt}$

$$W(f) = \frac{j2\pi f}{1 + j2\pi f}$$

find $X(f)$ for the following waveforms.
(a) $x(t) = w(2t + 2)$.

c) $x(t) = w(1-t)$