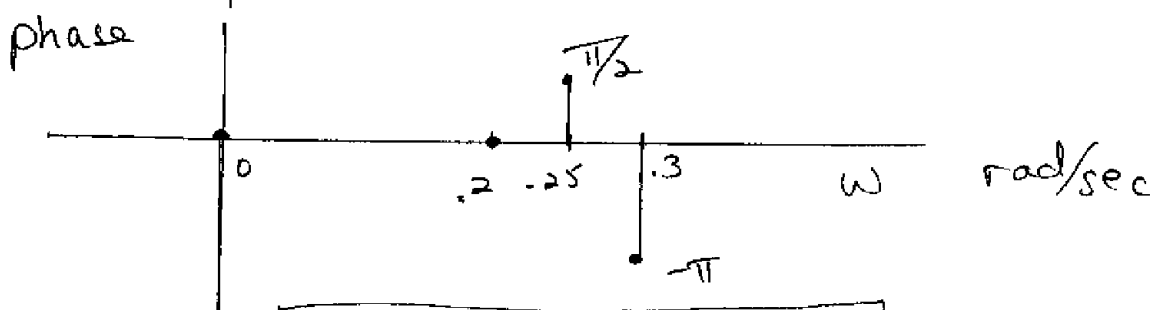
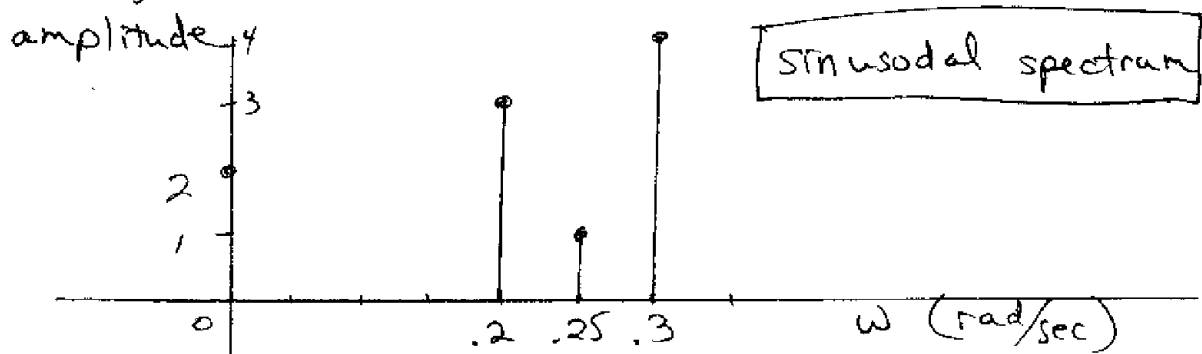


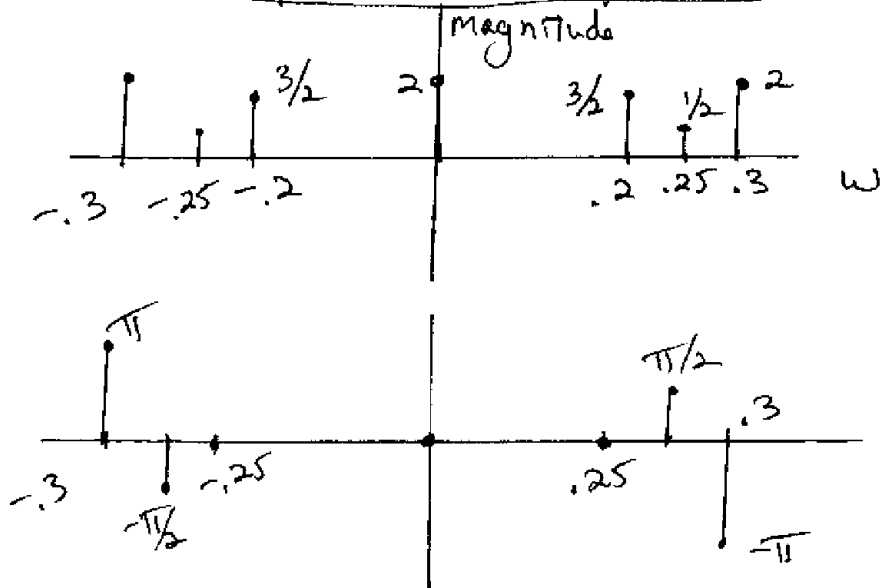
$$1) x(t) = 2 + 3\cos(.2t) + \cos(.25t + \pi/2) + 4\cos(.3t - \pi)$$

frequencies are .2 rad/sec, .25 rad/sec, .3 rad/sec

the greatest common divisor is 0.05 rad/sec  
 (all the frequencies are divided by 0.05 in an integer number of ways)  $\Rightarrow \omega_0 = 0.05$  rad/sec

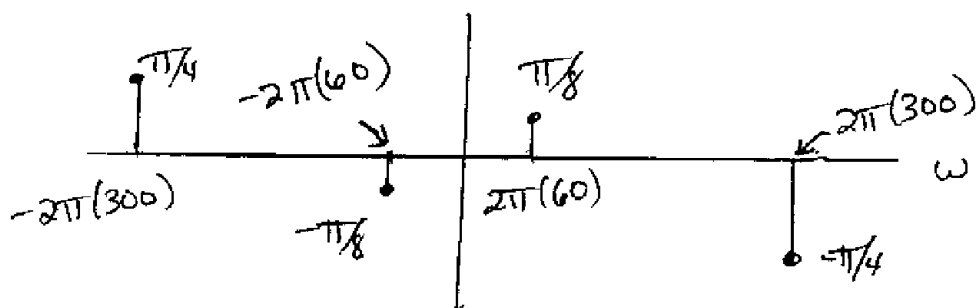
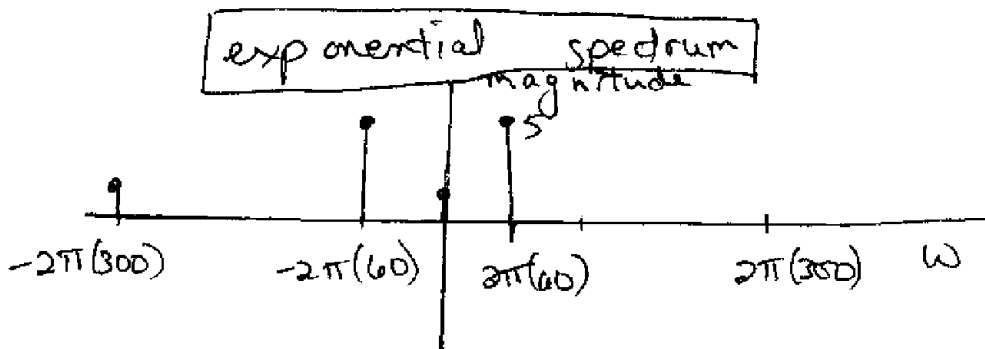
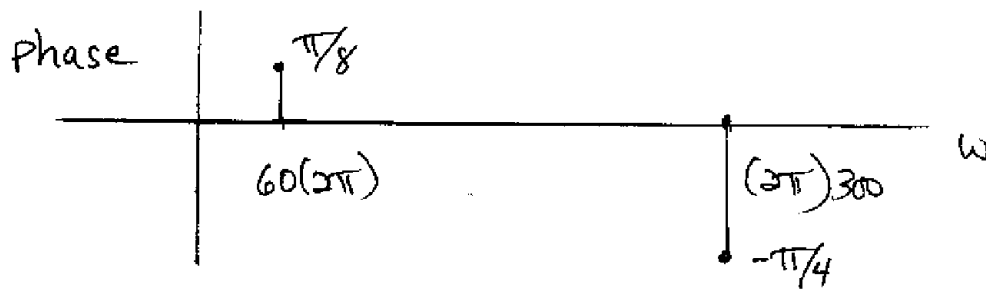
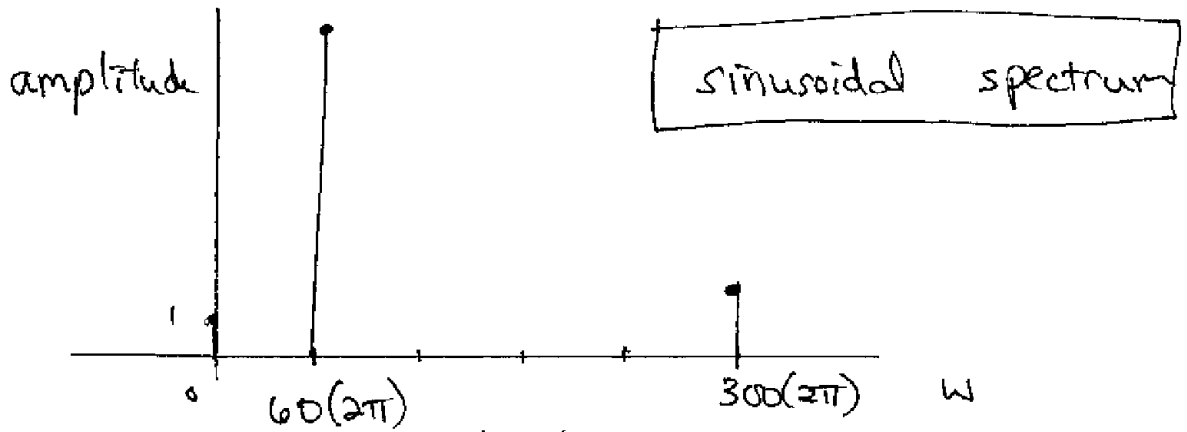


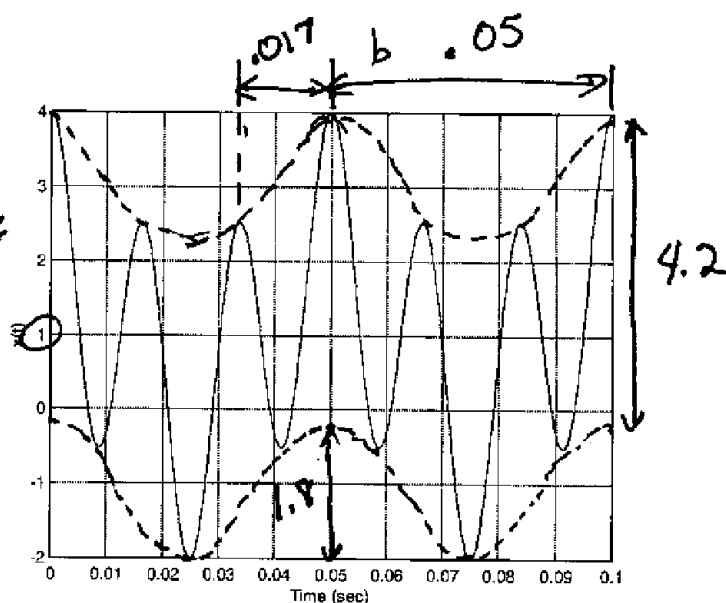
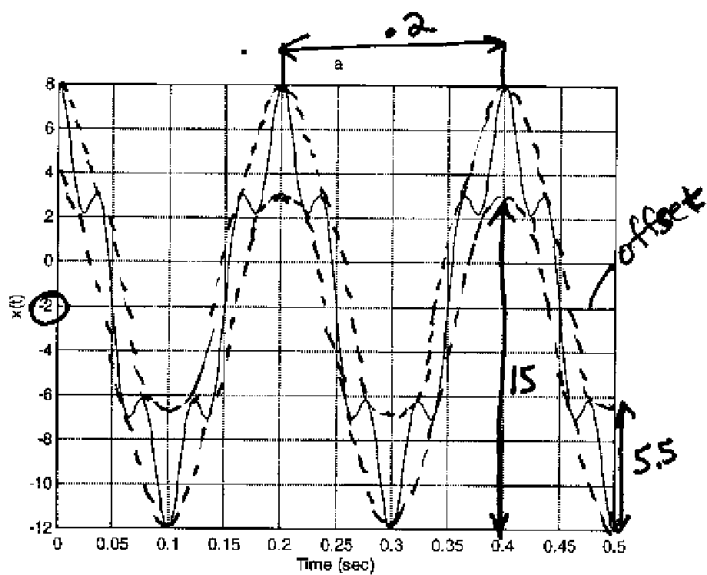
exponential spectrum



$$b) x(t) = 1 + 10 \cos(2\pi(60)t + \pi/8) + 2 \cos(2\pi(300)t - \pi/4)$$

greatest common divisor is  $2\pi(60)$  rad/sec  
 or 60 Hz.  $\Rightarrow f_0 = 60$  Hz





a) low frequency signal:  $A = 15/2 = 7.5$ ,  $T = 0.2$  so  
 $\omega = \frac{2\pi}{.2} = 10\pi$ ,  $\phi = 0$  (peak at  $t=0$ )

high frequency:  $A = 5.5/2 = 2.75$ ,  $T = 0.04 \rightarrow \omega = \frac{2\pi}{.04} = 50\pi$   
 (5 cycles of high freq in 0.2 sec),  $\phi = 0$   
 offset = -2

$$x(t) = -2 + 7.5 \cos(10\pi t) + 2.75 \cos(50\pi t)$$

b) low freq:  $A = 1.8/2 = 0.9$ ,  $T = 0.05 \Rightarrow \omega = 40\pi$ ,  $\phi = 0$

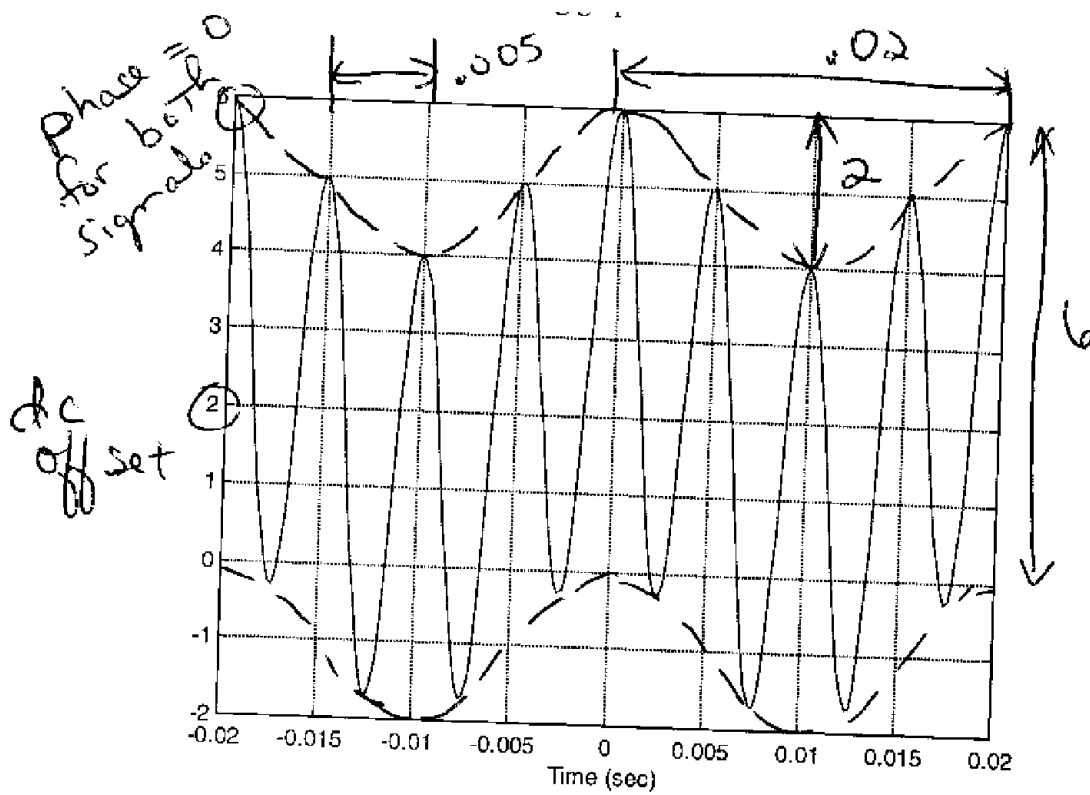
high freq:  $A = 4.2/2 = 2.1$ ,  $T = 0.017$  (or 3 cycles in .05 sec)  
 $\phi = 0$   $\omega = 118\pi$

offset = 1

$$x(t) = 1 + 0.9 \cos(40\pi t) + 2.1 \cos(118\pi t)$$

These are estimates based on the plot, exact values may differ.

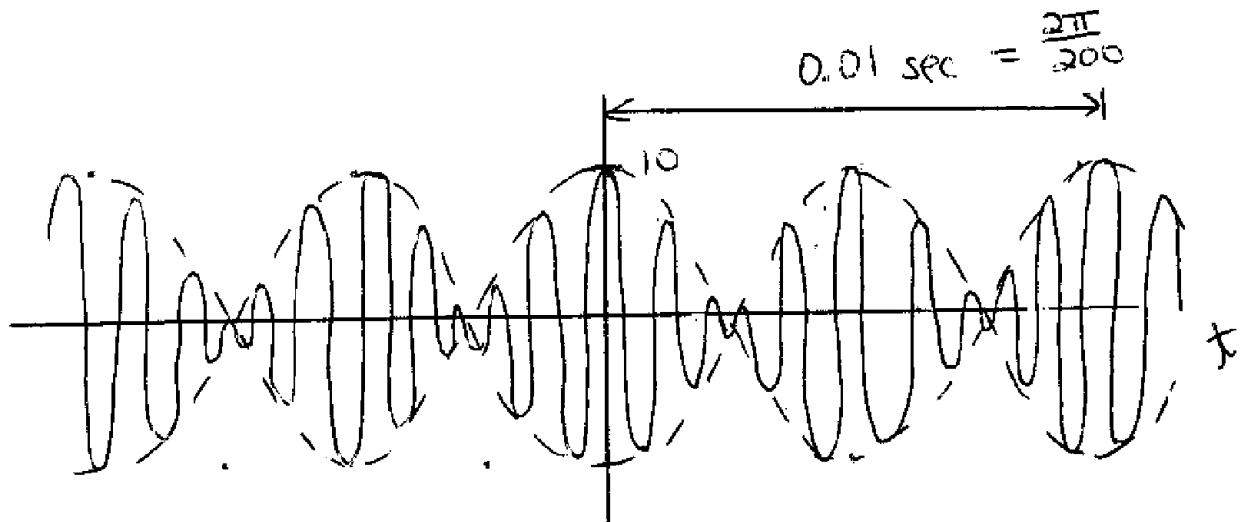
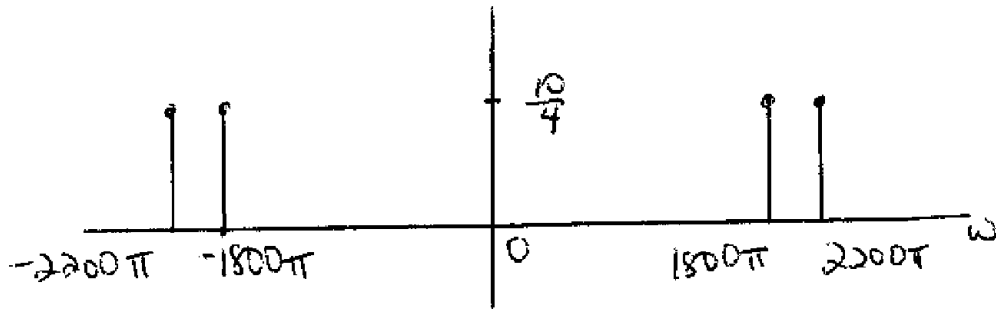
3.



$$\begin{aligned}
 x(t) &= 2 + \cos\left(\frac{2\pi}{0.02}t\right) + 3\cos\left(\frac{2\pi}{0.005}t\right) \\
 &= 2 + \cos(100\pi t) + 3\cos(400\pi t)
 \end{aligned}$$

$$4. \quad x(t) = 10 \left[ \frac{e^{j2000\pi t} + e^{-j2000\pi t}}{2} \right] \left[ \frac{e^{j1800\pi t} + e^{-j1800\pi t}}{2} \right]$$

$$= \frac{10}{4} \left[ e^{j2200\pi t} + e^{-j2200\pi t} + e^{j1800\pi t} + e^{-j1800\pi t} \right]$$



5. Time signals and their corresponding spectra are shown below. However, they are in random order. Match them up.

1.   e      2.   a      3.   c      4.   b      5.   d  

