

24/6/20

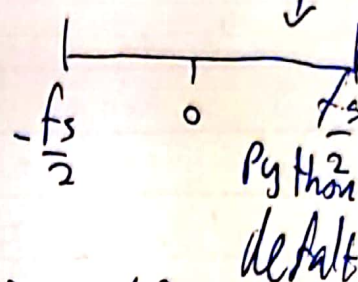
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HW 09

1) (a)  $X(t) = \cos(2\pi a t) \cdot \cos(2\pi b t)$   $a, b > 0$

$f_s$   $f_s$



by the freq pairs + given pair of  $\cos(a) \cdot \cos(b)$

$$X(t) = \frac{1}{2} [\cos(2\pi a t - 2\pi b t) + \cos(2\pi a t + 2\pi b t)]$$

$$X(t) = \frac{1}{2} [\cos(2\pi t(a-b)) + \cos(2\pi t(a+b))]$$

$\cos(x) = \cos(-x) \iff f_{s1} = 100 \quad || \quad f_{s2} = 120$

for each  $f_s$ , freq pair  $\cos(2\pi f_c t)$

$$X(\omega) = \frac{1}{2} \left[ \frac{1}{2} [\delta(f - (a-b)) + \delta(f + (a-b))] + \frac{1}{2} [\delta(f - (a+b)) + \delta(f + (a+b))] \right]$$

given  $a=10, b=110$

$$X(\omega) = \frac{1}{2} \left[ \frac{1}{2} [\delta(f+100) + \delta(f+100)] + \frac{1}{2} [\delta(f-120) + \delta(f+120)] \right] =$$

(b) see file assogex01.png, ~~what is the max freq~~

(c) minimal sampling rate to avoid aliasing is  $2 \times f_{\max} = 240$  Hz  
by Nyquist theorem  $\rightarrow$  twice of max freq.

(d) below minimal sampling rate  $\rightarrow$  Aliasing! we're missing peaks!

(e) above "  $\rightarrow$  good sample! representative of original signals

see figs!

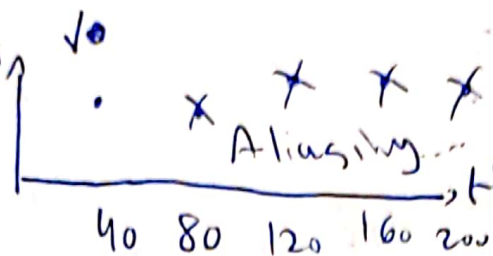
8192 = 1 sec

2) a) see file.

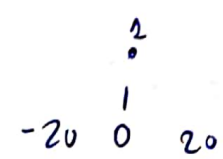
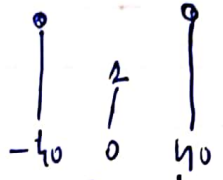
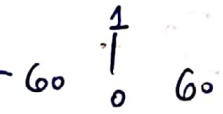
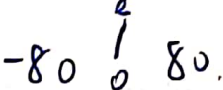
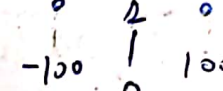
Power =  $20 \log_{10}(A)$ , on top of figs!! with good res.

b) the 2 highest are:

	$f_s$	Power
1	3971	72 $\leftarrow 20 \log_{10}(A)$
2	3702	71.3 $\leftarrow 20 \log_{10}(A)$

Part A  
3)  which one is correct for 240 Hz  
Hz of 200 Hz?

for a signal of 200 Hz, the min sampling rate should be 400 Hz for a complete representation of the signal

a)		$240 - 200 = 40 \text{ Hz}$	if we sample 480 Hz
b)		$240 - 200 = 40$ out of range Aliasing	but we sample at 240 Hz:
c)		out of range Aliasing	
d)		out of range Aliasing	
e)		out of range only aliasing	So $240 - 200$ 40 Hz