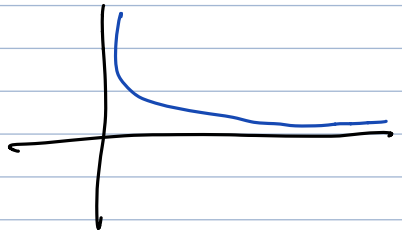
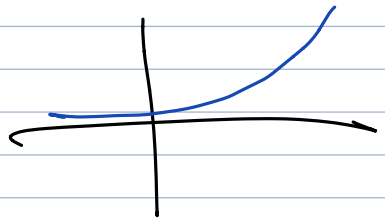
1. $H(s) = \frac{1}{s - x}$ $\quad \mathcal{L}[H(s)] = e^{xt}$

positive = stable

$x = -3 \Rightarrow e^{-3t}$ $\quad x = 3 \Rightarrow e^{3t}$





$H(s) = \frac{1}{s + \#}$ $\quad H(s) = \frac{1}{s - \#}$

↑ Stable $\quad$ ↑ Unstable

---

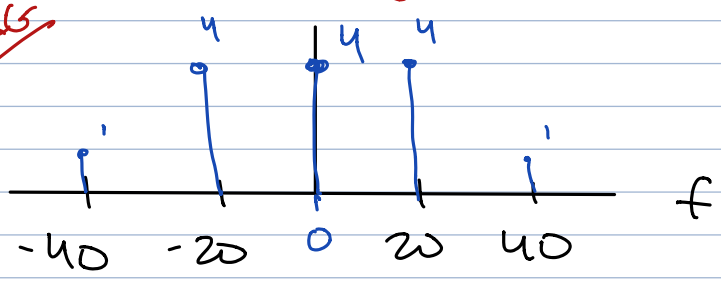
2. $x(t) = 4 + 8\sin(20t) + 2\cos(40t)$

How many freq. components?

$x(t) = X + A\cos(\Omega_0 t + \phi)$

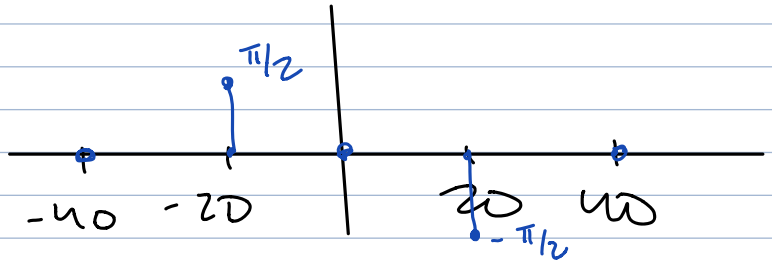
↓ baseline $\quad$ * graph A/2

Mag



(5)

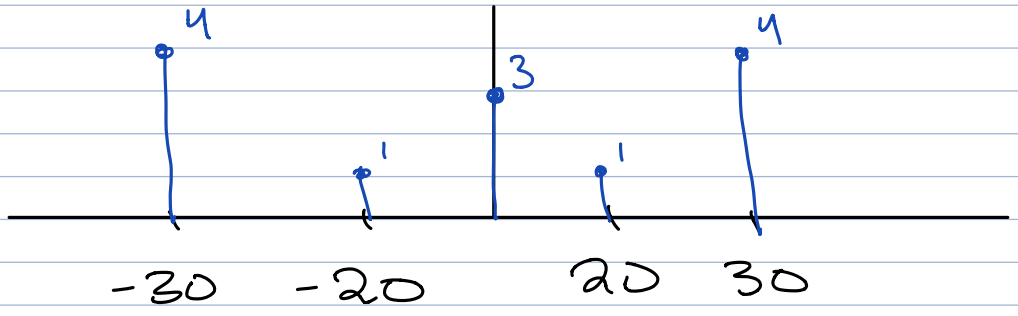
Phase



3. Mag at 30 Hz?

$$y(t) = 3 + 2\sin(20t) + 8\cos(30t)$$

$$\frac{8}{2} = 4$$

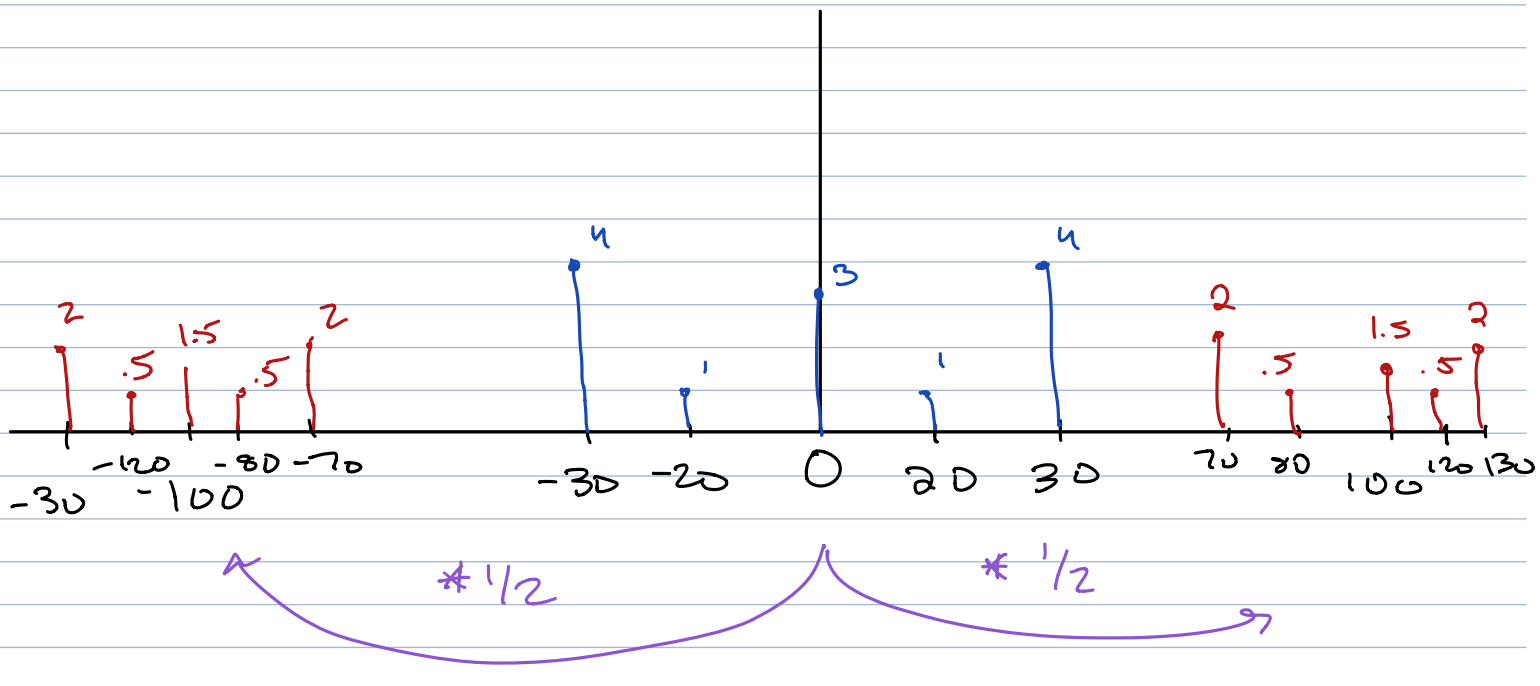


---

4. Modulation Ex.

$$y(t) = (3 + 2\sin(20t) + 8\cos(30t)) \cdot \cos(100t)$$

modulated



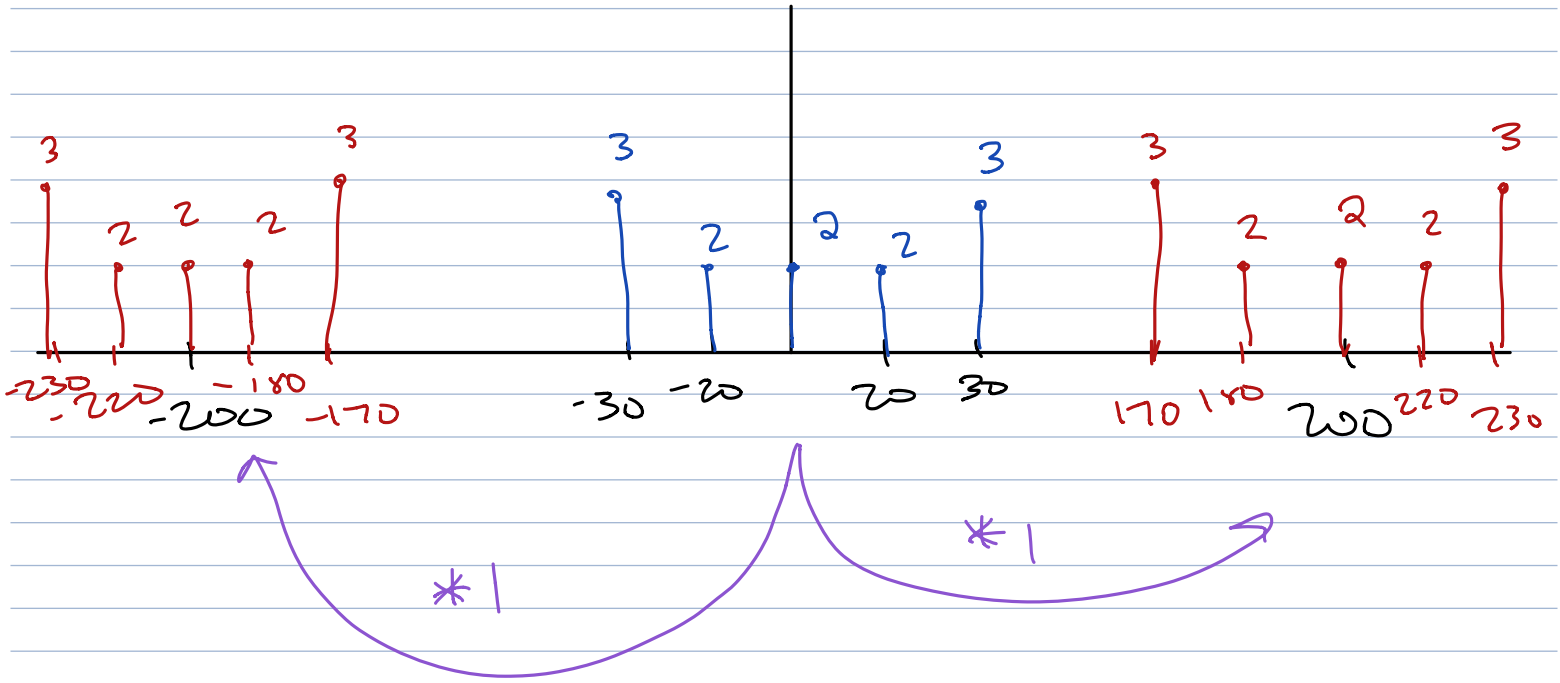
1.5

Sampling Ex

$$y(t) = 2 + 4\sin(20t) + 6\cos(30t)$$

$$f_s = 200$$

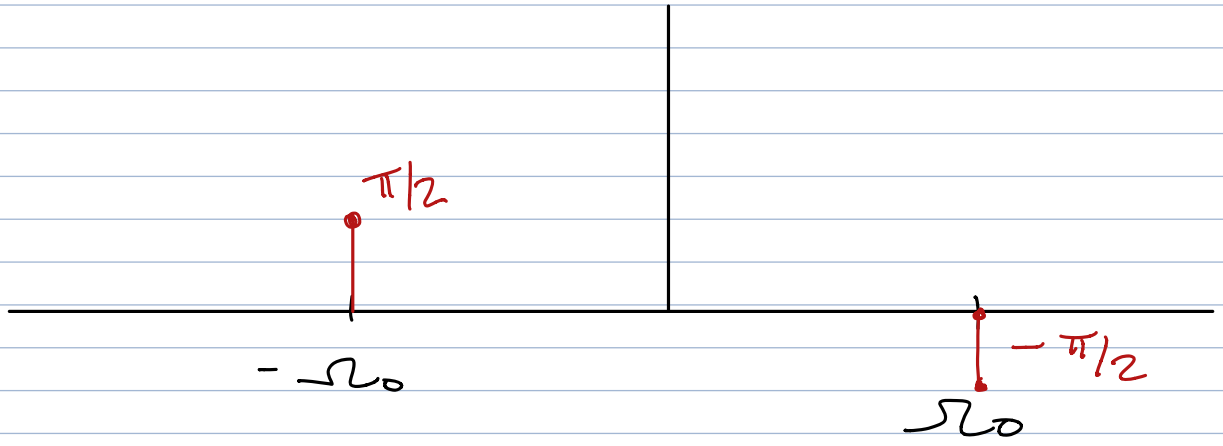
What is mag. at 220? 2



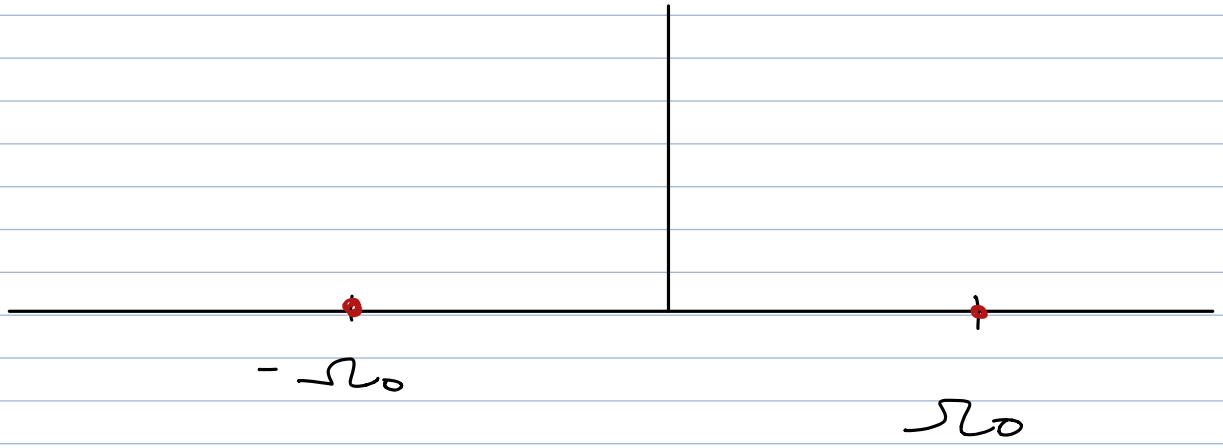
Nyquist: $\Omega_s \geq 2 \cdot 30$

$200 \geq 60$

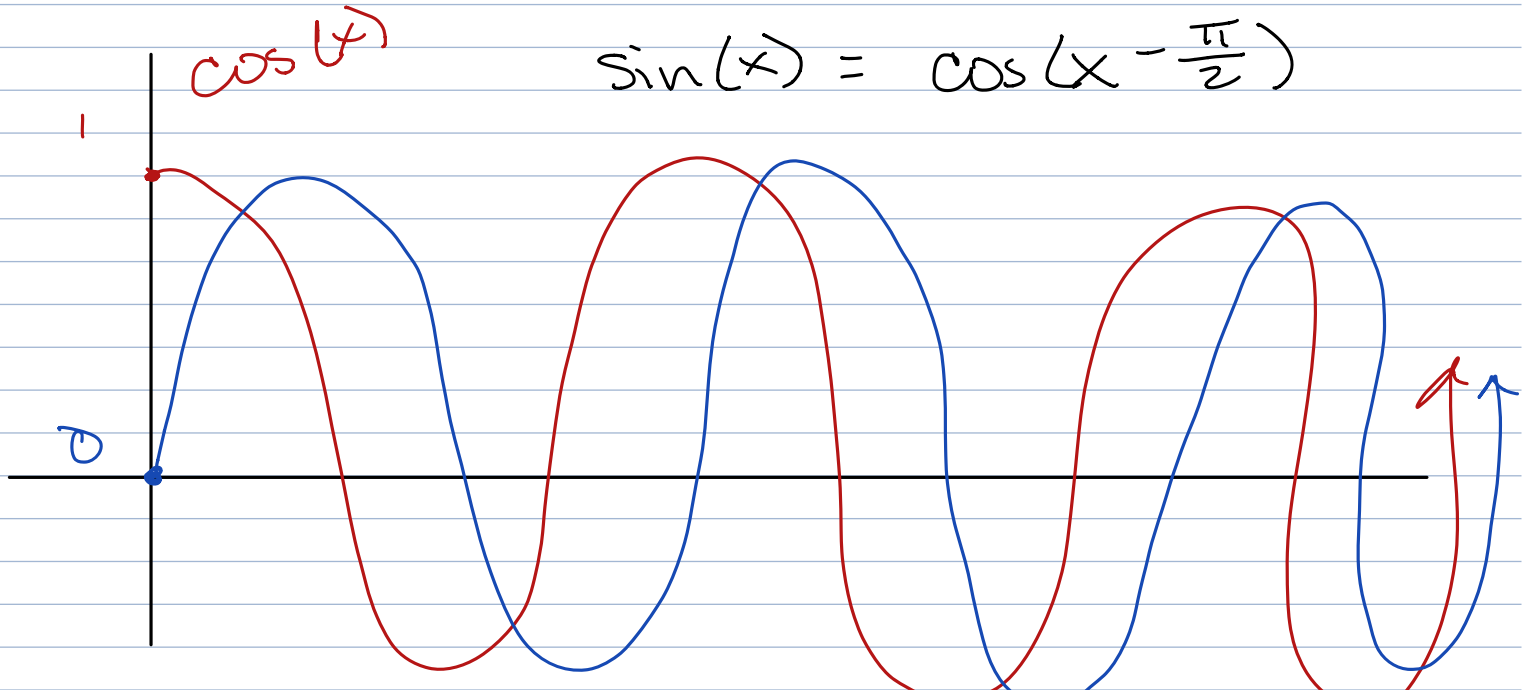
Phase for $\sin(\Omega_0 t)$



Phase for $\cos(\Omega_0 t)$



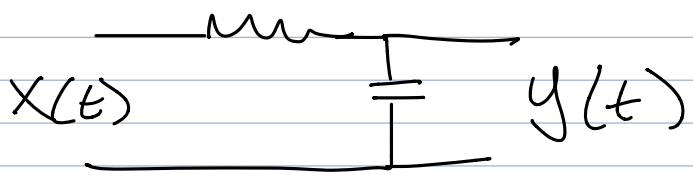
$\sin(x) = \cos(x - \frac{\pi}{2})$



5. $\frac{1}{\sqrt{1+(\omega RC)^2}} = \frac{1}{\sqrt{1+(1000 \cdot 1k\Omega \cdot 1\mu F)^2}}$

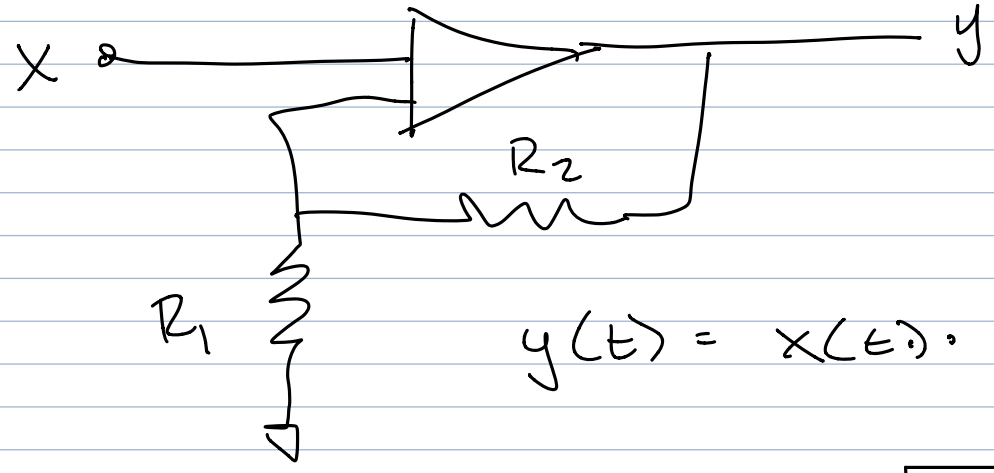
* see pin in 381

$= 0.707$



→ Low Pass: $\frac{1}{\sqrt{1+(\omega RC)^2}}$

→ High Pass: $\frac{\omega RC}{\sqrt{1+(\omega RC)^2}}$



$y(t) = x(t) \cdot \frac{R_1 + R_2}{R_1}$

just another circuit / V. divider ex.

for H(s)

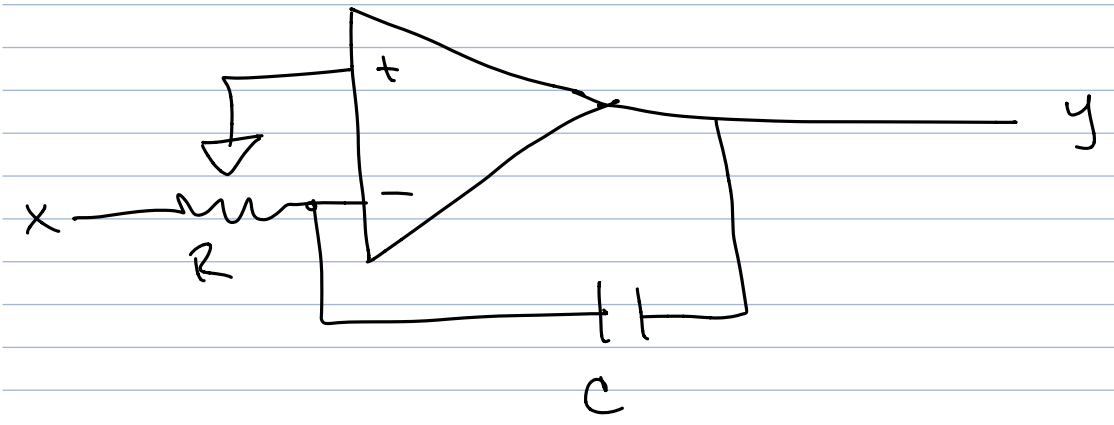
R → R

C → $\frac{1}{Cs}$

L → Ls

Eq. for Band Pass + Band Stop

* get these



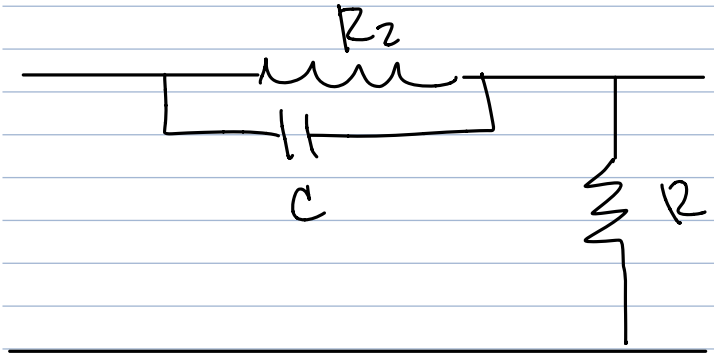
$$H(s) = \frac{-1}{RCs} \qquad h(t) = \frac{-t}{RC}$$

$$u(t) - u(t-2)$$

Property is $\mathcal{L}[u(t)] = \frac{1}{s}$

$$\mathcal{L}[u(t-c)] = \frac{e^{-cs}}{s}$$

$$= \frac{1}{s} - \frac{e^{-2s}}{s} = \frac{1 - e^{-2s}}{s}$$

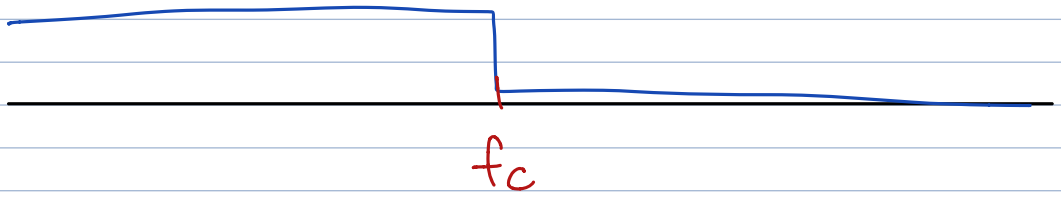


$$Y(s) = \frac{Z_{R_1}}{Z_{R_1} + Z_{RC_2}}$$

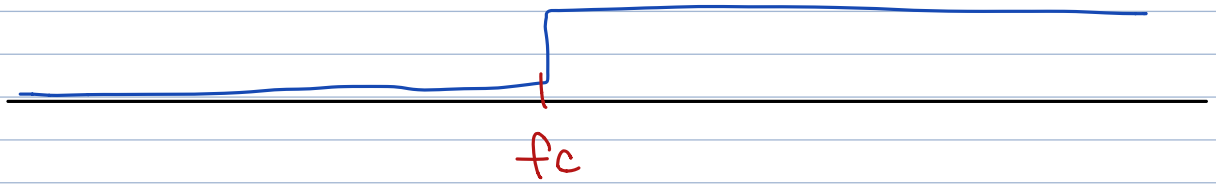
$$= \frac{R_1 C s R_2 + R_1}{R_1 C s R_2 + R_1 + R_2}$$

Filter Rev

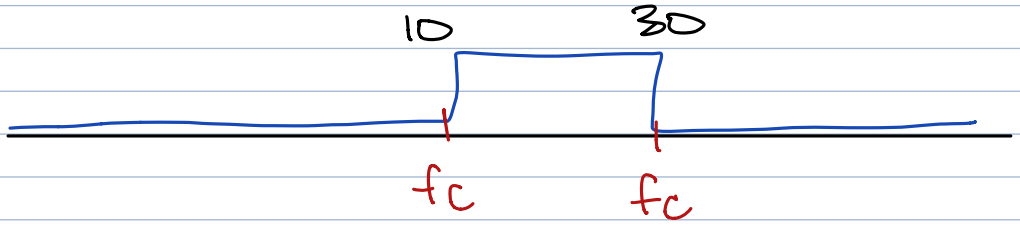
LPF



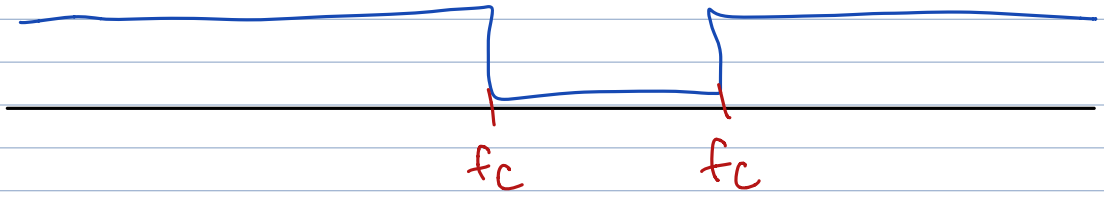
HPF



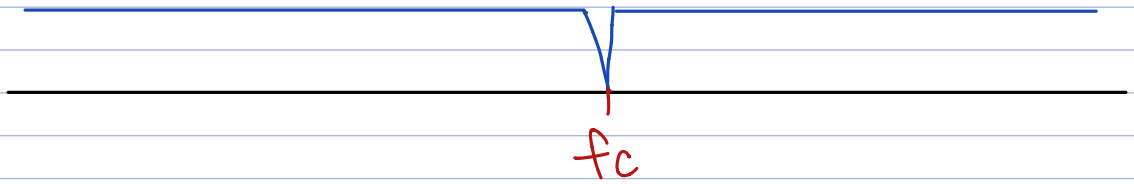
Band Pass



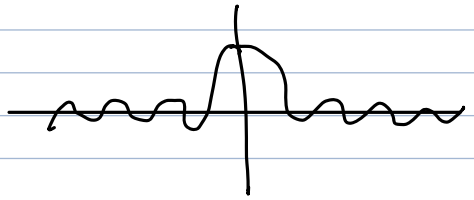
Band Stop



Notch



7. If you have a pulse in the frequency domain, you have some form of sinc function in time domain.



(HW 4)

8. Nyquist Thm.

$\Omega_s \geq 2\Omega_{max}$

$2 \cdot max = 2 \cdot 60 = 120$

Alt. You have Fs of 180 Hz, what is the max Ω w/o aliasing?

90 Hz

9. $\Delta f = \frac{Fs}{NFFT} = \frac{200}{256} =$ **0.781**

10. Filter Circuits

→ through inductor → HPF

→ through capacitor → LPF

→ Resistor → Band pass

→ Inductor + Capacitor → Band Stop

Moving average questions

$$\text{coefficients} = \frac{1}{\#\text{ of terms}}$$

Quiz 6 #2

$$BW = F_s \cdot 2(S_{amp\,size}) = 352{,}800 \text{ bps}$$

$$\downarrow$$

$$44100 \text{ Bps}$$

$$MEM = BW \cdot T_0$$

$$\left[\frac{B}{s} \cdot s = B\right]$$

$$MEM = 44100 \cdot 3600$$

$$1 \text{ hr} = 3600 \text{ s}$$

$$= \frac{158{,}760{,}000 \text{ B}}{1024}$$

$$= \frac{155039.06 \text{ kB}}{1024}$$

$$= \boxed{151.41 \text{ MB}}$$