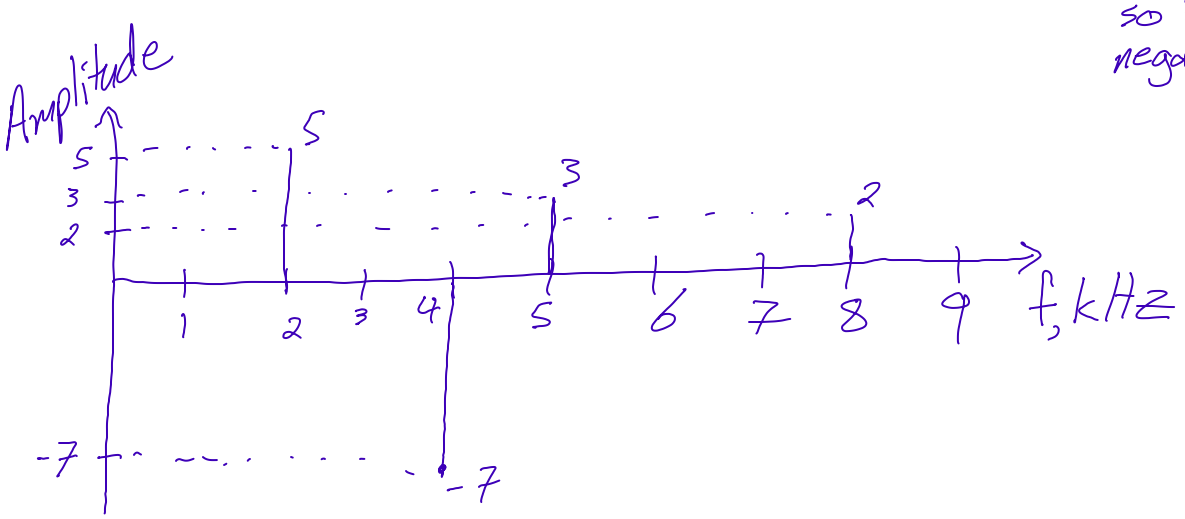
1. Sketch the amplitude spectrum (amplitude vs. frequency) for each of the following signals:

(a) $y(t) = 3\cos(360^\circ * 5k * t) + 5\cos(360^\circ * 2k * t) + 2\cos(360^\circ * 8k * t) - 7\cos(360^\circ * 4k * t)$

* Amplitude (not magnitude) so plotting positive and negative




(b) $y(t) = 3\cos(360^\circ * 5k * t + 30^\circ) + 5\cos(360^\circ * 2k * t - 45^\circ) + 2\cos(360^\circ * 8k * t) - 7\cos(360^\circ * 4k * t + 150^\circ)$

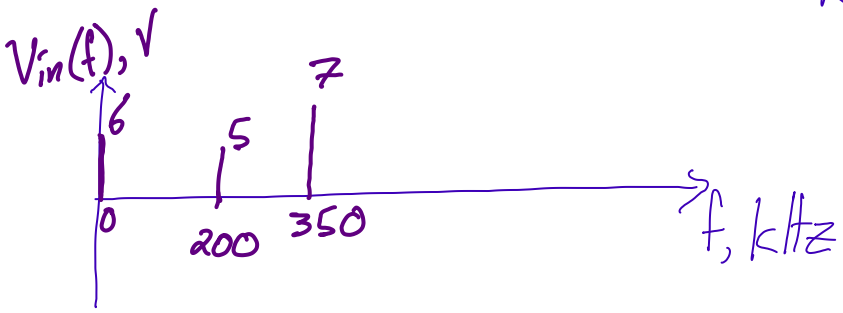
* The problem is only asking for the amplitude spectrum. The amplitudes haven't changed from part (a) to (b) - just the phase shifts have - so the amplitude spectrum plot is unchanged.

Same as part (a).

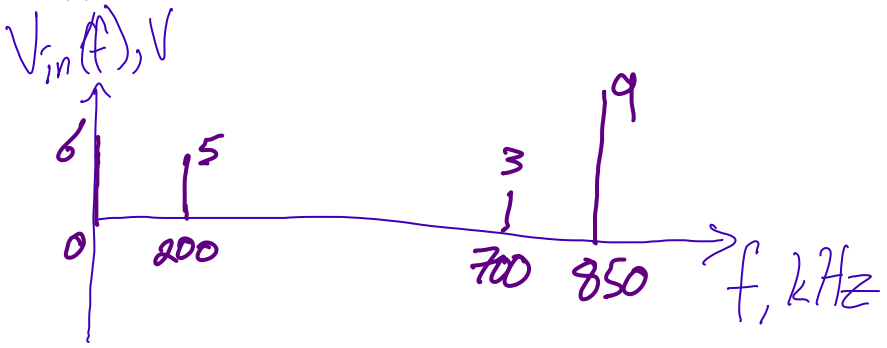
2. Plot the output spectrum when the given signal is applied to the input of each of the following filters:

$$V_{in}(t) = 6V + 5V\cos(360^\circ * 200k * t) + 7V\cos(360^\circ * 350k * t) + 4V\cos(360^\circ * 550k * t) + 3V\cos(360^\circ * 700k * t) + 9V\cos(360^\circ * 850k * t)$$

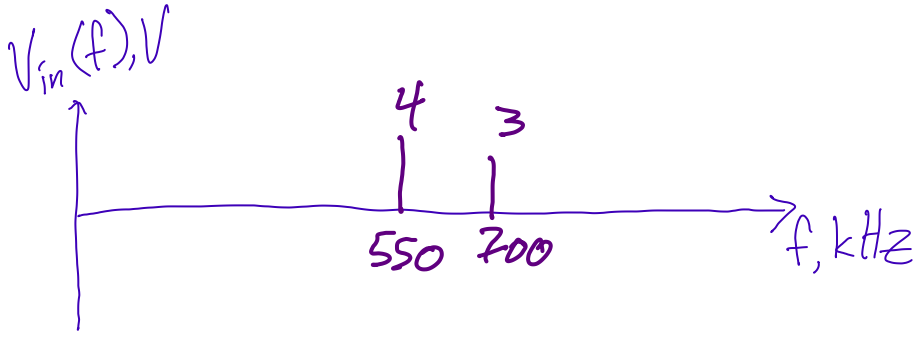
(a) An ideal low-pass filter with a cutoff frequency of 400kHz. Remove any freq's > 400kHz



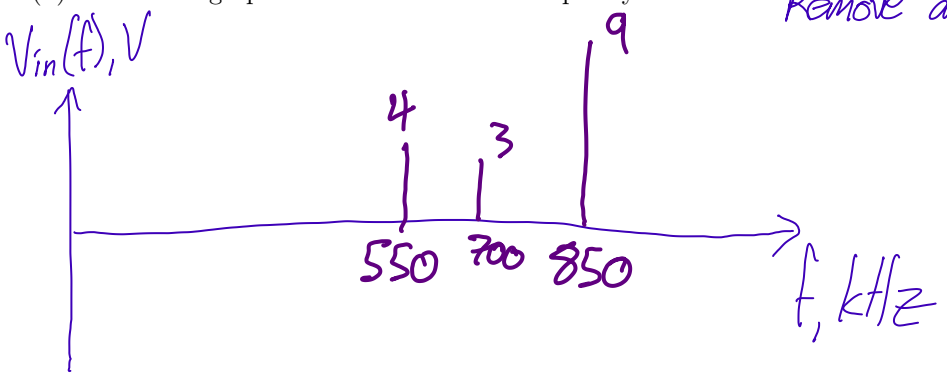

(b) An ideal band-reject filter with cutoff frequencies of 300kHz and 600kHz. Remove any freq's between 300kHz - 600kHz




(c) An ideal band-pass filter with cutoff frequencies of 400kHz and 750kHz. Remove any freq's < 400kHz or > 750 kHz

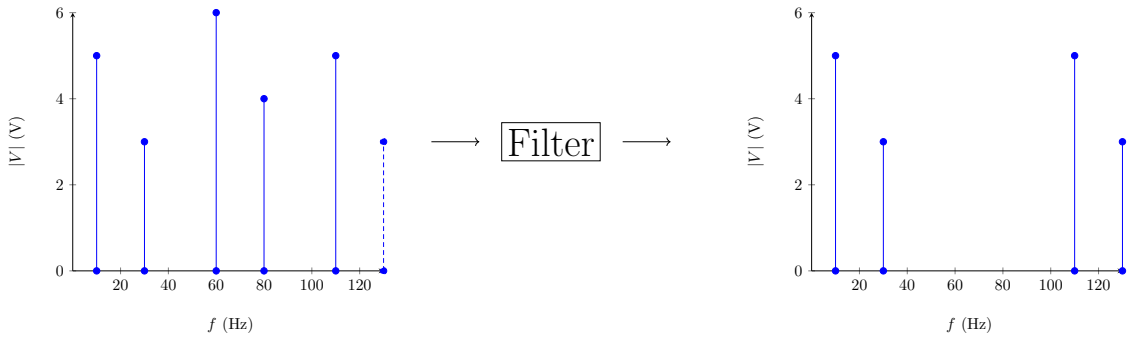



(d) An ideal high-pass filter with a cutoff frequency of 500kHz. Remove any freq's < 500kHz.



3. Given the following input and output amplitude spectra, determine the type of ideal filter and propose representative cutoff frequency/frequencies.

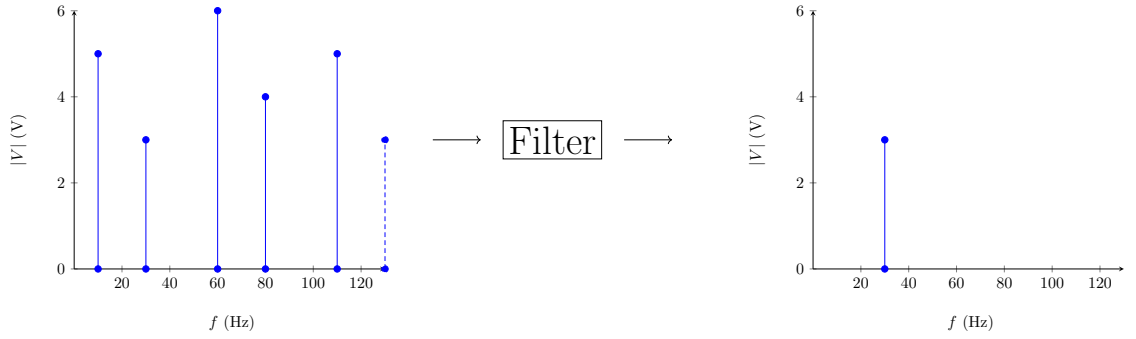
(a)




Filter type = BRF (Band Reject Filter)

Cutoff frequency(ies) = 40Hz + 100Hz

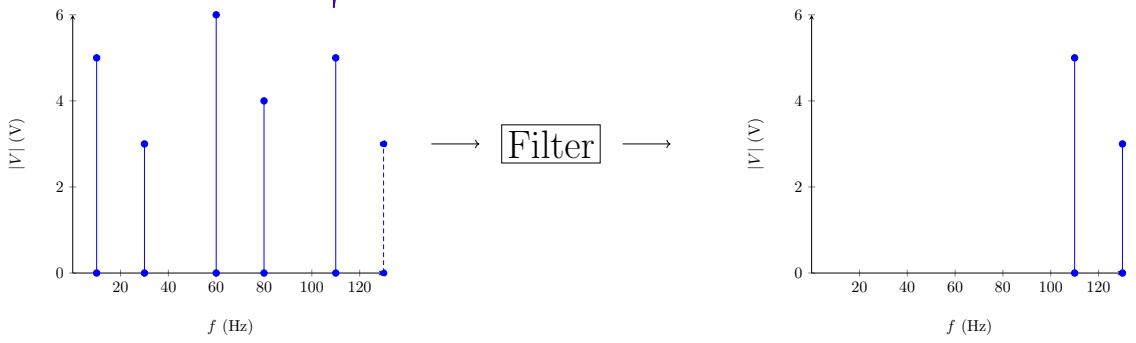
(b)




Filter type = BPF (Band pass filter)

Cutoff frequency(ies) = 20Hz + 40 Hz

(c)




Filter type = HPF (High pass filter)

Cutoff frequency(ies) = 100 Hz