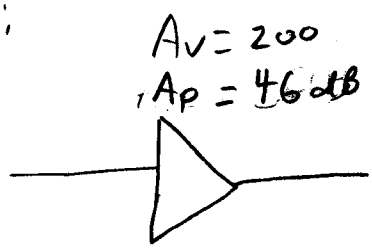
PRACTICE REVIEW PROBLEMS

(1) If $f = 2.3\,MHz$, what is the wavelength?

(2) If a signal has a wavelength of 2 km, what is its frequency?

(3) Given:



(A) If the input signal is 14mV, what is the output voltage?

(B) If the input power is $-3dB$, what is output power?

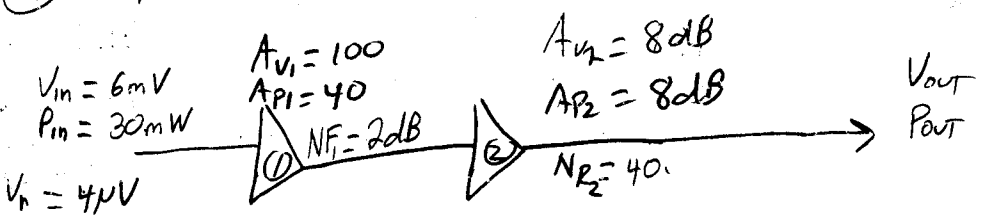
(C) What is your answer from (A) in dB?

(D) What is your answer from (B) in watts?

(E) What is A_P in ratio form?

(F) If the noise at the input is 2μV, what is SNR in both ratio and dB?

(4) Given:



(A) What is the TOTAL VOLTAGE gain?

(B) what is V_{OUT}?

(C) what is the TOTAL power gain?

(D) what is P_{OUT}?

(E) what is the TOTAL NOISE RATIO (NR_T)?

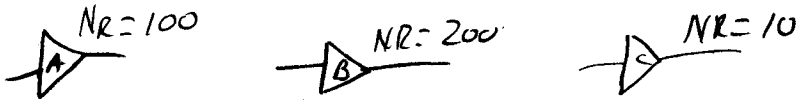
(F) what is the TOTAL Noise Figure (NF_T)?

(G) what is the SNR AT the input in BOTH RATIO and dB?

(H) what is the SNR AT the output in BOTH RATIO and dB? (RATIO FOR BOTH POWER AND VOLTS)

(5) If Signal has a power of 4mW and a noise level of 24pW, what is its SNR in dB?

(6) If you have 3 stages as shown below, which one should come first from a noise perspective and why?

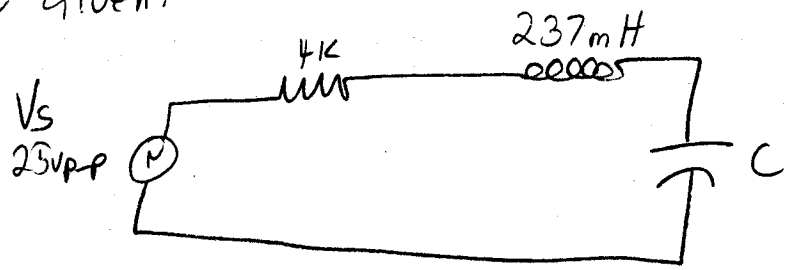


(7) If a 10K Ω resistor is operating in a circuit whose bandwidth is 1kHz and the temperature is 75°C, what is the magnitude of its noise?

(8) What is the equation for the reactance of a capacitor? What does its reactance do as frequency increases?

(9) Same question as #8, but for an inductor.

(10) Given:

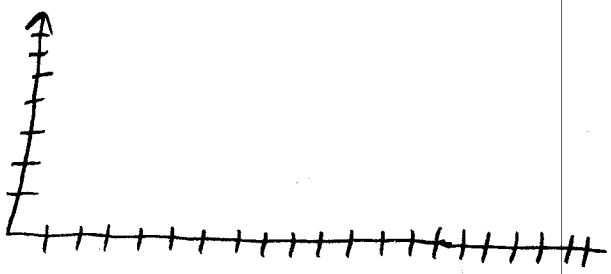


(A) IF we want the resonant frequency to be 85 KHz, what is C?

(B) What is Q for this circuit?

(C) what is the Bandwidth of this circut?

(d) Draw the frequency response and label the upper and lower cut-off frequencies, the voltage at the peak, and voltage at the cut-offs



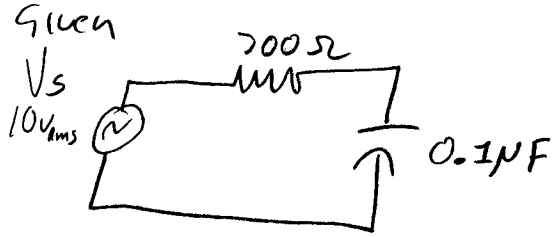
(e) If the input voltage is $25 V_{p-p}$, how much power is dissipated in the resistor at the Lower cut-off frequency? what is the dB difference between the dB at the peak and the dB @ the cut-off?

(f) How much power is dissipated in the resistor @ the resonant frequency?

(g) what is $\left|\frac{V_R}{V_S}\right|$ @ Resonance? what is that in dB?

(11) TELL me The 3 Things The CUT-OFF FREQUENCY means.

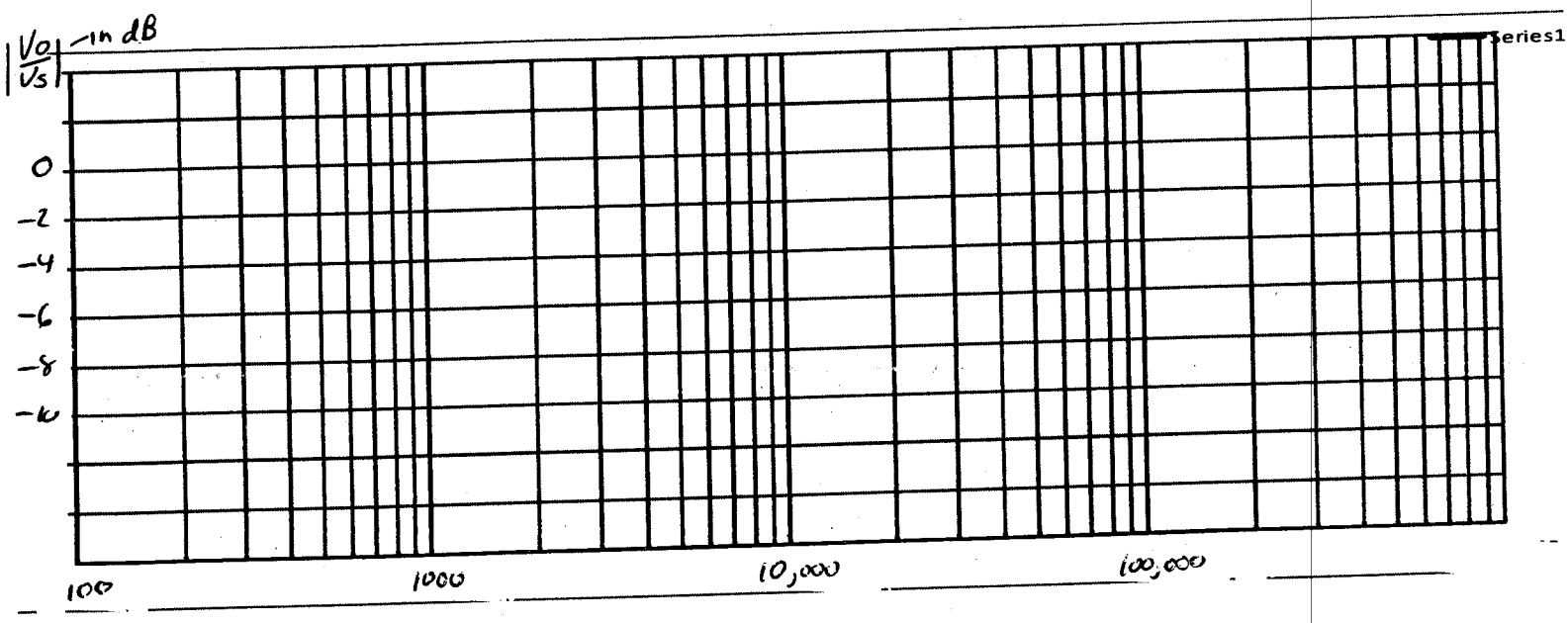
(12) Given



(A) WHAT IS The CUT-OFF FREQUENCY FOR THIS CIRCUIT?

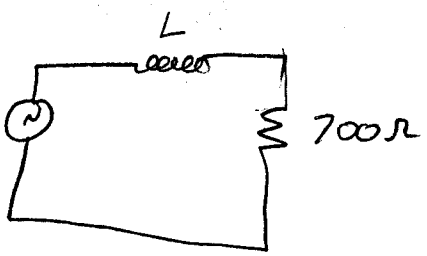
(B) IF I WANT TO USE This AS A high-PASS CIRCUIT, WHAT component do I TAKE The VOLTAGE ACROSS? WHY?

(C) PLOT The FREQUENCY RESPONSE FOR This HP FILTER



(13)

Given: V_s 25 V P-P

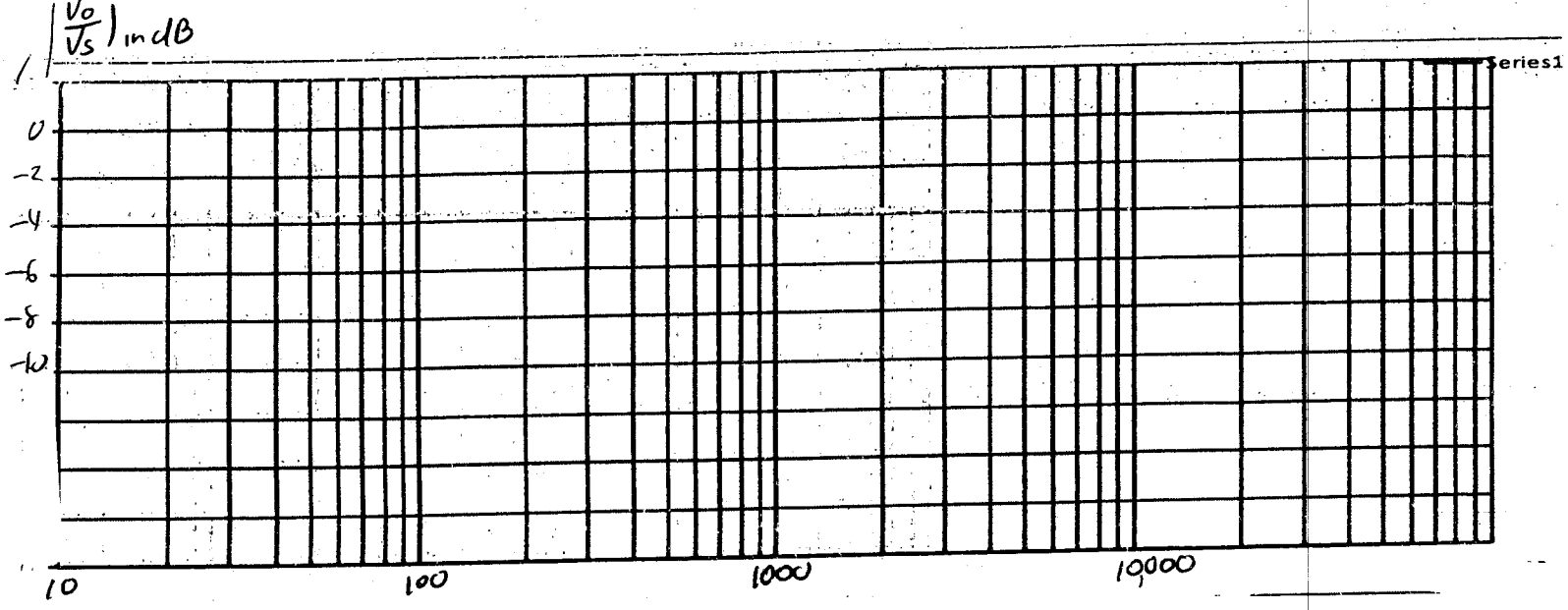


(A) WHAT IS L IF WE WANT A CUT-OFF FREQUENCY OF 5KHz?

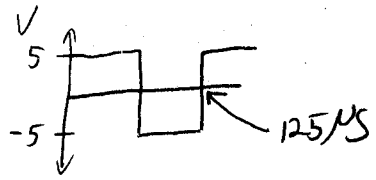
(B) IF WE WANT TO USE THIS AS A LOW PASS FILTER, WHAT COMPONENT DO WE TAKE THE VOLTAGE ACROSS AND WHY?

(C) WHAT IS THE VOLTAGE ACROSS THE COMPONENT SELECTED IN B AT THE CUT-OFF FREQUENCY?

(D) PLOT THE FREQUENCY RESPONSE

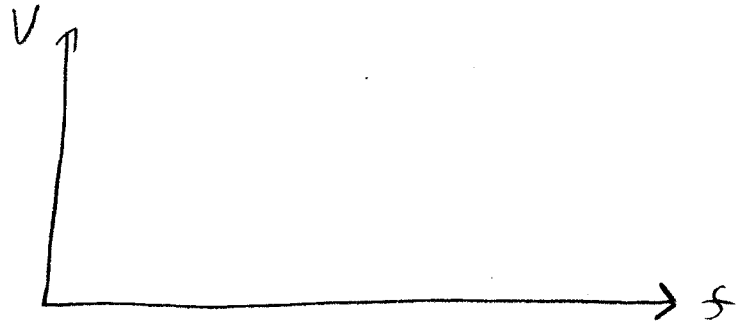


(14) Given:

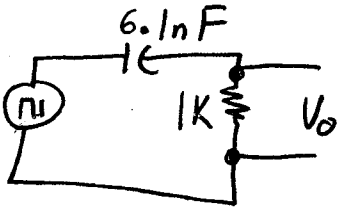


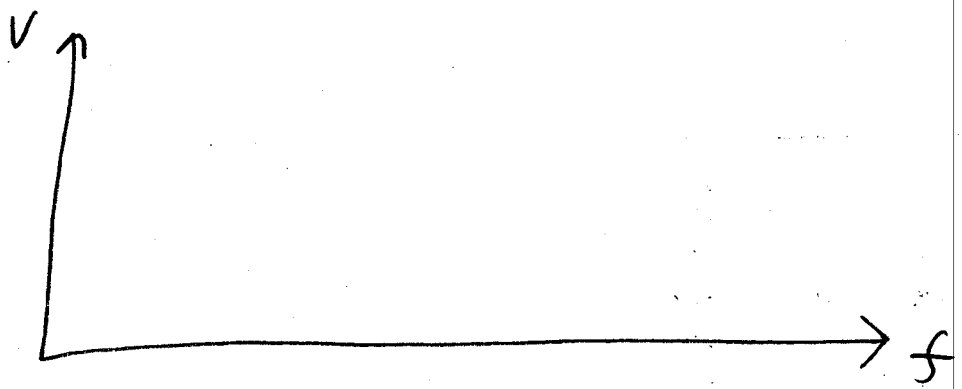
(A) What is the frequency spectrum using

$$f(t) = \frac{4V}{\pi}\left[\sin 2\pi\left(\frac{1}{T}\right)t + \frac{1}{3}\sin 2\pi\left(\frac{3}{T}\right)t + \frac{1}{5}\sin 2\pi\left(\frac{5}{T}\right)t \ldots\right]$$



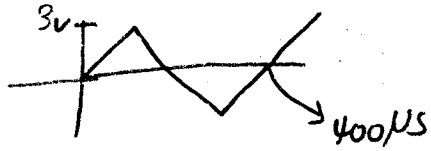
(B) If the above waveform was soure of the below circuit, what would the resulting frequency spectrum look like?





(C) What would the time domain equation be? [Hint: look @ A]

(15) Given:



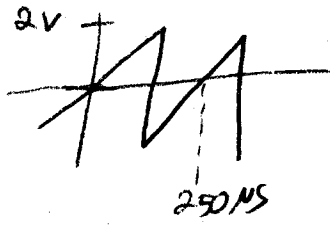
$$f(t) = \frac{8V}{\pi^2}\left[\cos 2\pi\left(\frac{1}{T}\right)t + \frac{1}{9}\cos 2\pi\left(\frac{3}{T}\right)t + \frac{1}{25}\cos 2\pi\left(\frac{5}{T}\right)t \ldots\right]$$

(A) WHAT IS THE FREQUENCY SPECTRUM?

(B) IF THE ABOVE WAS PASSED THRU A BANDPASS FILTER w/ Q=5 AND A RESONANT FREQUENCY OF 8KHz, WHAT DOES THE RESULTANT FREQUENCY SPECTRUM LOOK LIKE?

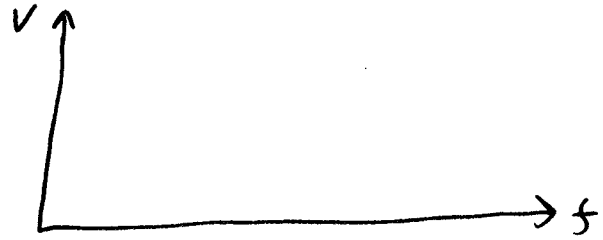
(C) WHAT WOULD THE TIME DOMAIN EQUATION BE? [HINT: LOOK @ A]

(16) Given:

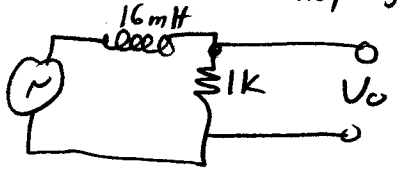


$$f(t) = \frac{2V}{\pi}\left[\sin 2\pi\left(\frac{1}{T}\right)t - \frac{1}{2}\sin 2\pi\left(\frac{2}{T}\right)t + \frac{1}{3}\sin 2\pi\left(\frac{3}{T}\right)t - \frac{1}{4}\sin 2\pi\left(\frac{4}{T}\right)t \ldots\right]$$

(A) WHAT IS THE FREQUENCY SPECTRUM?



(B) ASSUME THIS WAVE IS THE SOURCE OF THE CIRCUIT BELOW, WHAT WOULD THE RESULTANT FREQUENCY SPECTRUM LOOK LIKE?



(C) SUPPOSE WE WANTED A BAND PASS FILTER TO PASS ONLY THE 2, 3, AND 4TH HARMONICS, WHAT WOULD THE RESONANT FREQUENCY NEED TO BE AND WHAT WOULD THE BW NEED TO BE?

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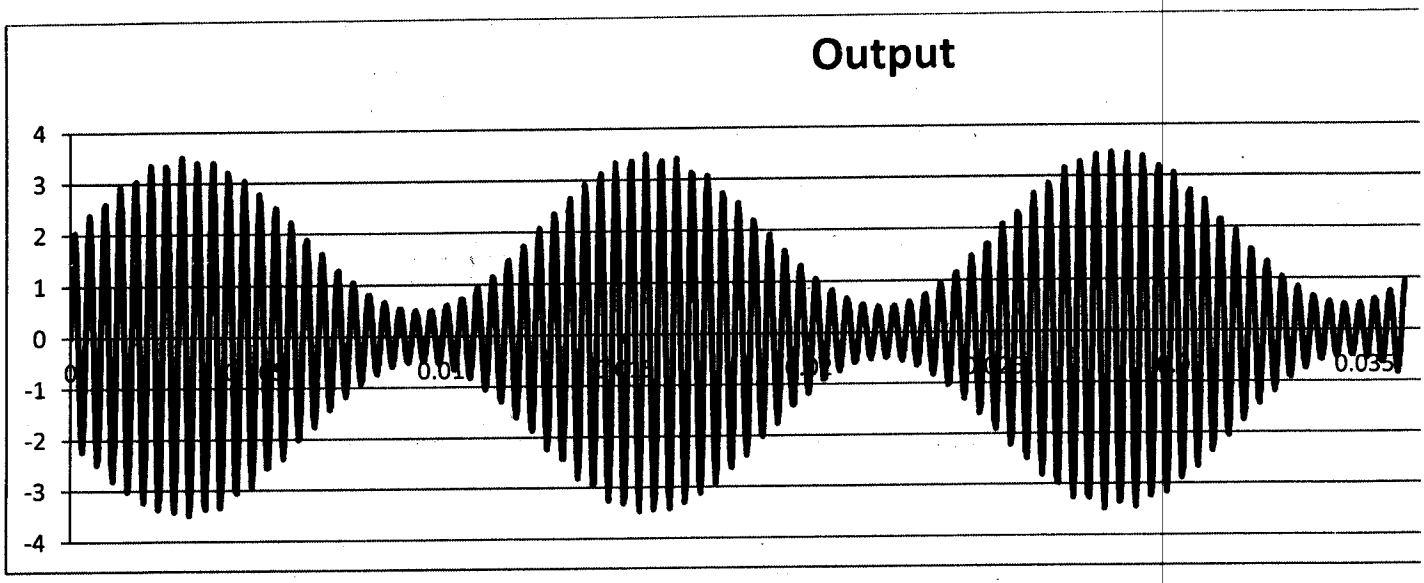


(A) DRAW IN WHAT WOULD BE THE MODULATING FREQUENCY

(B) WHAT IS V_{MAX}?

(C) WHAT IS V_{MIN}?

(D) WHAT COULD YOU CALCULATE GIVEN THESE 2 VALUES? [HINT: LABS!]

(18) Given:

An AM signal

$V_c = 10$

$V_m = 6.5$

$f_c = 500\,KHz$

$f_m = 6\,KHz$

I_c (unmodulated) $= 25A$

$R_{ANTENNA} = 75\Omega$

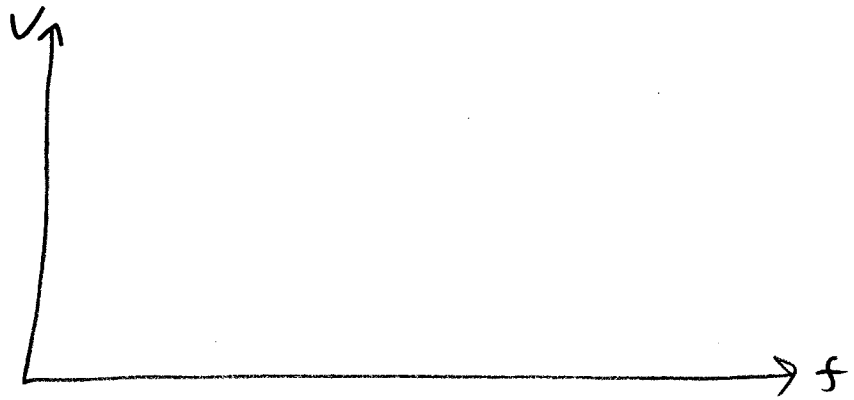
(A) What is the modulation index?

(B) What is the Bandwidth?

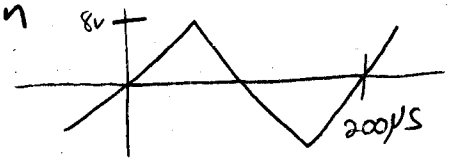
(C) How much power is in the carrier?

(D) how much power is in each sideband?

(E) Draw the frequency spectrum for this AM signal.



(F) Use the above graph to verify B.

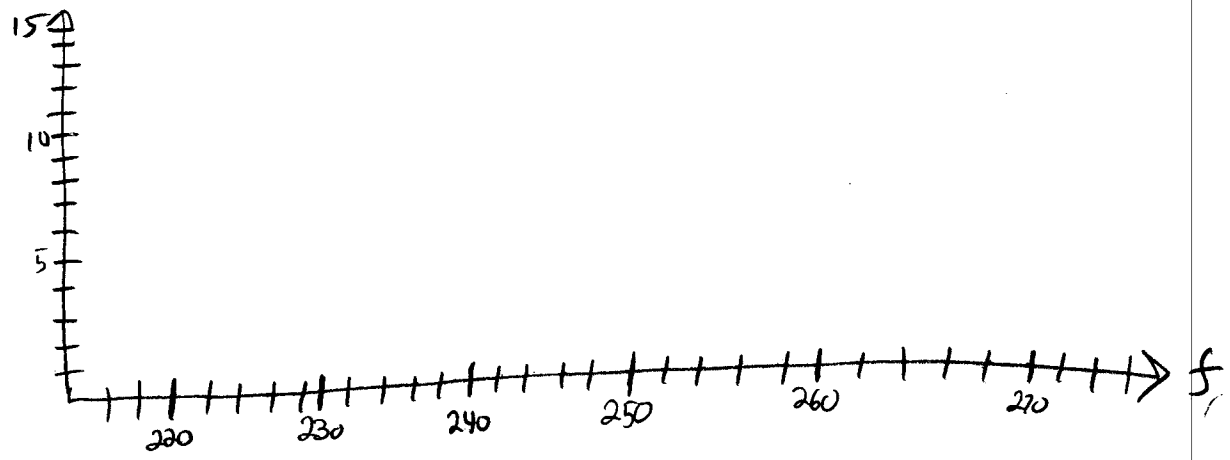
(19) Given 

$$v(t) = \frac{8V}{\pi^2}\left[\cos 2\pi\left(\frac{1}{T}\right)t + \frac{1}{9}\cos 2\pi\left(\frac{3}{T}\right)t + \frac{1}{25}\cos 2\pi\left(\frac{5}{T}\right)t\right]$$

(12)

If we modulate the signal with a carrier of 250 kHz and magnitude of 15V:

(A) what does the resultant frequency spectrum look like?



(B) If the antenna has a resistance 75Ω and the unmodulated current is 1.5 A, what is total power, power in the carrier, and the power in each sideband?

(C) what is m for each harmonic in this AM signal?