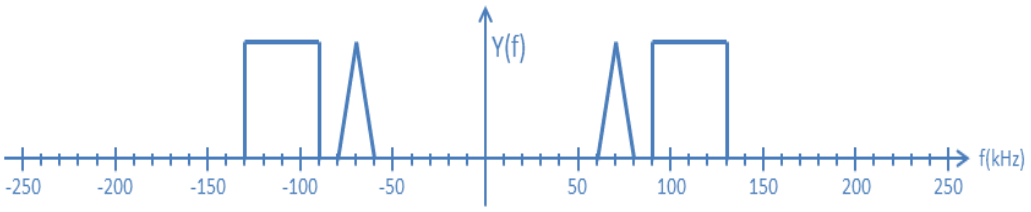
8.4 QUIZ QUESTION 1 (1 point possible)

Consider a received signal containing two baseband signals modulating two different carriers so that they occupy non-overlapping regions of the spectrum. One of the baseband signals has a rectangular spectrum, and the other has a triangular specturm. The spectrum of the received signal, $Y(f)$, is shown below.



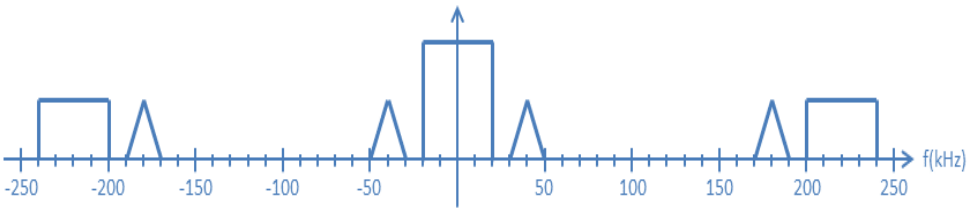
The desired signal is demodulated by first mixing the received signal with a cosine with frequency 110kHz.

Which of the following is the bandwidth of an ideal low pass filter that will isolate the desired baseband signal only?

- 15kHz
- 25kHz ✔
- 55kHz ✖
- 85kHz

EXPLANATION

After mixing with the cosine with frequency 110kHz, the spectrum of the signal looks like the signal below.



The signal with rectangular spectrum is the desired signal, as it has been mixed down to be centered around zero frequency. To isolate this signal alone, we must remove signals above 30kHz, but retain signals below 20kHz. Only the low pass filter with cutoff frequency of 25kHz satisfies both requirements.

You have used 2 of 2 submissions

8.4 QUIZ QUESTION 2 (1/1 point)

Suppose that the amplitude of the frequency response of a low pass filter is given by

$$|H(f)| = \frac{1}{\sqrt{1+0.0625f^2}}$$

where the frequency f is measured in kHz.

What is the 3dB cutoff frequency of this filter in kHz? Give your answer to one decimal place (e.g. 3.1).

4.0 kHz ✔ **Answer:** 4

4.0

EXPLANATION

The 3dB cutoff frequency f_c is the frequency where $|H(f_c)| = \frac{1}{\sqrt{2}}|H(0)|$. Since $|H(0)| = 1$,

$$\frac{1}{\sqrt{1+0.0625f_c^2}} = \frac{1}{\sqrt{2}}$$

This occurs when $0.0625f_c^2 = 1$, i.e.

$$f_c = \sqrt{(0.0625)^{-1}} = 4.0\text{kHz}.$$

You have used 1 of 3 submissions