Apply definitions of decibels and decades

1. (vin/vout to dB) If an electronic component takes a 1.0v sine wave as input and output a 0.1v sine wave, how much attenuation would it have?

2. (vin/dB to vout) If you input a 2.4 V sin wave into a circuit that attenuated it by -32dB, what would the amplitude of the output waveform be?

3. (out/dB to vin) A circuit attenuates an input signal by -68 dB to produce a 0.5 V signal. What is the amplitude of the input signal?

4. (fhi/flo to decades) How many decades separate 10kHz and 30kHz?

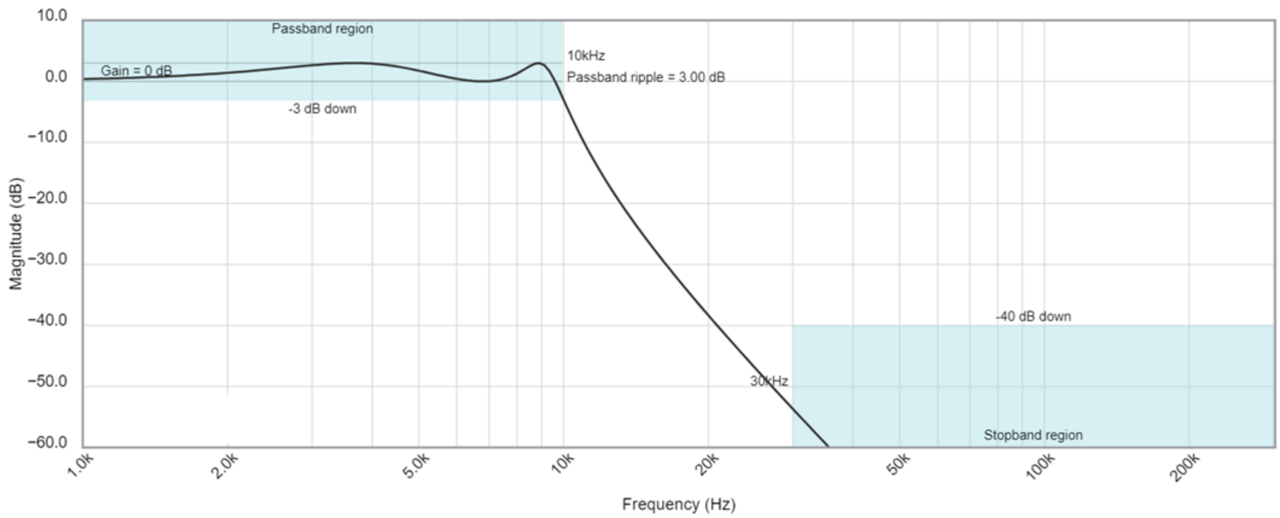
5. (fhi/decades to flo) What frequency is 1.5 decades below 300kHz?

6. (flo/decades to fhi) What frequency is 1.5 decades above 10kHz?

Interpret a Bode plot

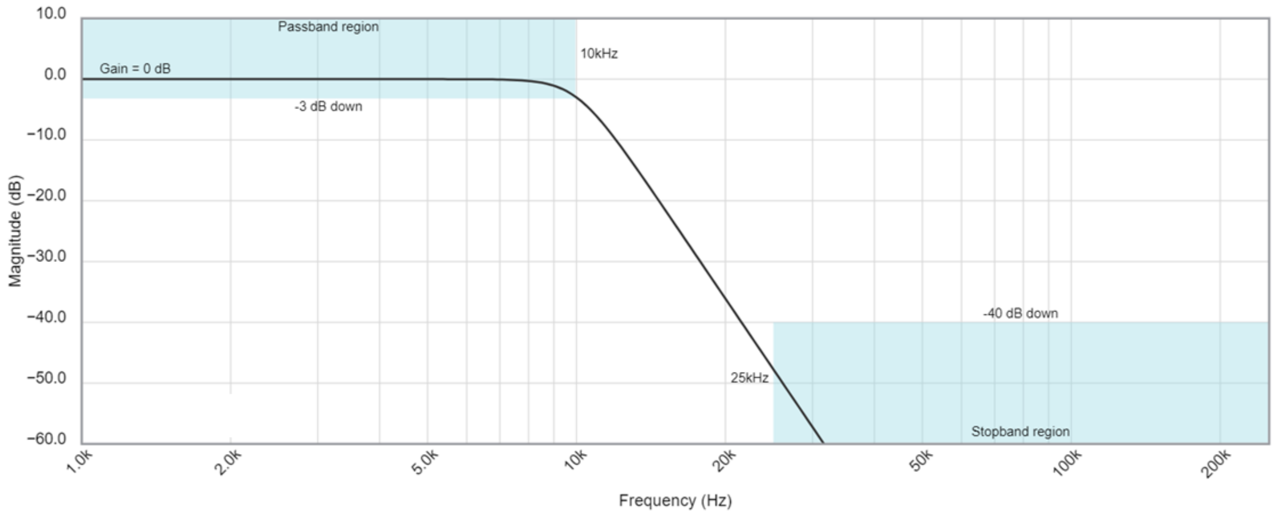
The following (magnitude) Bode plots were created using the Analog Devices filter wizard at tools.analog.com/en/filterwizard

The following Bode plot is from a 4th order Chebyshev low pass filter (note the ripple in the pass band) with corner frequency of 10kHz. Use the information in the Bode plot to answer the following questions.

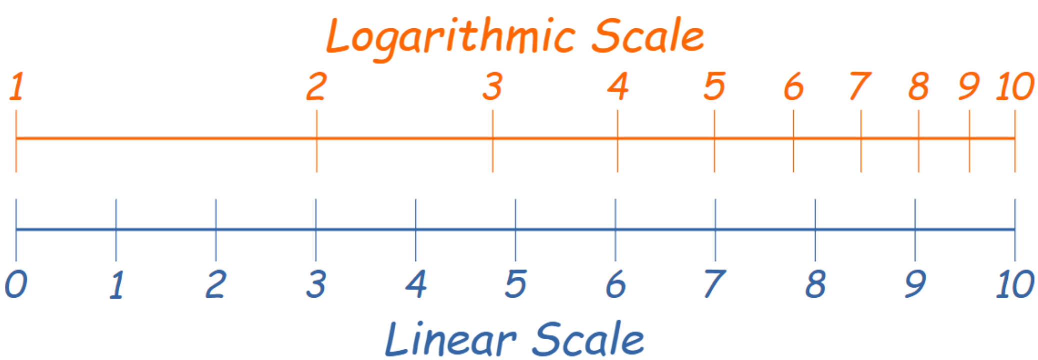


7. If you apply a 20kHz sin wave to this filter, how much attenuation will the output experience?
8. You want -45dB of attenuation, what frequency sin wave should you apply?
9. Estimate the slope of the magnitude in the stop band and use this to estimate the order of the filter. Hint, use the corner frequency as one of your points.

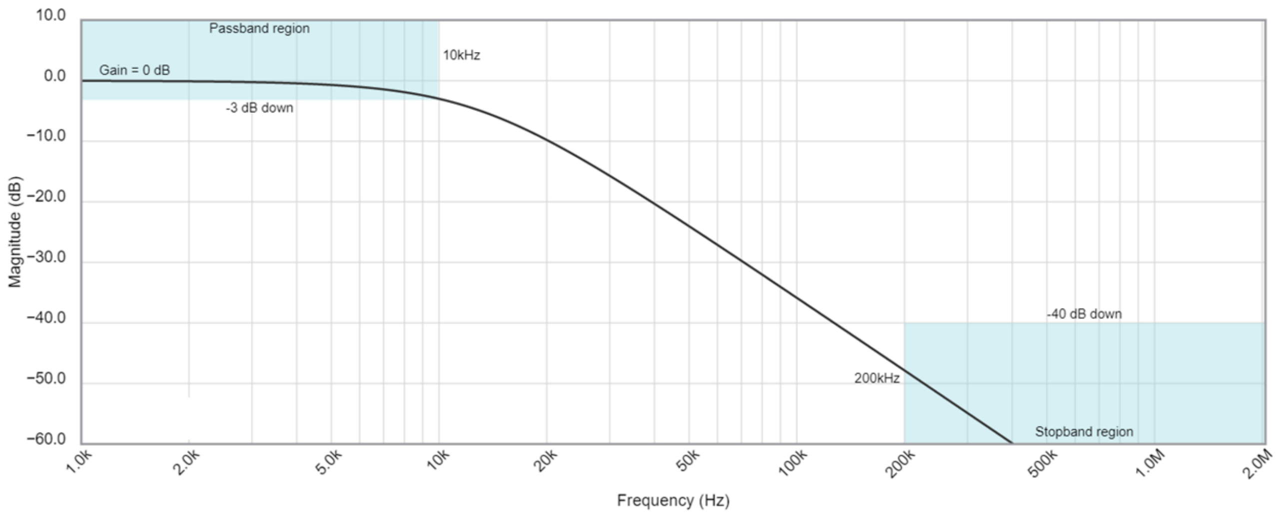
The following Bode plot is from a 6th order Butterworth low pass filter with corner frequency of 10kHz. Use the information in the Bode plot to answer the following questions.



10. If you apply a 25kHz sin wave to this filter, how much attenuation will the output experience?
11. You want -35dB of attenuation, what frequency sin wave should you apply?
12. Estimate the slope of the magnitude in the stop band and use this to estimate the order of the filter. Hint, use the corner frequency as one of your points.



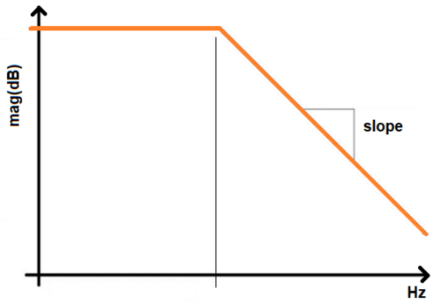
The following Bode plot is from a 2nd order Bessel low pass filter (note the slow roll off) with corner frequency of 10kHz. Use the information in the Bode plot to answer the following questions.



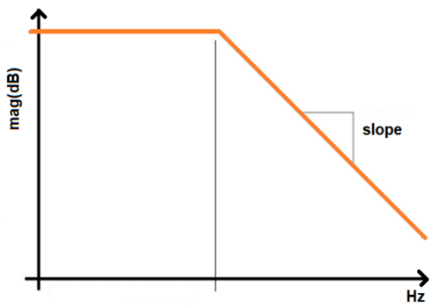
13. If you apply a 20kHz sin wave to this filter, how much attenuation will the output experience?
14. You want -55dB of attenuation, what frequency sin wave should you apply?
15. Estimate the slope of the magnitude in the stop band and use this to estimate the order of the filter. Hint, use the corner frequency as one of your points.

The following questions are based on a 1st order LPF with 0dB of attenuation in the passband. You will find it helpful to annotate the Bode plot with the

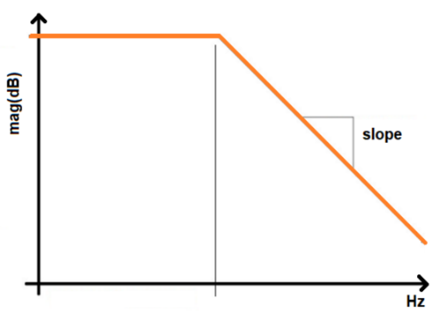
a. Given an 80kHz input signal, how much is the output attenuated?



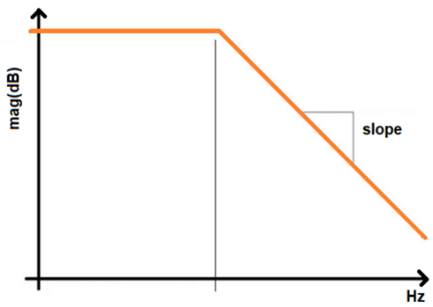
b. Given that the output signal has been attenuated by -48dB, what was the frequency of the input?



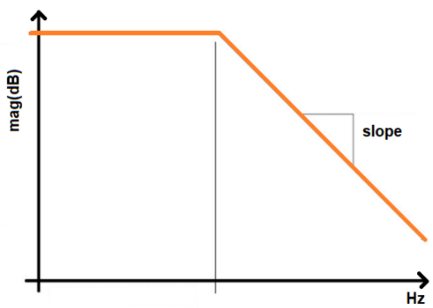
16. Determine the corner frequency of a 4th order LPF that has 0dB of attenuation in the passband and attenuates a 130kHz input by -68dB.



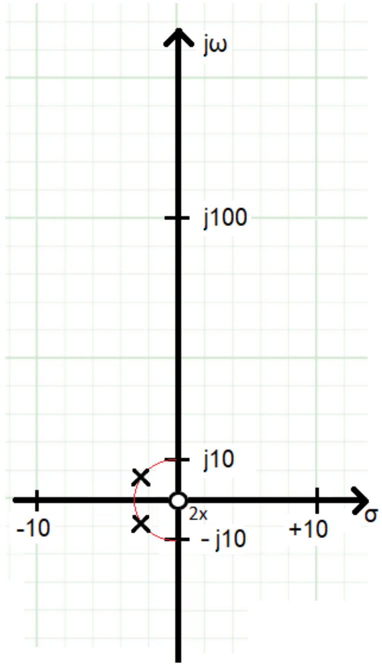
17. Determine the order of a filter that has 0dB of attenuation in the passband, a 15kHz corner frequency and attenuates a 90kHz input by -77.8dB.

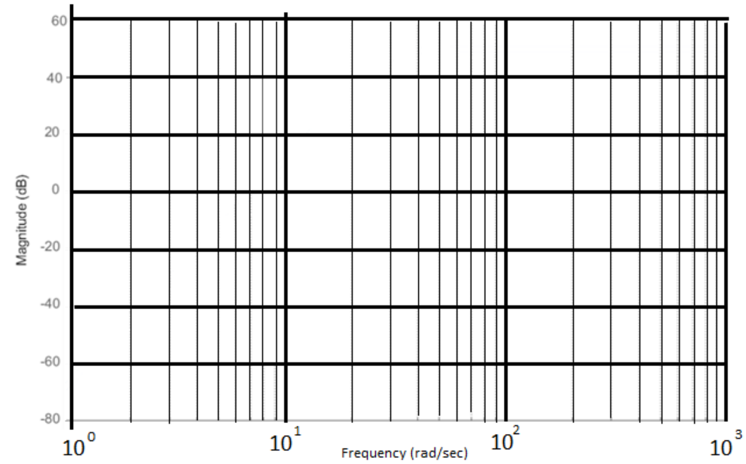


18. Determine the magnitude in the passband of a second order LPF, an 8kHz corner frequency and attenuates a 56kHz input by -13.8dB.

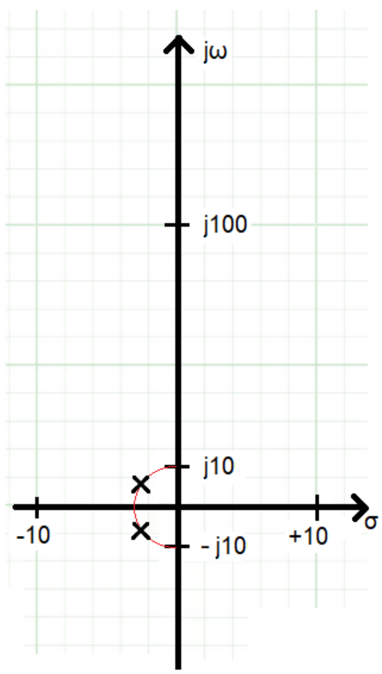


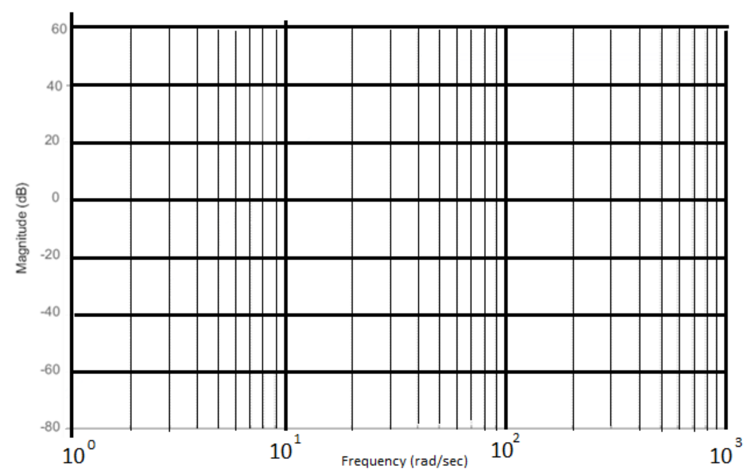
13. Use the pole zero locations of a transfer function given in the plot below to determine the frequency response of the transfer function. The real and imaginary axis are scaled differently. There are two zeros at the origin.



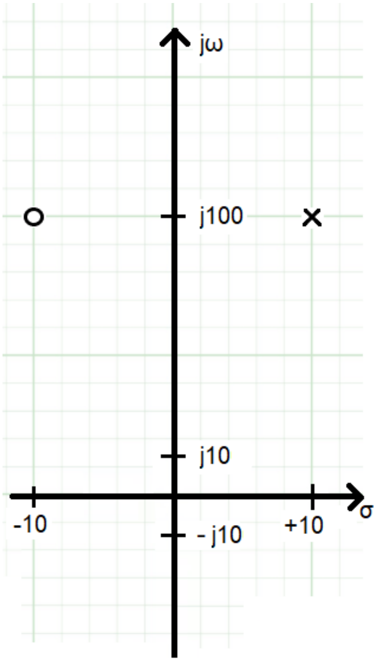


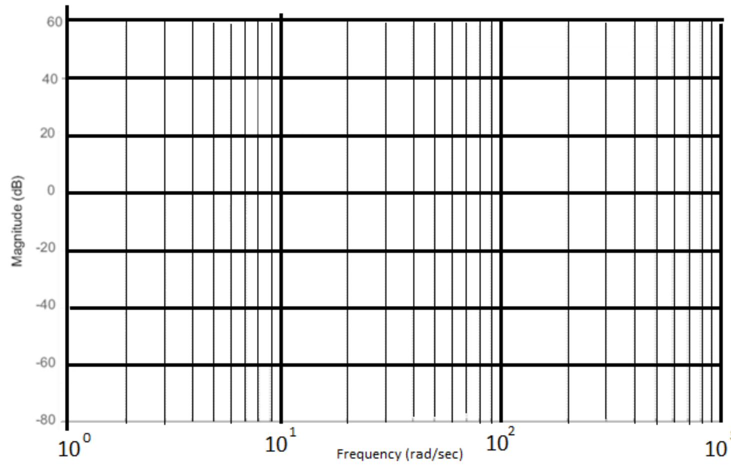
14. Use the pole zero locations of a transfer function given in the plot below to determine the frequency response of the transfer function. The real and imaginary axis are scaled differently.



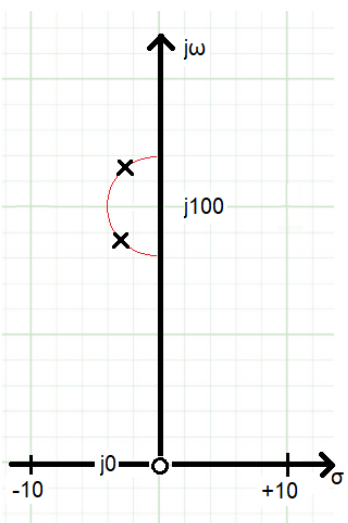


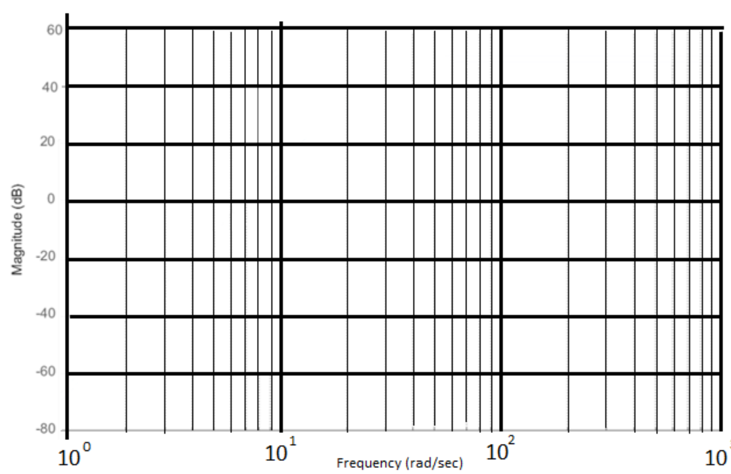
13. Use the pole zero locations of a transfer function given in the plot below to determine the frequency response of the transfer function. The real and imaginary axis are scaled differently.



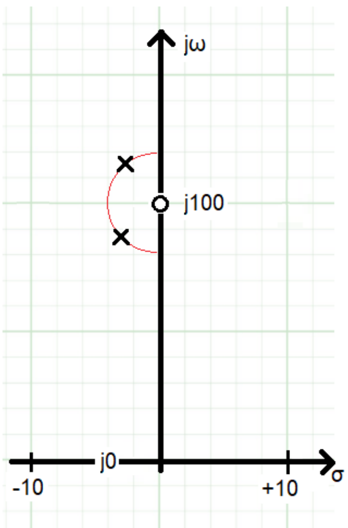


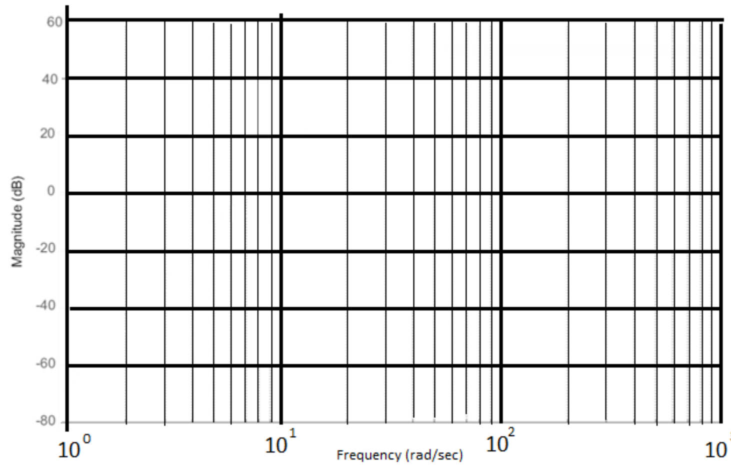
13. Use the pole zero locations of a transfer function given in the plot below to determine the frequency response of the transfer function. The real and imaginary axis are scaled differently. There is one zero a the origin.





13. Use the pole zero locations of a transfer function given in the plot below to determine the frequency response of the transfer function. The real and imaginary axis are scaled differently. There is one zero at j100.





15. Use the pole zero locations of a transfer function given in the plot below to determine the frequency response of the transfer function. The real and imaginary axis are scaled differently.