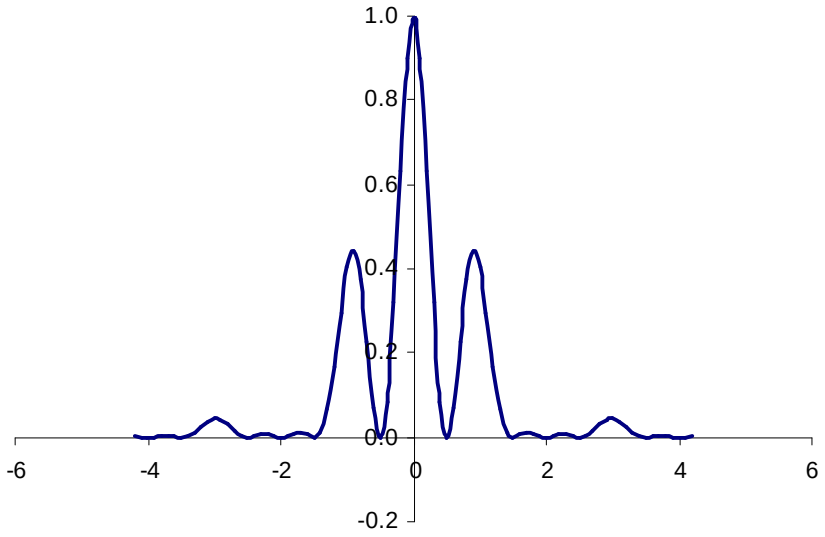
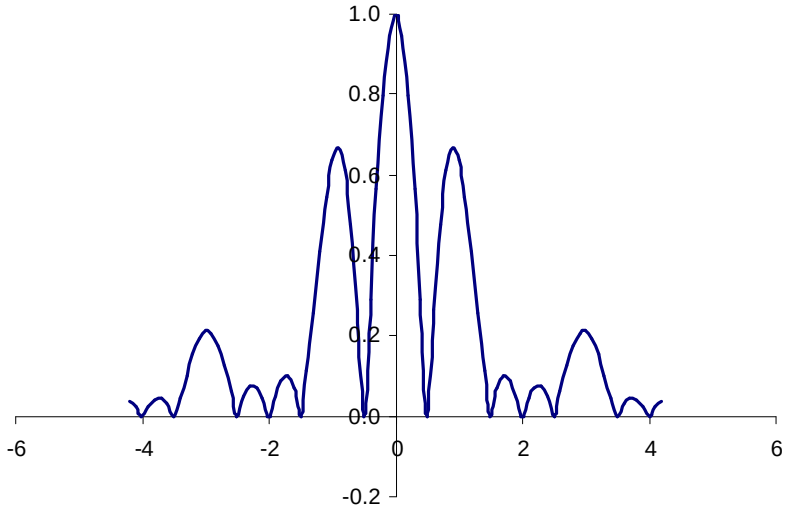
Final Exam Practice Problems

1. Propose a circuit that provides a gain of 2 and a phase angle of 30° when the input is a sinusoid with a radian frequency that is numerically equal to the year of George Washington's birth.

2. Propose a circuit that has a quality of 20, a center frequency of 2 kHz. If the maximum allowable error in center frequency is 10%, what is the tolerance on the component values? You may assume that the tolerance is the same on all components.

3. The following figure is the frequency-domain representation of a particular signal.
a) Is the following plot most likely a diffraction/interference pattern, or simply the magnitude of the Fourier transform of a time-domain signal?
b) What is the shape of the aperture(s) used to generate this pattern? Provide width and spacing information where possible.
c) Is is possible to tell whether this pattern was created using a cosine or a sine in frequency?
d) What is the difference between the inverse Fourier transform of a cos(ω) and a sin(ω)?





4. Explain how a Fourier transforming circuit or signal processor might be used to convert an acoustic signal into a signal that can be interpreted by the auditory nerve. You do not need to address the physical interface between the electronic device and the neurons in the auditory nerve.

5. Explain briefly how the optical information is converted into cognizance of the surrounding visual field. Propose an alternative method of spatially encoding the optical information at the retina. Discuss the advantages and disadvantages of this method over the existing arrangement.