

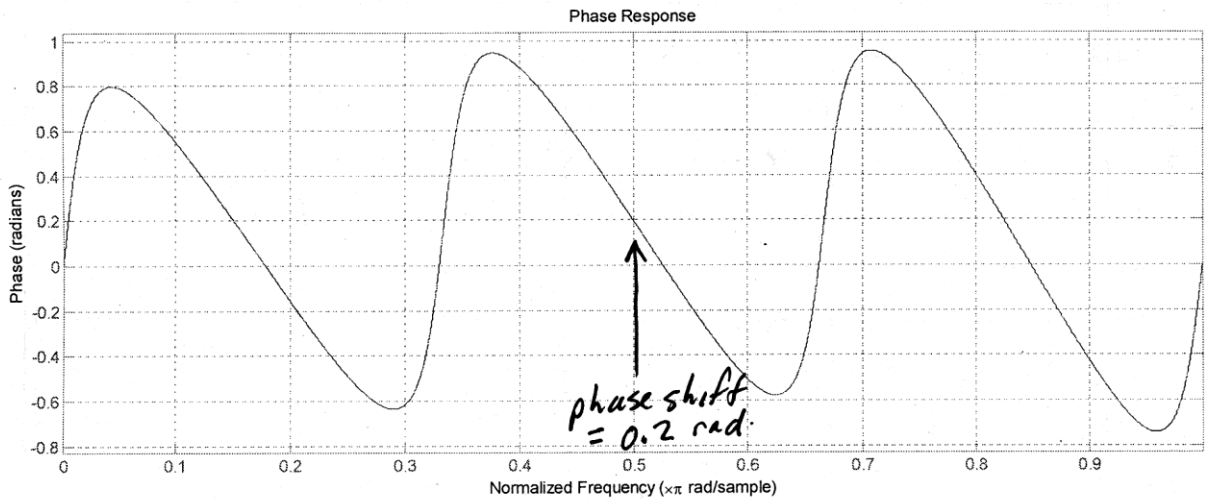
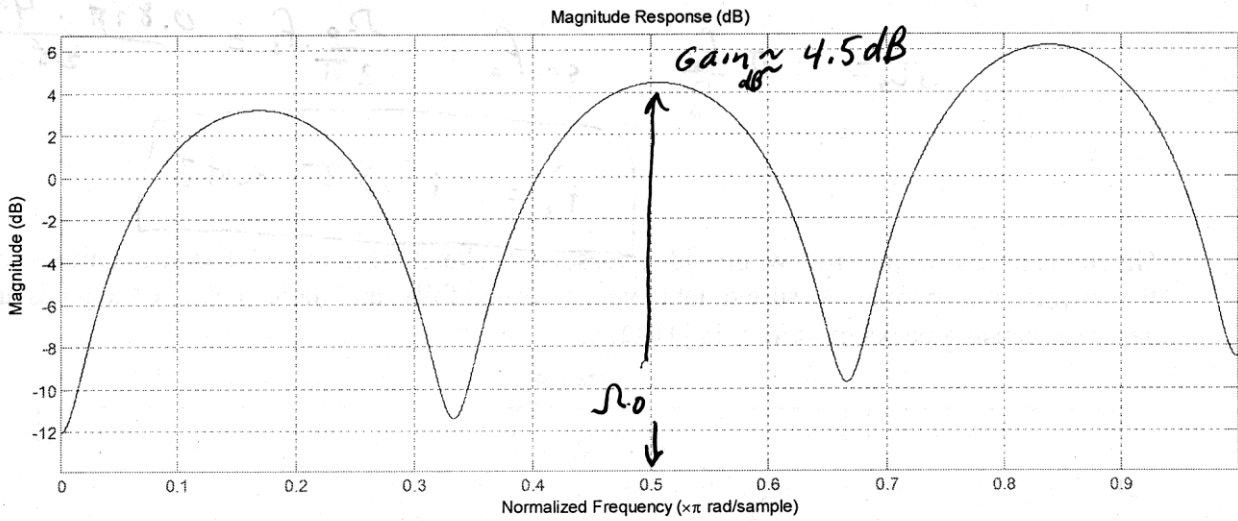
Name: Key

EE432 Fall 2011 Quiz 7

$\Omega_0 = 0.5\pi$

$\theta_0 = -0.1$

1. A digital sinusoid  $x[n] = \cos(0.5\pi n - 0.1)$  is input to a filter that has the magnitude and phase response shown below. Determine the equation for the output sinusoid.



Gain<sub>dB</sub> = 4.5 dB, so Gain =  $10^{\frac{4.5}{20}} = 1.68$

$y[n] = 1.68 \cos(0.5\pi n - 0.1 + 0.2)$

$y[n] = \underline{\underline{1.68 \cos(0.5\pi n + 0.1)}}$

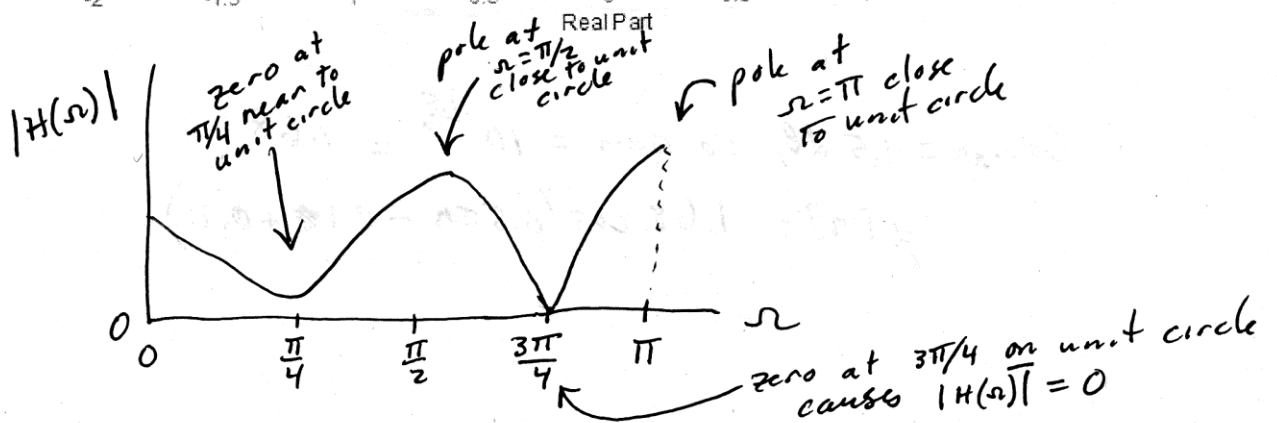
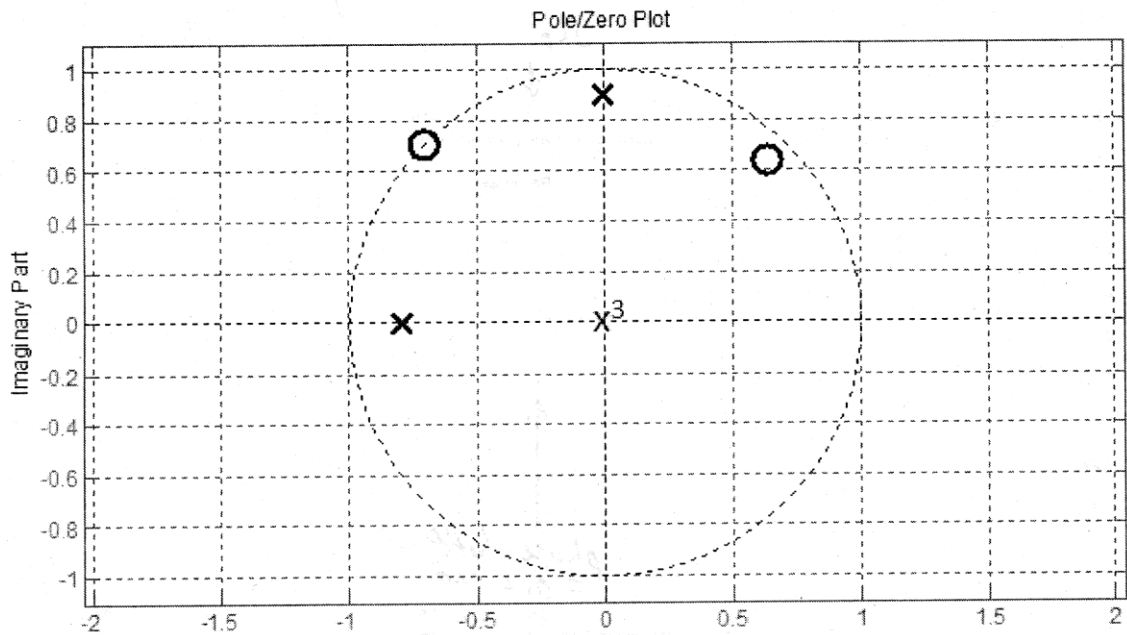
2. In the filter from problem 1, if a signal is input with sample frequency 44.1 kHz, what frequency in the input signal would see the largest gain? Explain your reasoning, and put your answer in Hz.

peak gain is at  $\sim 0.84\pi$

$$\Omega_0 = 2\pi \frac{f_0}{f_s} \quad \text{so } f_0 = \frac{\Omega_0}{2\pi} \cdot f_s = \frac{0.84\pi \cdot 44.1 \text{ kHz}}{2\pi}$$

$$f_0 = 18.522 \text{ kHz}$$

3. Given the pole-zero plot below, provide a reasonable sketch of the filter shape (magnitude of the frequency response). Be sure to label your axes carefully, and indicate where the poles and zeros are causing peaks or valleys in  $|H(\Omega)|$ .



Bonus: What is the only commissioned US Navy ship that has water-cooled handrails?

USS Arizona