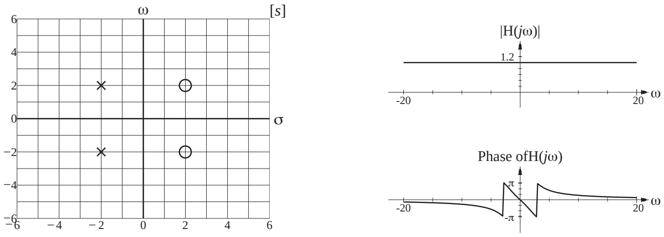
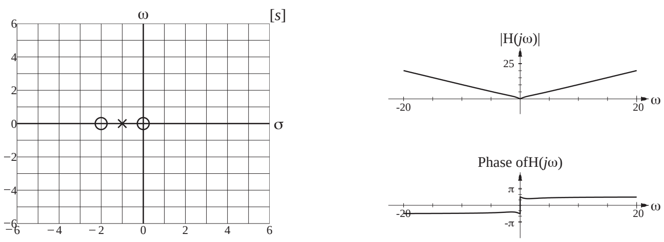
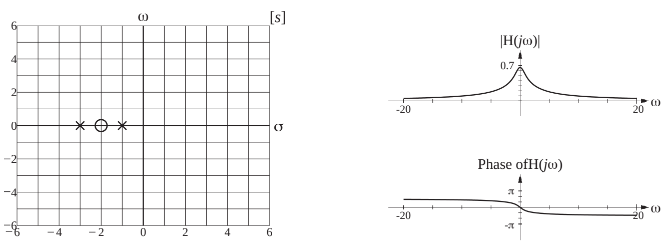
Solution to ECE Test #7 S07 #1



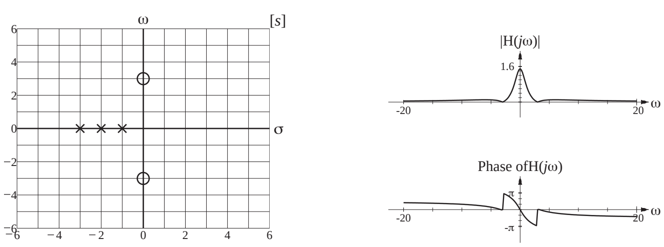
This is an "all pass" filter. As ω moves from zero to infinity each zero vector is exactly the same length as its corresponding pole vector so the magnitude of the transfer function never changes.



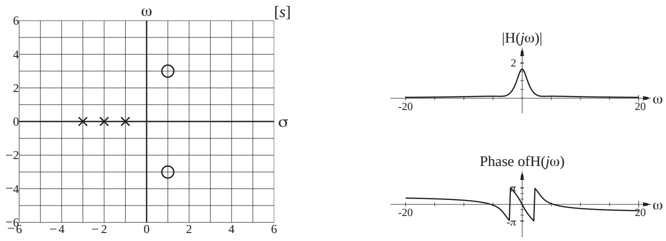
The response must be zero at $\omega = 0$. There is one more finite zero than finite poles so at high frequencies the magnitude must rise linearly with ω.



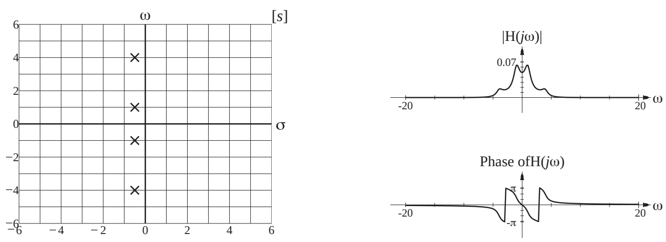
Finite response at $\omega = 0$. One more finite pole than finite zeros so the magnitude falls as $1/\omega$ at high frequencies and phase approaches $-\pi/2$ for $\omega \to +\infty$.



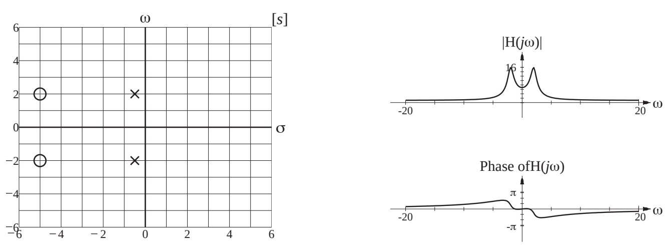
Two zeros on the ω axis. Therefore the magnitude must go to zero at a non-zero finite value of ω. Also, the phase is discontinuous at that point. One more finite pole than finite zeros so the phase must approach $-\pi/2$ for $\omega \to +\infty$.



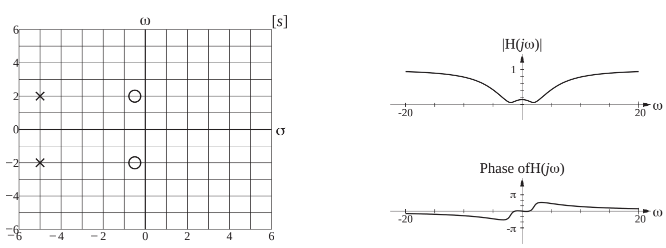
Similar to the last one except the zeros are near but not on the ω axis. Similar magnitude response except the magnitude does not go to zero at a non-zero finite value of ω. One more finite pole than finite zeros so the phase must approach $-\pi / 2$ for $\omega \to +\infty$.



Four finite poles and no finite zeros. All four poles are near the ω axis. Therefore there are four recognizable peaks, one per pole, in the magnitude. Phase goes through $-\pi$ and jumps to $+\pi$ (because of the way MATLAB plots phase) and then goes negative from there another π radians, because of four finite poles and no finite zeros.



Two finite poles near the ω axis so there are two sharp peaks in the magnitude frequency response. Same number of finite poles and finite zeros so the phase approaches zero at high frequencies.



Two finite zeros near the ω axis so there are two dips in the magnitude frequency response. Same number of finite poles and finite zeros so the phase approaches zero at high frequencies.