

When the input to a causal LTI system is

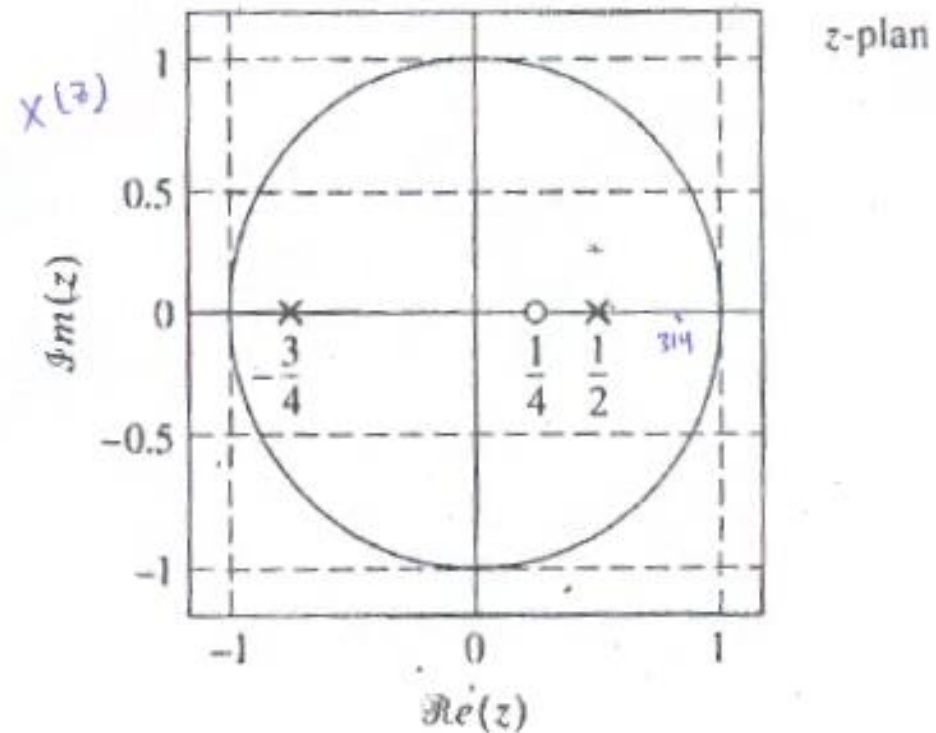
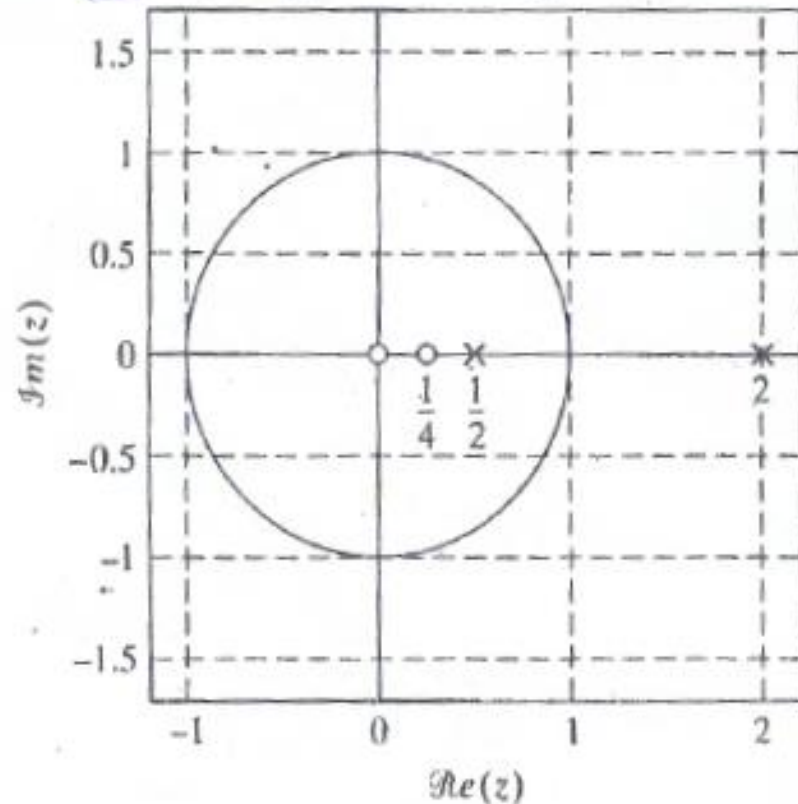
$$x[n] = -\frac{1}{3} \left(\frac{1}{2} \right)^n u[n] - \frac{4}{3} 2^n u[-n-1]$$

The z-transform of the output is

$$Y(z) = \frac{1 + z^{-1}}{(1 - z^{-1})(1 + \frac{1}{2}z^{-1})(1 - 2z^{-1})}$$

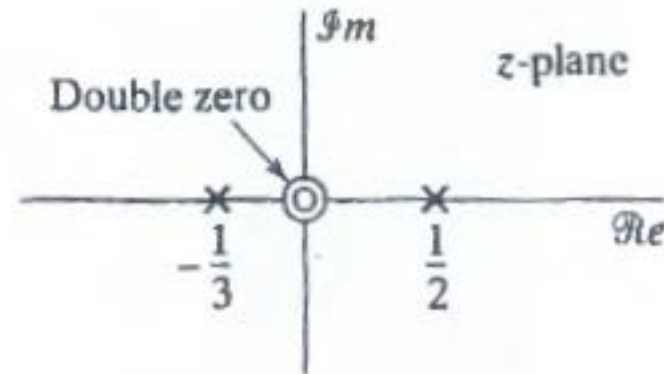
- (a) Find z-transform of $x[n]$?
- (b) What is the region of convergence (ROC) of $Y(z)$?
- (c) Find the system function of this system $H(z)$? Plot its zero-pole diagram and indicate ROC?
- (d) Is the system stable?

The signal $y[n]$ is the output of an LTI system with impulse response $h[n]$ for a given input $x[n]$. Assuming signal $y[n]$ is stable and its z-transform $Y(z)$ has a pole-zero diagram in the left figure, and that signal $x[n]$ is also stable and its pole-zero diagram shown in the right figure.



- What is the region of convergence (ROC) of $Y(z)$?
- Is $y[n]$ left sided, right sided or two sided?
- What is the ROC of $X(z)$?
- Is $x[n]$ a causal sequence? That is, does $x[n]=0$ for $n<0$?
- Draw the pole-zero plot of $H(z)$ and specify its ROC.
- Is $h[n]$ anticausal? That is, does $h[n]=0$ for $n>0$?

The system function $H(z)$ of a causal LTI system has pole-zero plot shown in the following figure. It is also known that $H(z) = \frac{3}{4}$ when $z=1$.



- Determine $H(z)$.
- Determine impulse response $h(n)$ of the system.
- Determine the response of the system to the following input signal:

$$x(n) = u(n) - \frac{1}{2}u(n-1)$$