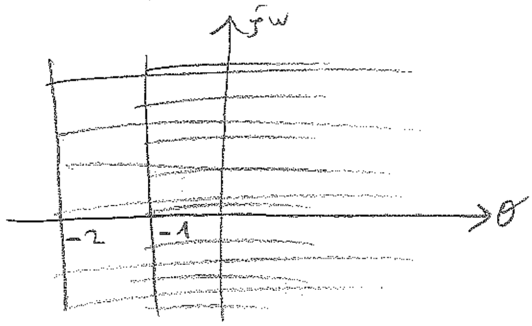
Example



$x(t) = e^{-t}u(t) + e^{-2t}u(t) \qquad X(s) = ?$

$e^{-t}u(t) \overset{\mathcal{L}}{\longleftrightarrow} \frac{1}{s+1} \qquad Re\{s\} > -1$

$e^{-2t}u(t) \overset{\mathcal{L}}{\longleftrightarrow} \frac{1}{s+2} \qquad Re\{s\} > -2$

$\boxed{ROC \longrightarrow Re\{s\} > -1}$

Example

$x(t) = \delta(t) \qquad X(s) = ?$

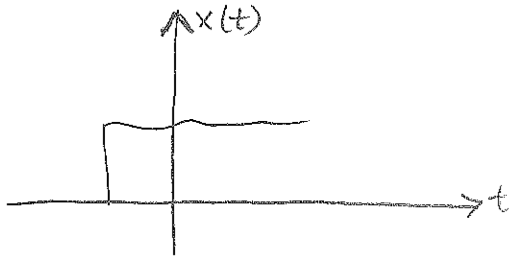
$$X(s) = \int_{-\infty}^{\infty} x(t)e^{-st}dt = \int_{-\infty}^{\infty} \delta(t)e^{-st}dt = \boxed{1}$$

Properties of ROC for Laplace Transform

1) The ROC of $X(s)$ consists of strips parallel to the $j\omega$ axis in the s-plane.

2) For rational L.T. $X(s) = \frac{N(s)}{D(s)}$ roots of $N(s) = 0$ are zeros of $X(s)$ roots of $D(s) = 0$ are poles of $X(s)$. For rational $\mathcal{L}$.T. the ROC doesn't contain any poles.

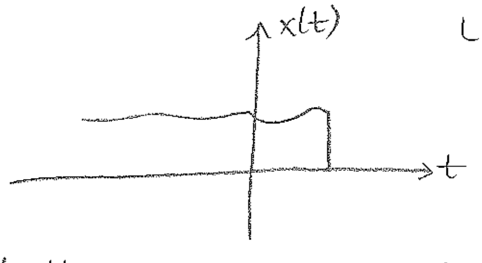
3) For a right sided signal ROC is $Re\{s\} > k$ (real number)



R.S.S (Right Sided Signal)

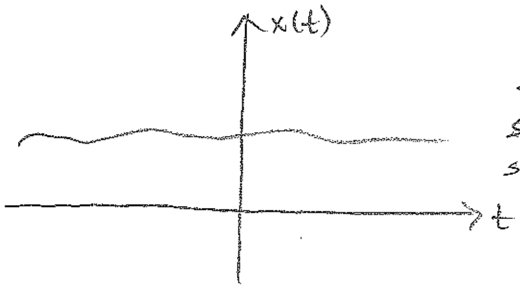
4) For a left sided signal;

The ROC is $Re\{s\} < k$ (real num.)



L.S.S (Left Sided Signal)

5) If $x(t)$ is a two sided signal then ROC will consist of a strip in the s-plane



two sided signal

$\boxed{-k_1 < Re\{s\} < k_2 \longrightarrow \text{The ROC}}$