NCERT-discrete : 10.5.3 - 2

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I. QUESTION

The laplace transform of $x_1(t) = e^{-t}u(t)$ is $X_1(s)$, where $u(t)$ is the unit step function. The laplace transform of $x_2(t) = e^{t}u(-t)$ is $X_2(s)$. Which one of the following statements is TRUE?

1) The region of convergence of $X_1(s)$ is $Re(s) \geq 0$
2) The region of convergence of $X_2(s)$ is confined to the left half-plane of s.
3) The region of convergence of $X_1(s)$ is confined to the right half-plane of s.
4) the imaginary axis in the s-plane is included in both the region of convergence of $X_1(s)$ and the region of convergence of $X_2(s)$.

Solutions :

Symbols	Description	Values
r	Common ratio of the GP	-2
$x(n)$	$(n+1)^{th}$ term of the Sequence	$x(0)r^n u(n)$
$x(0)$	First term of the GP	3

TABLE I
PARAMETERS, DESCRIPTIONS, AND VALUES

Laplace transform of $x_1(t)$ is given by :

$$X_1(s) = \int_{-\infty}^{\infty} e^{-t}e^{-st}u(t)\,dt = \frac{1}{s-1}, s > -1 \tag{1}$$

Laplace transform of $x_2(t)$ is given by :

$$X_2(s) = \int_{-\infty}^{\infty} e^{t}e^{-st}u(-t)\,dt = \frac{-1}{s-1}, s < 1 \tag{2}$$

Based on the regions of convergence of $X_1(s)$ and $X_2(s)$, we can conclude that option 4) is correct .