Sheet (7)

4.1. Find the z-transform of

(a) $x[n] = -a^n u[-n-1]$

(b) $x[n] = a^{-n} u[-n-1]$

4.3. A finite sequence $x[n]$ is defined as

$$x[n] = \{5, 3, -2, 0, 4, -3\}$$
$$\uparrow$$

Find $X(z)$ and its ROC.

4.6. Find the z-transform $X(z)$ and sketch the pole-zero plot with the ROC for each of the following sequences:

(a) $x[n] = (\frac{1}{2})^n u[n] + (\frac{1}{3})^n u[n]$

(b) $x[n] = (\frac{1}{3})^n u[n] + (\frac{1}{2})^n u[-n-1]$

(c) $x[n] = (\frac{1}{2})^n u[n] + (\frac{1}{3})^n u[-n-1]$

4.7. Let

$$x[n] = a^{|n|} \qquad a > 0 \qquad (4.66)$$

(a) Sketch $x[n]$ for $a < 1$ and $a > 1$.

(b) Find $X(z)$ and sketch the zero-pole plot and the ROC for $a < 1$ and $a > 1$.

4.15. Find the inverse z-transform of

$$X(z) = z^2(1 - \tfrac{1}{2}z^{-1})(1 - z^{-1})(1 + 2z^{-1}) \qquad 0 < |z| < \infty \qquad (4.79)$$

4.21. Find the inverse z-transform of

$$X(z) = \frac{2z^3 - 5z^2 + z + 3}{(z-1)(z-2)} \qquad |z| < 1$$

4.32. A causal discrete-time LTI system is described by

$$y[n] - \tfrac{3}{4}y[n-1] + \tfrac{1}{8}y[n-2] = x[n] \qquad (4.88)$$

where $x[n]$ and $y[n]$ are the input and output of the system, respectively.

(a) Determine the system function $H(z)$.

(b) Find the impulse response $h[n]$ of the system.

(c) Find the step response $s[n]$ of the system.