

Medium

Deputy Executive Engineer (Electricity) - 2026

Public Works Authority of Gujarat / Assistant Engineer (Electrical)

- A

$1 - \frac{1}{2}z^{-1}$
- B

$2 - 3z^{-1}$
- C

$1, 2 - 4z^{-1}$ Correct
- D

Correct Answer: C

Full Detailed Explanation

Given: $x[n] = \delta[n - 1] - \frac{1}{2}\delta[n - 2]$

ROC: $|z| > \frac{1}{2}$

Fourier Transform: $X(z) = \sum_{n=-\infty}^{\infty} x[n]z^{-n}$

Substituting $x[n]$ in the above equation:

$$X(z) = \sum_{n=-\infty}^{\infty} \left(\delta[n - 1] - \frac{1}{2}\delta[n - 2] \right) z^{-n}$$
$$= \sum_{n=-\infty}^{\infty} \delta[n - 1] z^{-n} - \frac{1}{2} \sum_{n=-\infty}^{\infty} \delta[n - 2] z^{-n}$$

Let $m = n - 1$ in the first sum and $k = n - 2$ in the second sum:

$$= \sum_{m=-\infty}^{\infty} \delta[m] z^{-(m+1)} - \frac{1}{2} \sum_{k=-\infty}^{\infty} \delta[k] z^{-(k+2)}$$
$$= z^{-1} \sum_{m=-\infty}^{\infty} \delta[m] z^{-m} - \frac{1}{2} z^{-2} \sum_{k=-\infty}^{\infty} \delta[k] z^{-k}$$

Since $\sum_{m=-\infty}^{\infty} \delta[m] z^{-m} = 1$ and $\sum_{k=-\infty}^{\infty} \delta[k] z^{-k} = 1$:

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

Therefore, the correct answer is C: $1, 2 - 4z^{-1}$.