

NCERT 11.9.3 1Q

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Question: Find the 20th and n^{th} terms of the G.P $\frac{5}{2}, \frac{5}{4}, \frac{5}{8}, \dots$

Solution:

Parameter	Description	Value
$x(0)$	First Term	$\frac{5}{2}$
$r = \frac{x(1)}{x(0)}$	Common Ratio	$\frac{1}{2}$
$x(n)$	n^{th} Term	$\frac{5}{2} \left(\frac{1}{2}\right)^n \cdot u(n)$
$x(19)$	20 th Term	$\frac{5}{2} \left(\frac{1}{2}\right)^{19}$
$u(n)$	Unit step function	

TABLE 1: Parameters

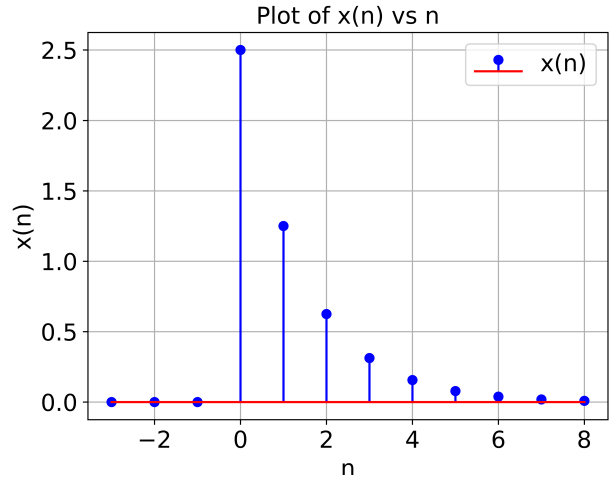


Fig. 1

Z-Transform of $x(n)$:

$$x(n) \xrightarrow{\mathcal{Z}} X(z) \quad (1)$$

$$\therefore X(z) = \sum_{n=-\infty}^{\infty} x(n)z^{-n} \quad (2)$$

From Table 1:

$$\Rightarrow X(z) = \sum_{n=-\infty}^{\infty} \left(\frac{5}{2} \left(\frac{1}{2} \right)^n u(n) \right) z^{-n} \quad (3)$$

$$\Rightarrow X(z) = \frac{5}{2} \sum_{n=0}^{\infty} \left(\frac{z^{-1}}{2} \right)^n \quad (4)$$

$$\Rightarrow X(z) = \frac{5}{2} \left(\frac{1}{1 - \frac{z^{-1}}{2}} \right); \left\{ z \in \mathbb{C} : |z| > \frac{1}{2} \right\} \quad (5)$$