# NCERT 11.9.3 1Q

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

**Solution:**

| Parameter | Description | Value |
|---|---|---|
| $a$ | First Term | $\frac{5}{2}$ |
| $r = \frac{x(n)}{x(n-1)}$ | 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

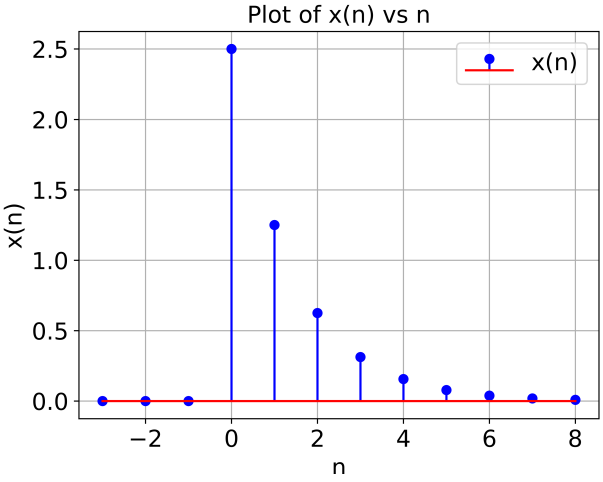


Fig. 1

$Z$-Transform of $x(n)$:

$$x(n) \overset{\mathcal{Z}}{\longleftrightarrow} X(z) \tag{1}$$

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

From Table 1:

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

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

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