NCERT 11.9.3.Q10

EE23BTECH11224 - Sri Krishna Prabhas Yadla*

Question: Find the sum to indicated number of terms in the geometric progression $x^3, x^5, x^7, ...n$ terms (if $x \neq \pm 1$).

Solution:

Input Parameters	Values	Description
$x(0)$	x^3	Initial term
r	x^2	Common ratio
$x(n)$	x^{2n+3}	General term

TABLE 1
GIVEN INPUTS

$$X(z) = \frac{x(0)}{1 - rz^{-1}} \tag{1}$$

$$= \frac{x^3}{1 - x^2 z^{-1}} \quad |z| > x^2 \tag{2}$$

$$y(n) = x(n) * u(n) \tag{3}$$

$$Y(z) = X(z)U(z) \tag{4}$$

$$= \frac{x^3}{(1 - x^2 z^{-1})(1 - z^{-1})} \quad |z| > x^2 \cap |z| > 1 \tag{5}$$

$$= \frac{x^3}{x^2 - 1}\left(\frac{x^2}{1 - x^2 z^{-1}} - \frac{1}{1 - z^{-1}}\right) \tag{6}$$

$$u(n) \xleftrightarrow{\mathcal{Z}} \frac{1}{1 - z^{-1}} \tag{7}$$

$$x^{2n+2}u(n) \xleftrightarrow{\mathcal{Z}} \frac{x^2}{1 - x^2 z^{-1}} \tag{8}$$

Taking inverse Z transform of $Y(z)$,

$$y(n) = x^3\left(\frac{x^{2n+2} - 1}{x^2 - 1}\right)u(n) \tag{9}$$

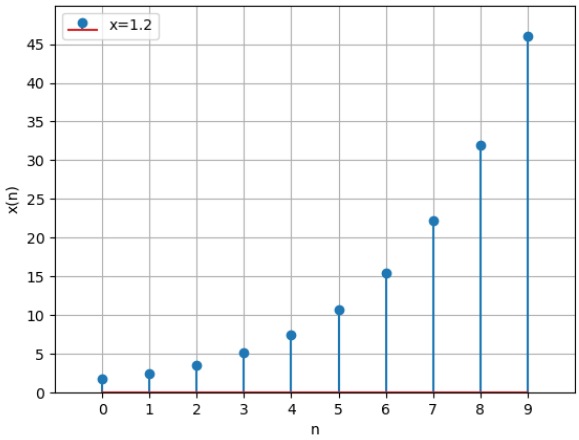

Fig. 1. Plot of $x(n)$ for $x = 1.2$