

NCERT 11.9.3.Q10

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

Solution:

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

TABLE 1
GIVEN INPUTS

From Table 1,

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

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

$$y(n) = x(n) * u(n) \quad (3)$$

$$Y(z) = X(z)U(z) \quad (4)$$

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

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

$$u(n) \xleftrightarrow{Z} \frac{1}{1 - z^{-1}} \quad |z| > 1 \quad (7)$$

$$x^{2n+2}u(n) \xleftrightarrow{Z} \frac{x^2}{1 - x^2z^{-1}} \quad |z| > x^2 \quad (8)$$

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

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

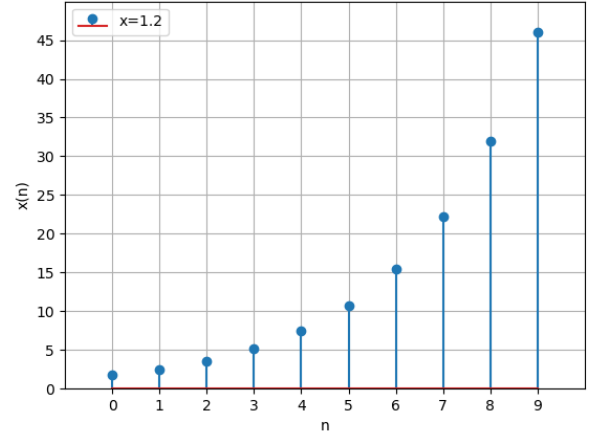


Fig. 1. Plot of $x(n)$ for $x = 1.2$