NCERT 11.9.3.Q10

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

Solution: Let $S(n)$ be the sum of the first n terms in G.P starting from $x(0)$.

Input Parameters	Values
$x(0)$	x^3
r	x^2

TABLE 1
GIVEN INPUTS

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

From Table 1,

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

$$S(n) = \sum_{k=0}^{n-1} x(k) \tag{3}$$

$$= x(n) * u(n) - x(n) \tag{4}$$

Let $y(n) = x(n) * u(n)$, then

$$Y(z) = X(z)U(z) \tag{5}$$

$$= \frac{x^3}{(1 - x^2 z^{-1})(1 - z^{-1})} \qquad |z| > x^2 \cap |z| > 1 \tag{6}$$

$$= \frac{x^3}{r - 1}\left(\frac{x^2}{1 - x^2 z^{-1}} - \frac{1}{1 - z^{-1}}\right) \tag{7}$$

$$\implies y(n) = x^3\left(\frac{x^{2n+2} - 1}{r - 1}\right)u(n) \tag{8}$$

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

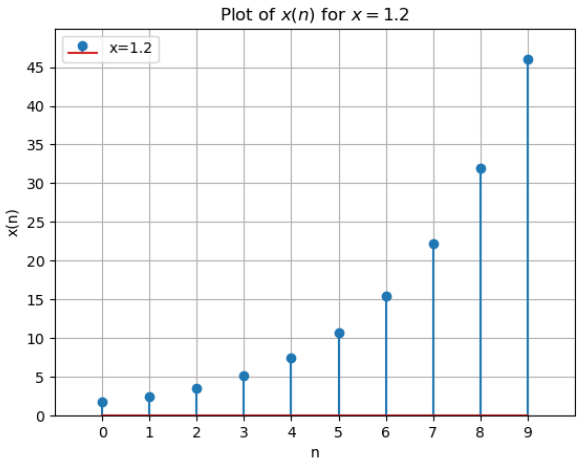

Fig. 1.