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

$$x(n) = x(0) \cdot r^n \tag{1}$$

$$S(n) = \sum_{k=0}^{n-1} x(k) \tag{2}$$

$$= x(0)\frac{r^n - 1}{r - 1} \text{ (for r}\neq 1) \tag{3}$$

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

TABLE 0
GIVEN INPUTS

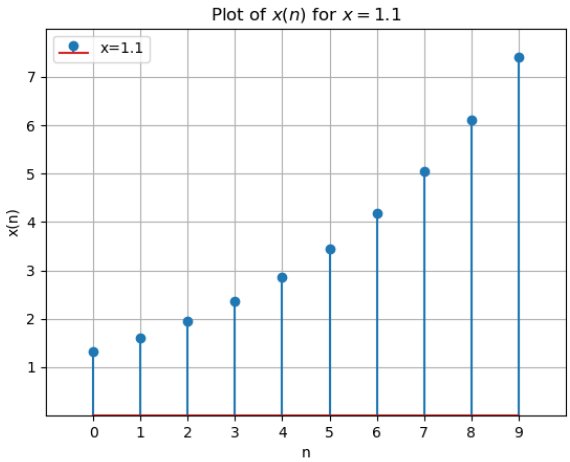

Fig. 0.

Since $x \neq \pm 1$, $r \neq 1$,

$$S(n) = x(0)\frac{r^n - 1}{r - 1} \tag{4}$$

$$= x^3\frac{x^{2n} - 1}{x^2 - 1} \tag{5}$$

$$X(z) = \frac{x(0)}{1 - rz^{-1}} \tag{6}$$

$$= \frac{x^3}{1 - x^2z^{-1}} \qquad ROC : |z| > x^2 \tag{7}$$

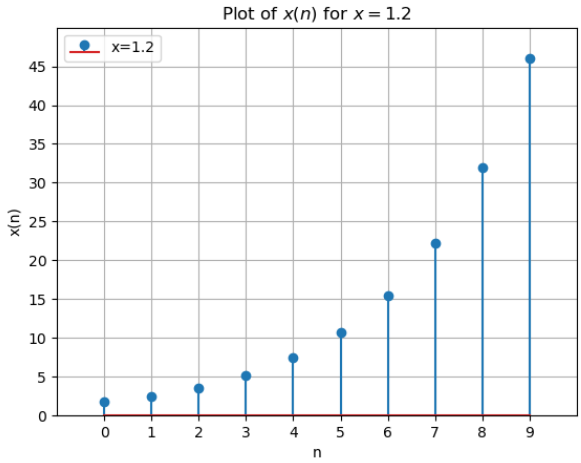

Fig. 0.

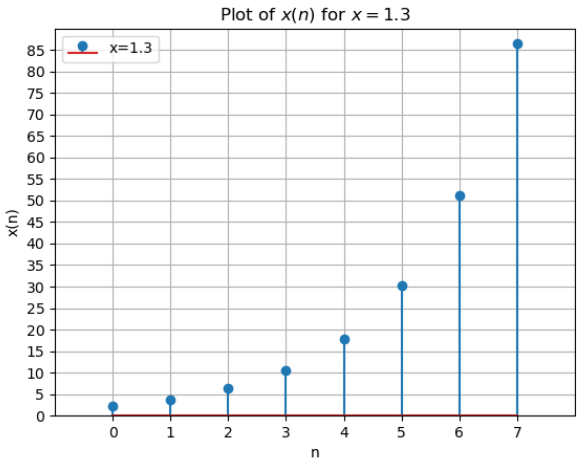
Plot of $x(n)$ for $x = 1.3$
x=1.3
x(n)
n
0
1
2
3
4
5
6
7
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85

Fig. 0.