

# Progressions (7) 11.9.5

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*Question :-*

If a function Satisfying  $f(x+y) = f(x) f(y)$  for all  $x, y \in N$  such that  $f(1) = 3$  and  $\sum_{x=1}^n f(x) = 120$ , find the value of  $n$ .

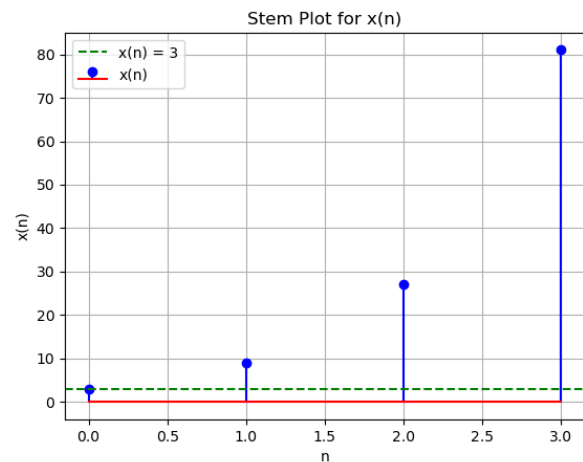
*Solution:-*

$$y = 1 \quad (1)$$

$$\frac{f(x+1)}{f(x)} = 3 \quad (2)$$

| Symbol | Description      | Value        |
|--------|------------------|--------------|
| $x(0)$ | first term       | 3            |
| $r$    | common ratio     | 3            |
| $y(n)$ | sum of all terms | 120          |
| $x(n)$ | n term           | depends on n |

TABLE I



$$x(n) = x(0) r^n u(n) \quad (3)$$

From (??)

$$X(z) = \frac{3}{1 - 3z^{-1}} \quad |z| > |3| \quad (4)$$

By contour integration:

$$y(n) = x(0) \left( \frac{r^{n+1} - 1}{r - 1} \right) u(n) \quad (5)$$

$$120 = 3 \left( \frac{3^{n+1} - 1}{3 - 1} \right) \quad (6)$$

$$\Rightarrow n = 3 \quad (7)$$

