

Progressions (7) 11.9.5

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Question :-

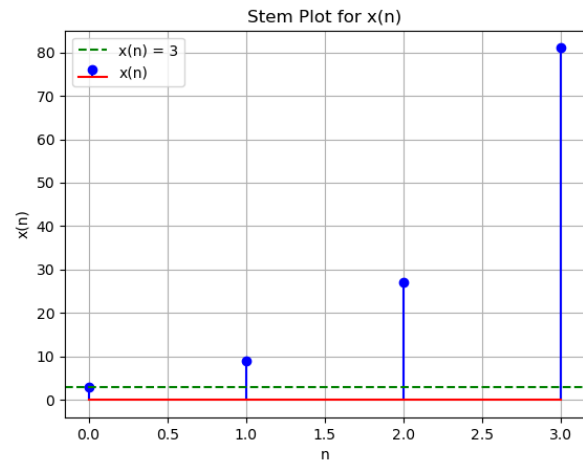
If a function Satisfying $f(x+y) = f(x) f(y)$ for all $x, y \in N$ such that $f(1)=3$ and $\sum_{x=1}^n f(x) = 120$, find the value of n .

Solution:- Putting $y=1$, we get

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

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

TABLE I



$$x(n) = x(0) r^n u(n) \quad (2)$$

From (??)

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

$$Y(z) = \frac{X(0)}{r-1} \left(\frac{r}{1 - rz^{-1}} - \frac{1}{1 - z^{-1}} \right) \quad |z| > |r| \quad (4)$$

inverse of above can be expressed as

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

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

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

