Progressions (7) 11.9.5

EE23BTECH11051-Rajnil Malviya

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 .

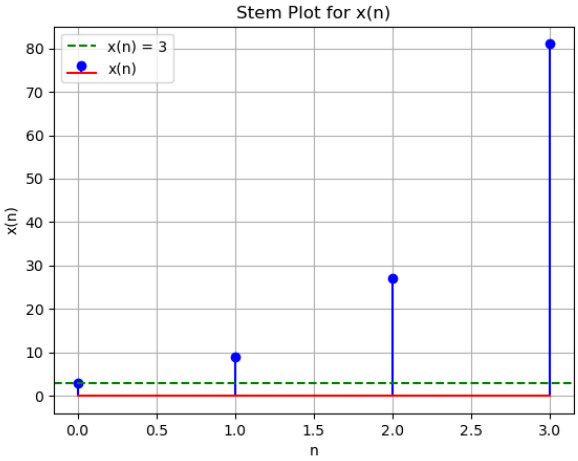
Solution:-

$$y = 1 \tag{1}$$

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

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



$$x(n) = x(0)\, r^n u(n) \tag{3}$$

From (**??**)

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

$$Y(z) = \frac{X(0)}{r-1}\left(\frac{r}{1-rz^{-1}} - \frac{1}{1-z^{-1}}\right) \quad |z| > |r| \tag{5}$$

inverse of above can be expressed as

$$y(n) = x(0)\left(\frac{r^{n+1}-1}{r-1}\right)u(n) \tag{6}$$

$$120 = 3\left(\frac{3^{n+1}-1}{3-1}\right) \tag{7}$$

$$\implies n = 3 \tag{8}$$