# Progressions (7) 11.9.5

## EE23BTECH11051-Rajnil Malviya

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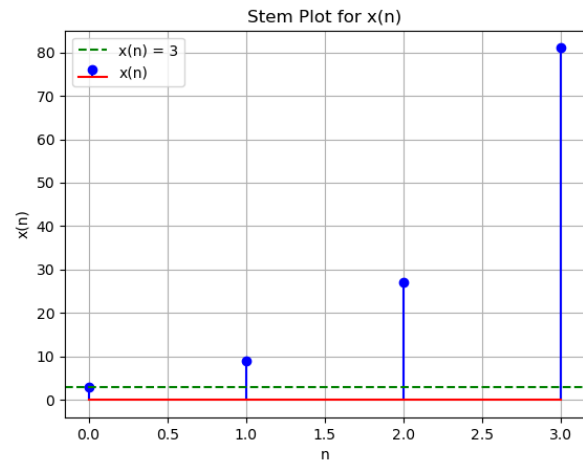
If a function Satisfying f$(x + y)$ = f$(x)$ f$(y)$ for all $x, y \in N$ such that f(1) =3 and $\sum_{x=1}^{n} f(x)$ = 120 , find the value of n .

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

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

| 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



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

From (**??**)

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

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

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

applying inverse z transform ;

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

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

$$\implies n = 3 \qquad (8)$$