Assignment-2

EE:1205 (*SignalsSystems*)
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Question 11.9.3.22

If the first and the n^{th} term of a G.P. are a and b, respectively, and if P is the product of n terms , prove that $P^2 = (ab)^n$

Solution:

Parameter	Value	Description
$x(0)$	a	First Term
$x(n)$	b	n^{th} term
r	$\left(\frac{b}{a}\right)^{\frac{1}{n}}$	Common Ratio
P	?	Product of n terms

TABLE 1: Parameter Table 11.9.3.22

‘ The n^{th} term of GP is :-

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

$$(x(0)\, x(n))^n = (x(0))^{2n}\, r^{n^2} = (ab)^n \tag{2}$$

$$P = \prod_{k=0}^{n} x(0)\, r^k = (x(0))^n\, r^{\frac{n^2}{2}} \tag{3}$$

$$P^2 = (x(0))^{2n}\, r^{n^2} \tag{4}$$

$$\implies P^2 = (ab)^n \tag{5}$$

$$\tag{6}$$

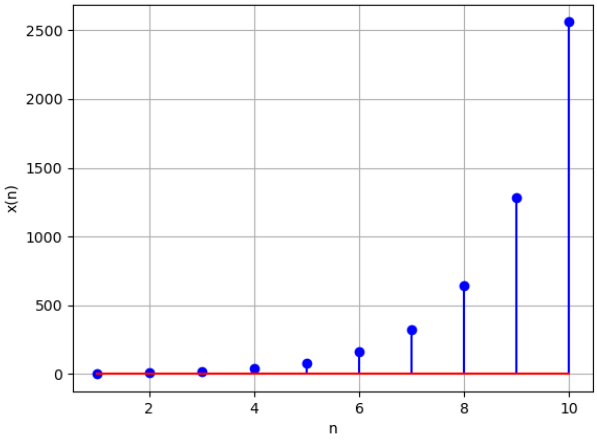

Fig. 1: (x(0)=5, r=2) Plot of x(n)= (5) $(2)^n$

Z-transform of $x(n)$:

$$X(z) = \frac{a}{1 - \left(\frac{b}{a}\right)^{\frac{1}{n}} z^{-1}}, \quad |z| > \left(\frac{b}{a}\right)^{\frac{1}{n}} \tag{7}$$