11.9.3.3

EE23BTECH11065 - prem sagar

Question:
The 5th,8th and 11th terms of a GP are p,q and s respectively .show that

$$q^2 = ps$$

solution:
let r be common ratio

Symbol	Value	Description
$x(5)$	$p = x(0)r^5$	5th term of G.P
$x(8)$	$q = x(0)r^8$	8th term of G.P
$x(11)$	$s = x(0)r^{11}$	11th term of G.P
$x(n)$	$x(0)r^n$	nth term of G.P

TABLE 1
INPUT PARAMETERS

From Table 1:

$$\implies x(8)\,x(8) = x(0)\,r^8\,x(0)\,r^8 \tag{1}$$
$$= x(0)^2\,r^{16} \tag{2}$$
$$\implies x(5)\,x(11) = x(0)\,r^5\,x(0)\,r^{11} \tag{3}$$
$$= x(0)^2\,r^{16} \tag{4}$$
$$\implies x(8)^2 = x(5)\,x(11) \tag{5}$$
$$q^2 = ps \tag{6}$$

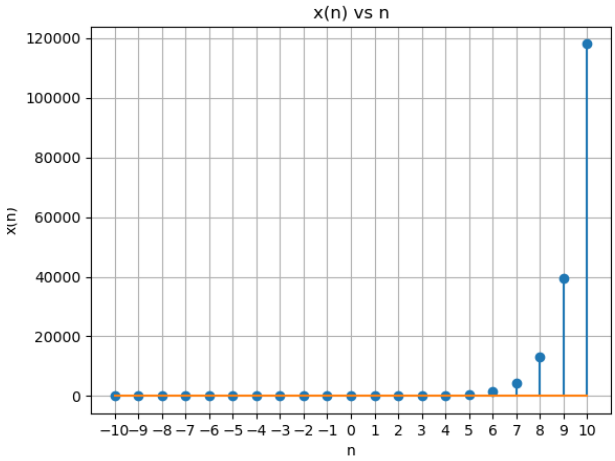

Fig. 1. plot x(n)vs n p=486, q=13122, s=118098, r=3

Applying z-Transform:

$$\implies X(z) = \frac{x(0)}{1 - r\,z^{-1}}\ ,|z| > |r| \tag{7}$$
$$r = \left(\frac{s}{p}\right)^{\frac{1}{5}} \tag{8}$$
$$x(0) = \frac{p^2}{s} \tag{9}$$
$$\implies X(z) = \frac{p^2 q}{qs - z^{-1}s^2} \tag{10}$$