

# EE23BTECH11047 - Deepakreddy P

**17** If  $a, b, c, d$  are in G.P, prove that  $(a^n + b^n), (b^n + c^n), (c^n + d^n)$  are in G.P

**Solution:**

TABLE I  
INPUT PARAMETERS

Symbol	Remarks
$x(0)$	$a$
$x(1)$	$b$
$x(2)$	$c$
$x(3)$	$d$
$r$	ratio of G.P $a, b, c, \dots$
$r_1$	ratio of G.P $a^n + b^n, b^n + c^n, \dots$
$X(z)$	z transform of G.P $a, b, c, \dots$
$Y(z)$	z transform of G.P $a^n + b^n, b^n + c^n, \dots$

$$r = \frac{b}{a} = \frac{c}{b} = \frac{d}{c} \quad (1)$$

From eq(1)

$$\frac{b^n + c^n}{a^n + b^n} = \frac{(ar)^n + (ar^2)^n}{(a)^n + (ar)^n} \quad (2)$$

$$= \frac{a^n r^n (1 + r^n)}{a^n (1 + r^n)} \quad (3)$$

$$= r^n \quad (4)$$

$$\frac{c^n + d^n}{b^n + c^n} = \frac{(ar^2)^n + (ar^3)^n}{(ar)^n + (ar^2)^n} \quad (5)$$

$$= \frac{a^n r^{2n} (1 + r^n)}{a^n r^n (1 + r^n)} \quad (6)$$

$$= r^n \quad (7)$$

$$\frac{b^n + c^n}{a^n + b^n} = \frac{c^n + d^n}{b^n + c^n} \quad (8)$$

Hence proved they are in in G.P

$$x(n) = a \left( \frac{b}{a} \right)^n u(n) \quad (9)$$

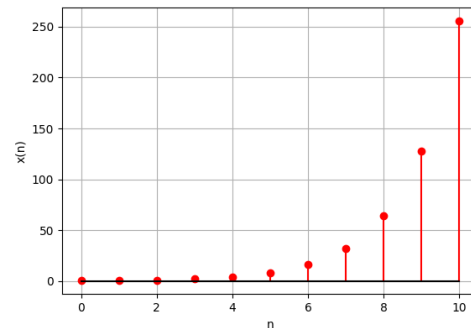
$$X(z) = \frac{a}{1 - \left( \frac{b}{a} \right) z^{-1}}, \quad |z| > \left| \frac{b}{a} \right| \quad (10)$$

$$r_1 = \frac{b^n + c^n}{a^n + b^n} = \frac{c^n + d^n}{b^n + c^n} \quad (11)$$

From eq(11)

$$y(n) = (a^n + b^n) \left( \frac{b^n + c^n}{a^n + b^n} \right)^n u(n) \quad (12)$$

$$Y(z) = \frac{a^n + b^n}{1 - \left( \frac{b^n + c^n}{a^n + b^n} \right) z^{-1}}, \quad |z| > \left| \frac{b^n + c^n}{a^n + b^n} \right| \quad (13)$$



(2) Fig. 1. Stem Plot of  $x(n) = (0.25)2^n, a = 0.25, r = 2$

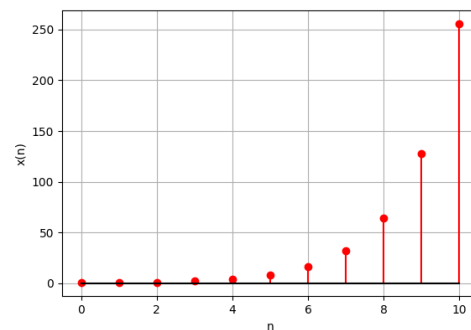


Fig. 2. 'Stem Plot of  $x(n) = 0.25^n + 0.5^n, a = 0.25, b = 0.5$ '