

## 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	Input value
$r$	$\frac{x(n)}{x(n-1)}$
$x(0)$	$a$
$x(1)$	$b$
$x(2)$	$c$
$x(3)$	$d$

$$r = \frac{b}{a} = \frac{c}{b} = \frac{d}{c}$$

From eq(1)

$$\begin{aligned} &= \frac{b^n + c^n}{a^n + b^n} \\ &= \frac{(ar^1)^n + (ar^2)^n}{(ar^0)^n + (ar^1)^n} \\ &= \frac{r^n ((ar^1)^n + (ar^2)^n)}{r^n ((ar^0)^n + (ar^1)^n)} \\ &= \frac{(ar^2)^n + (ar^3)^n}{(ar^1)^n + (ar^2)^n} \\ &= \frac{c^n + d^n}{b^n + c^n} \\ \Rightarrow &\frac{b^n + c^n}{a^n + b^n} = \frac{c^n + d^n}{b^n + c^n} \\ \Rightarrow &\frac{x(1)^n + x(2)^n}{x(0)^n + x(1)^n} = \frac{x(2)^n + x(3)^n}{x(1)^n + x(2)^n} \end{aligned} \quad \begin{matrix} (2) \\ (3) \\ (4) \\ (5) \\ (6) \\ (7) \\ (8) \\ (9) \end{matrix}$$

Hence proved they are in in G.P

$$x(n) = ar^n u(n) \quad (10)$$

$$X(z) = \frac{a}{1 - rz^{-1}}, \quad |z| > |r| \quad (11)$$

