

NCERT DISCRETE 11.9.2.15

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Question: If $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$ is A.M between a and b , then find value of n .

Solution:

Symbol	Values	Description
$x(0)$	a	First term of A.P
$x(1)$	$\frac{a+b}{2}$	A.M of first and third terms of A.P
$x(2)$	b	Third term of A.P

TABLE I
PARAMETERS

A.M of two numbers a, b is $\frac{a+b}{2}$.

$$x(n) = x(0) + n \cdot d \cdot u(n) \quad (1)$$

Where,

$$x(1) = \frac{x(0)^n + x(2)^n}{x(0)^{n-1} + x(2)^{n-1}} \quad (2)$$

$$= \frac{a+b}{2} \quad (3)$$

$$\Rightarrow \frac{x(0)^n + x(2)^n}{x(0)^{n-1} + x(2)^{n-1}} = \frac{x(0) + x(2)}{2} \quad (4)$$

$$\Rightarrow x(0)^{n-1}(x(0) - x(2)) = x(2)^{n-1}(x(0) - x(2)) \quad (5)$$

From (5)

$$\Rightarrow n \begin{cases} = 1 & \text{if } a \neq b \\ \in R & \text{if } a = b \end{cases} \quad (6)$$

From (1)

$$d = x(1) - x(0) \quad (7)$$

$$= \frac{a+b}{2} - a \quad (8)$$

$$= \frac{b-a}{2} \quad (9)$$

Using Z transform.

$$x(n) \xleftrightarrow{Z} X(z) \quad (10)$$

$$X(z) = \frac{a}{1-z^{-1}} + \frac{dz^{-1}}{(1-z^{-1})^2} \quad (11)$$

From (9)

$$X(z) = \frac{a}{1-z^{-1}} + \frac{(b-a)z^{-1}}{2(1-z^{-1})^2} \quad (12)$$