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Question 11.9.3-19: Find the sum of the products of the corresponding terms of the sequences 2, 4, 8, 16, 32 and 128, 32, 8, 2, $\frac{1}{2}$.

Solution:

TABLE I: Input Parameters

Parameter	Value	Description
$x_1(n)$	2, 4, 8, 16, 32	Sequence 1
$x_2(n)$	128, 32, 8, 2, $\frac{1}{2}$	Sequence 2
$y(n)$	-	Sum of the Products

Define the sequences as follows:

$$\text{Sequence 1: } x_1(n) = 2 \times 2^n \quad (1)$$

$$\text{Sequence 2: } x_2(n) = 128 \times \left(\frac{1}{4}\right)^n \quad (2)$$

Z-Transform: The Z-transform of a sequence $x(n)$ is:

$$x(n) = x_1(n) \times x_2(n) = \frac{256}{2^n} \quad (3)$$

$$X(z) = \frac{512}{2 - z^{-1}} \quad (4)$$

$$\text{Let, } y(n) = x(n) \times u(n) \quad (5)$$

$$Y(z) = X(z) \times U(z) \quad (6)$$

$$= \left(\frac{512}{2 - z^{-1}}\right) \times \left(\frac{1}{1 - z^{-1}}\right) \quad (7)$$

$$= \frac{-256}{1 - \frac{z^{-1}}{2}} + \frac{512}{1 - z^{-1}} \quad (8)$$

Inverse of Z:

$$y(n) = \frac{-256}{2^n} + \frac{512}{1} \quad (9)$$

As, $n = 4$, $\text{sum} = 496$.

This gives us the sum of the products of corresponding terms, which is 496.

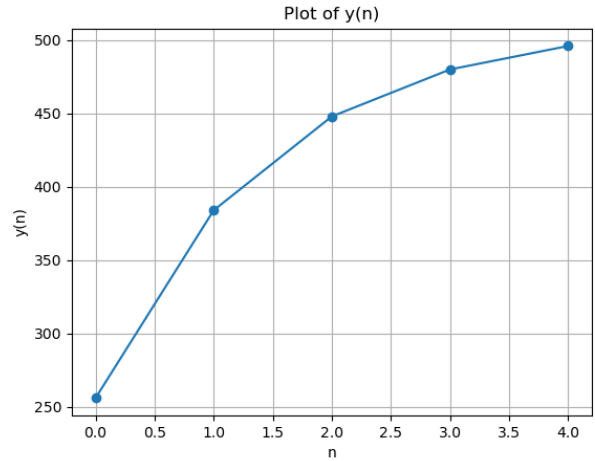


Fig. 1: Plot of $y(n)$ vs n