

# Assignment

## 11.9.1 - 9

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### QUESTION

Find  $a_9$  in the sequence  $a_n = (-1)^{n-1} n^3$

### SOLUTION

Symbol	Value	Description
$x(0)$	1	First term of the sequence
$x(n)$	$(-1)^n (n+1)^3 u(n)$	$(n+1)^{th}$ term of the sequence

TABLE 0  
TABLE OF PARAMETERS

To obtain 9<sup>th</sup> term of the sequence put  $n=8$  in  $x(n)$

$$x(8) = 729 \quad (1)$$

Using Z transform,

$$X(z) = \sum_{n=-\infty}^{\infty} (-1)^n (n+1)^3 u(n) z^{-n} \quad (2)$$

$$= \sum_{n=-\infty}^{\infty} (n+1)^3 u(n) (-z)^{-n} \quad (3)$$

$$= \sum_{n=-\infty}^{\infty} (n^3 + 3n^2 + 3n + 1) u(n) (-z)^{-n} \quad (4)$$

Replace  $z$  by  $-z$  in (??),(??),(??),(??)

$$u(n) \xleftrightarrow{Z} \frac{1}{1+z^{-1}}, |z| > 1 \quad (5)$$

$$nu(n) \xleftrightarrow{Z} \frac{-z^{-1}}{(1+z^{-1})^2}, |z| > 1 \quad (6)$$

$$n^2 u(n) \xleftrightarrow{Z} \frac{z^{-1}(z^{-1}-1)}{(1+z^{-1})^3}, |z| > 1 \quad (7)$$

$$n^3 u(n) \xleftrightarrow{Z} \frac{-z^{-1}(1-4z^{-1}+z^{-2})}{(1+z^{-1})^4}, |z| > 1 \quad (8)$$

$$X(z) = \frac{z^{-2} - z^{-1} + 1}{(1+z^{-1})^4}, |z| > 1 \quad (9)$$

