Discrete Assignment

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EE23BTECH11030

1) **Question 11.9.4.9**: Find the sum to n terms of the series whose nth term is given by $n^2 + 2^n$?
Solution:

TABLE I
INPUT PARAMETERS

Variable	Description	Value
$x(n)$	n-th term of sequence	$(n^2 + 2^n)u(n)$

$$x(n) = (n^2 + 2^n)u(n) \tag{1}$$

$$2^n \cdot u(n) \overset{\text{Z}}{\leftrightarrow} \frac{1}{1 - 2z^{-1}} \tag{2}$$

$$n^2 u(n) \overset{\mathcal{Z}}{\leftrightarrow} \frac{z^{-1}(1 + z^{-1})}{(1 - z^{-1})^3} \quad |z| > 1 \tag{3}$$

Taking z transform : (4)

$$X(z) = \frac{z^{-1}(z^{-1} + 1)}{(1 - z^{-1})^3} + \frac{1}{1 - 2z^{-1}} \tag{5}$$

$$Y(z) = X(z)U(z) \tag{6}$$

$$Y(z) = \left(\frac{z^{-1}(z^{-1} + 1)}{(1 - z^{-1})^3} + \frac{1}{1 - 2z^{-1}}\right)\left(\frac{1}{1 - z^{-1}}\right) \tag{7}$$

$$Y(z) = \frac{z^{-1}(1 + z^{-1})}{(1 - z^{-1})^4} + \frac{2}{1 - 2z^{-1}} - \frac{1}{1 - z^{-1}} \tag{8}$$

Taking inverse $\mathcal{Z}$ transform : (9)

$$y(n) = \frac{n^2(n^2 - 1)}{3}u(n) + 2.2^n u(n) - u(n) \tag{10}$$

$$y(n) = \left(\frac{n^2(n^2 - 1)}{3} + 2^{n+1} - 1\right)u(n) \tag{11}$$

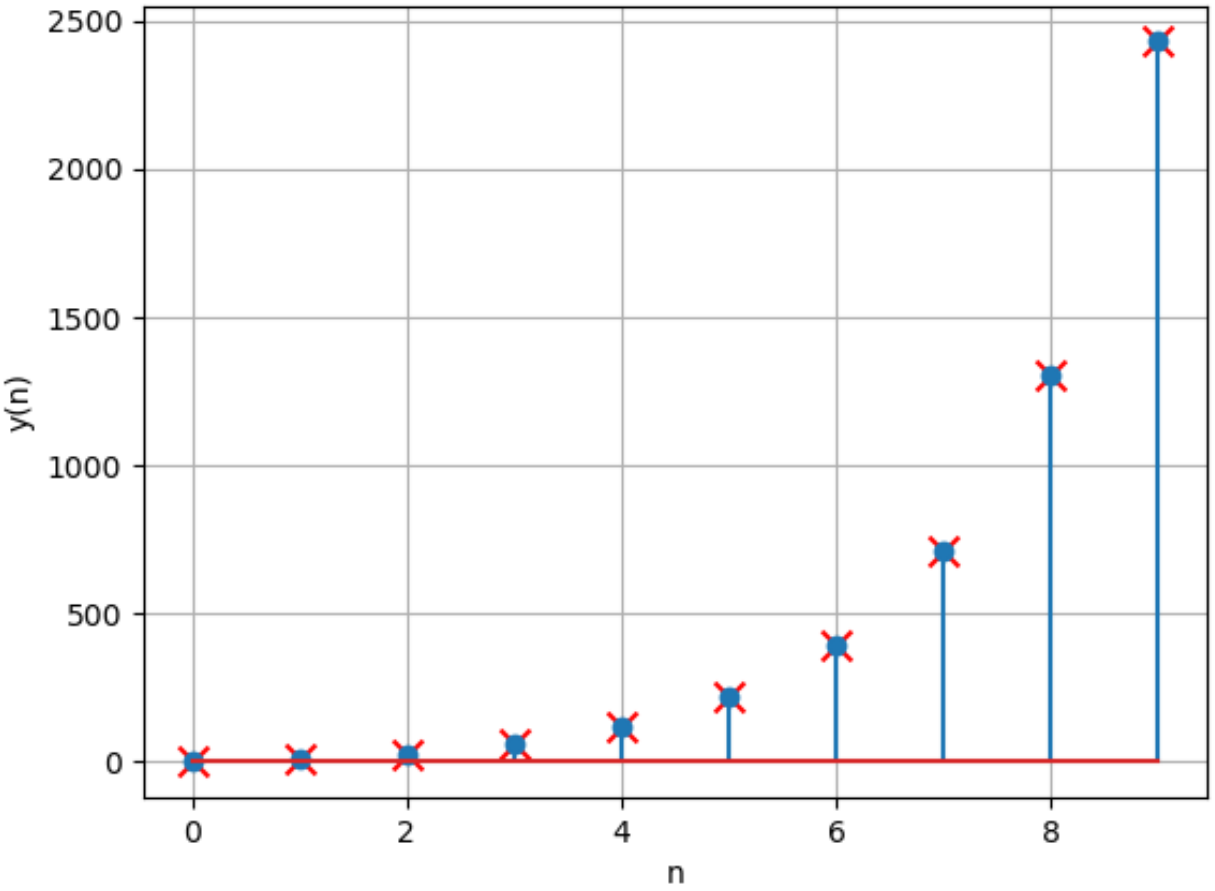

Fig. 1. Graph of $y(n)$