

# NCERT Discrete

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**Results for reference:**

$$Z(\delta(n)) = 1 \quad (1)$$

$$Z(u(n-1)) = U(Z)z^{-1} \quad (2)$$

$$Z(a^{n-k}u(n-k)) = \frac{(z)z^{-k}}{z-10} \quad (3)$$

$$Z((n-k)u(n-k)) = \frac{(z)z^{-k}}{(z-1)^2} \quad (4)$$

From (5), we get

$$S(z) = (X(z))(U(z)) \quad (10)$$

$$S(z) = \left( \frac{8}{(1-10z^{-1})(1-z^{-1})} \right) \left( \frac{1}{1-z^{-1}} \right) \quad (11)$$

$$S(z) = \left( \frac{8}{(1-10z^{-1})(1-z^{-1})^2} \right) \quad (12)$$

**Question 11.9.3.18:**

Find the sum to n terms of the sequence 8, 88, 888, 8888...

**Solution:**

$$S(z) = \frac{-224}{81(z-1)} - \frac{8}{9(z-1)^2} + \frac{8000}{81(z-10)} + 8 \quad (13)$$

$$S(z) = \frac{-224z(z)^{-1}}{81(z-1)} - \frac{8z(z)^{-1}}{9(z-1)^2} + \frac{8000z(z)^{-1}}{81(z-10)} + 8 \quad (14)$$

Parameter	Value	description
$x(0)$	8	First term
$x(1)$	88	Second term
$x(n)$	$(\sum_{k=0}^n 8(10)^k)u(n)$	General term
$S(n)$	$S(n) = \sum_{k=0}^{n-1} x(k)$	Sum of n terms

TABLE I

INPUT PARAMETERS

From (1),(2),(3) and (4)

$$s(n) = \frac{-224u(n-1)}{81} - \frac{8(n-1)u(n-1)}{9} + \frac{8000(10^{n-1})u(n-1)}{81} + 8\delta(n) \quad (15)$$

From (I)

$$s(n) = x(n) * u(n) \quad (5)$$

Z transform of general term

$$X(z) = \sum_{n=-\infty}^{\infty} \left( \sum_{k=0}^n 8(10)^k \right) u(n) z^{-n} \quad (6)$$

$$X(z) = 8 \sum_{n=0}^{\infty} \left( \sum_{k=0}^n (10)^k \right) u(n) z^{-n} \quad (7)$$

$$X(z) = 8 \left( \sum_{n=0}^{\infty} (10)^n (z^{-n}) \right) \left( \sum_{n=0}^{\infty} z^{-n} \right) \quad (8)$$

$$\Rightarrow X(z) = \left( \frac{8}{(1-10z^{-1})(1-z^{-1})} \right) \quad |z| > 10 \quad (9)$$

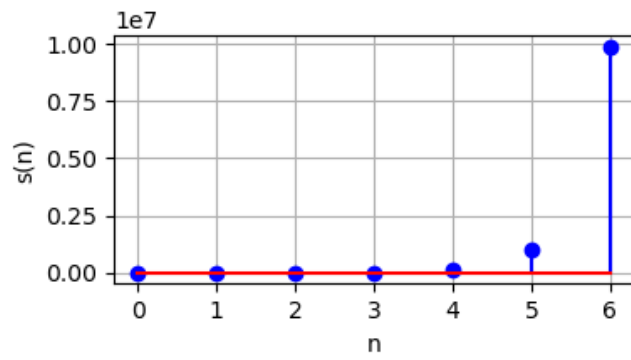


Fig. 1. graph of sum of n terms