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## NCERT Mathematics Ex 9.4 Q6

## EE23BTECH11059 - Tejas

**Question:** 1) Find the sum to n terms of  $3 \times 8 + 6 \times 11 + 9 \times 14 + ...$ 

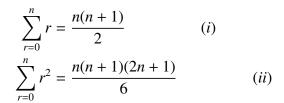
## **Solution:**

Writing the general term of the series

$$x_n = (3r+3) \times (8+3r)$$

$$S_n = \sum_{r=0}^{n} 9r^2 + 33r + 24$$
 (1)

Using formulas for the sum of n terms (i) and sum of the squares of the n terms (ii)



Equation (1) evaluates to

$$S_n = \frac{33n(n+1)}{2} + \frac{9n(n+1)(2n+1)}{6} + 24n$$

Z transform of  $x_n$ :

$$X(Z) = \sum_{n=0}^{\infty} (3n+3)(3n+8)Z^{-n}$$

$$X(Z) = \sum_{n=0}^{\infty} (9n^2 + 33n + 24)Z^{-n}$$

$$X(Z) = 9Z^{-1} \frac{(1+Z^{-1})}{(1-Z^{-1})^3} + \frac{33}{(1-Z^{-1})^2} + 24\frac{1}{1-Z^{-1}} \quad ; |Z| > 1$$

Z transform of  $S_n$ :

$$S(Z) = \sum_{n=0}^{\infty} \left( \frac{33n(n+1)}{2} + \frac{9n(n+1)(2n+1)}{6} + 24n \right)$$

$$S(Z) = \frac{33}{2} \left( \sum_{n=0}^{\infty} n^2 Z^{-n} + \sum_{n=0}^{\infty} n Z^{-n} \right) + \frac{9}{6} \left( \sum_{n=0}^{\infty} n^3 Z^{-n} + \sum_{n=0}^{\infty} n^2 Z^{-n} + \sum_{n=0}^{\infty} n Z^{-n} \right) + 24 \sum_{n=0}^{\infty} n Z^{-n}$$

$$S(Z) = \frac{18Z^{-1} \frac{-9}{Z^{-1}} + 6}{(1 - Z^{-1})^3} + \frac{1}{(1 - Z^{-1})^2} 42 - 9Z^{-1}$$

