NCERT Maths 11.9.2 Q9

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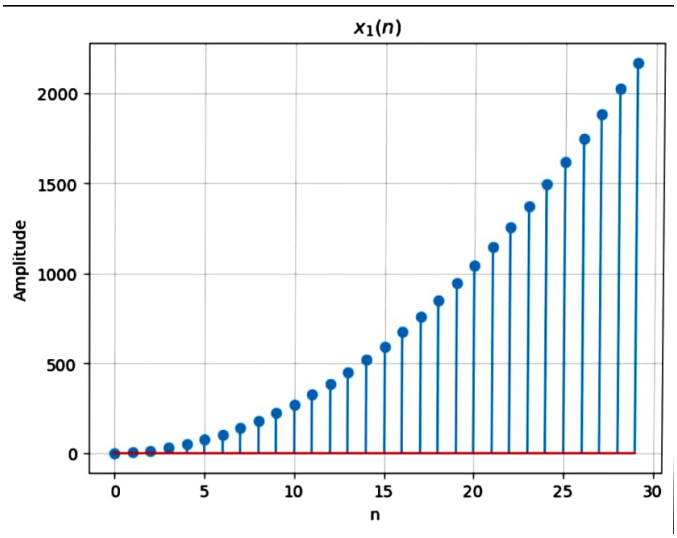
Question: The sum of the first n terms of two arithmetic progressions (AP) is in the ratio $5n+4 : 9n+6$. Find the ratio of their 18th terms.

solution:

Parameter	Value
$x_1(0)$	First term of the first arithmetic progression (AP).
$x_2(0)$	First term of the second arithmetic progression (AP).
d_1	Common difference of the first AP.
d_2	Common difference of the second AP.
n	Index of the term in the sequences.
$x_1(n)$	nth term of the first arithmetic progression (AP).
$x_2(n)$	nth term of the second arithmetic progression (AP).

TABLE I
INPUT PARAMETERS



$$x_1(n) = (x_1(0) + nd_1)u(n) \tag{1}$$

$$x_2(n) = (x_2(0) + nd_2)u(n) \tag{2}$$

Applying Z transform: Taking Z-Transform:

1) $\mathcal{Z}\{u(n)\}$

$$u(n) \overset{\mathcal{H}}{\longleftrightarrow} Z\frac{1}{1-z^{-1}}\{|z| > 1\} \tag{3}$$

2) $\mathcal{Z}\{nu(n)\}$

$$nu(n) \overset{\mathcal{H}}{\longleftrightarrow} Z\frac{z^{-1}}{(1-z^{-1})^2}\{|z| > 1\} \tag{4}$$

$$x_1(z) = \frac{9/2}{1-z^{-1}} + \frac{5z^{-1}}{(1-z^{-1})^2} \tag{5}$$

$$x_2(z) = \frac{15/2}{1-z^{-1}} + \frac{9z^{-1}}{(1-z^{-1})^2} \tag{6}$$

$$x_1(n) = \{9/2, 19/2, 29/2, ...\} \tag{7}$$

$$x_2(n) = \{15/2, 33/2, 51/2, ...\} \tag{8}$$

$$\frac{x_1(18)}{x_2(18)} = \frac{179}{321} \tag{9}$$