Assignment-1

EE:1205 Signals and Systems
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I. Question:

Ramkali saved Rs 5 in the first week of a year and then increased her weekly savings by Rs 1.75. If in the nth week, her weekly savings become Rs 20.75, find n.

II. Solution:

Parameter	Value	Description
$x(0)$	5	First term of AP
d	1.75	Common difference of AP
$x(n)$	20.75	n^{th} term of AP

TABLE 0
Parameter List

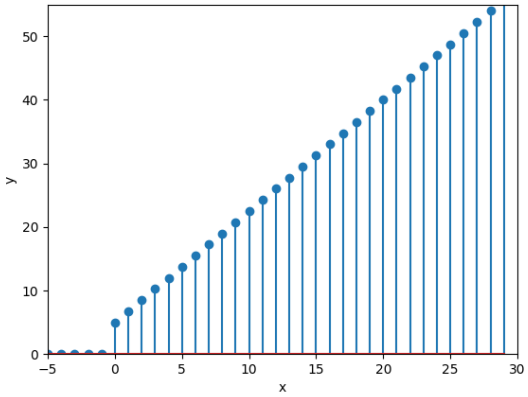

Fig. 0. Plot of $x(n) = 5 + 1.75n$

$$x(n) = x(0) + (n)(d) \tag{1}$$
$$20.75 = 5 + (n)(1.75) \tag{2}$$
$$\implies 15.75 = (n)(1.75) \tag{3}$$
$$\implies n = \frac{15.75}{1.75} \tag{4}$$
$$\implies n = 9 \tag{5}$$

Hence, n is 9.

$$x(n) = 5 + 1.75(n) \tag{6}$$

The Z-transform of a sequence $x(n)$ is given by:

$$X(z) = \sum_{n=1}^{\infty}(5 + 1.75n)z^{-n} \tag{7}$$
$$X(z) = \sum_{n=1}^{\infty}5z^{-n} + \sum_{n=1}^{\infty}1.75nz^{-n} \tag{8}$$
$$X(z) = 5U(z) + 1.75(z)\frac{d}{dz}U(z) \tag{9}$$
$$X(z) = \frac{5z^{-1}}{1 - z^{-1}} + \frac{1.75z^{-1}}{(1 - z^{-1})^2} \tag{10}$$

$$f(n) = \begin{cases} 5 + 1.75n, & \text{if } n \geq 0 \\ 0, & \text{if } n < 0 \end{cases} \tag{11}$$

Given that $n > 0$,

$$X(z) = \sum_{n=1}^{\infty}(5 + 1.75n) \cdot z^{-n} \tag{12}$$

$$ROC : |z| > 1$$