

10.5.4-5

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Question:

A small terrace at a football ground comprises of 15 steps each of which is 50 m long and built of solid concrete. Each step has a rise of $\frac{1}{4}$ m and a tread of $\frac{1}{2}$ m. Calculate the total volume of concrete required to build the terrace. [Hint: Volume of concrete required to build the first step=

$$V = \frac{1}{4} \cdot \frac{1}{2} \cdot 50 \quad (1)$$

solution

parameter	description	value
l	length	$50m$
b	breadth	$0.25m$
h	height	$0.5m$
V	volume	$6.25m^3$

TABLE 0: input parameters

$$l_n = l_{n+1} \quad (2)$$

$$b_n = b_{n+1} \quad (3)$$

$$h_{n+1} - h_n = 0.25m \quad (4)$$

$$V_{n+1} - V_n = 6.25m^3 \quad (5)$$

$$S_n = \frac{n+1}{2} [2x(0) + (n)d] \quad (6)$$

$$n = 0, 1, 2, 3, \dots \quad (7)$$

here

parameter	description	value
$x(0)$	first term	6.25
d	common difference	6.25
n	no of terms -1	14
$x(n)$	nth term	$x(0) + nd$

TABLE 0: formula parameters

$$S_n = \frac{14+1}{2} [12.5 + (14)6.25] \quad (9)$$

$$S_n = \frac{15}{2} [12.5 + 87.5] \quad (10)$$

$$S_n = \frac{15}{2} [12.5(14)6.25] \quad (11)$$

$$S_n = \frac{15}{2} [12.5 + 87.5] \quad (12)$$

$$V = (7.5) \cdot 100 = 750m^3 \quad (13)$$

plot of $x(n)$ and n

$$x(n) = (x(0) + n \cdot d) \cdot u(n) \quad (14)$$

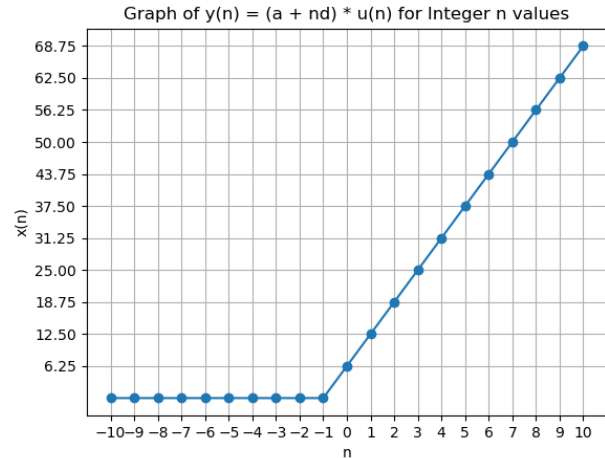


Fig. 1

$$x(n) \xleftrightarrow{Z} X(Z) \quad (15)$$

$$x(n) \xleftrightarrow{Z} X(Z) \quad (16)$$

$$x(n) = (x(0) + nd)u(n) \quad (17)$$

$$X(Z) = \sum_{n=-\infty}^{\infty} x(n)Z^{-n} \quad (18)$$

$$= \frac{x(0)}{1 - z^{-1}} + \frac{dz^{-1}}{(1 - z^{-1})^2}, |z| > |r| \quad (19)$$

$$= \frac{6.25}{1 - z^{-1}} + \frac{6.25z^{-1}}{(1 - z^{-1})^2}, |z| > |r| \quad (20)$$