Discrete Assignment
EE1205 Signals and Systems

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Question 11.9.3.8: Find the sum to indicated number of term in each of the geometric progressions in $\sqrt{7}, \sqrt{21}, 3\sqrt{7}, ...n$ terms

Solution: Sum of the geometric progression of $\sqrt{7}, \sqrt{21}, 3\sqrt{7}, ...n$ terms is

The common ratio of geometric progression is

$$r = \frac{a_2}{a_1} \tag{1}$$

common ratio

$$r = \frac{\sqrt{21}}{\sqrt{7}} \tag{2}$$

$$= \sqrt{3} \tag{3}$$

first term of the geometric progression is

$$x(0) = \sqrt{7} \tag{4}$$

x(n) is the n^{th} term of the geometric progression

$$x(n) = x(0) * r^{(n)} \tag{5}$$

$$x(n) = x(0) * \sqrt{3^{(n)}} \tag{6}$$

$$x(n) = \sqrt{7 * 3^{(n)}} \tag{7}$$

sum of n term in geometric progression is

$$S_n = \frac{x(0)(r^n)}{r-1} \tag{8}$$

Then, Sum of n term of given geometric progression is

$$S_n = \frac{\sqrt{7}(\sqrt{3}^n)}{(\sqrt{3}-1)} \tag{9}$$

$$= \frac{\sqrt{7}(\sqrt{3}^{n})}{(\sqrt{3}-1)} \tag{10}$$

Z-Transformation:

$$x(n) = x(0) * r^{(n)} \tag{11}$$

$$X(z) = \mathcal{Z}\{x(n)\} = \sum_{n=-\infty}^{\infty} x(n)z^{-n} \tag{12}$$

$$= \sum_{n=-\infty}^{\infty} x(n)z^{-n} \tag{13}$$

$$= \sum_{n=-\infty}^{\infty} x(0) * r^{n} * z^{-n} \tag{14}$$

$$= x(0) \sum_{n=-\infty}^{\infty} r^{n}z^{-n} \tag{15}$$

$$= x(0)(1 + r^{1} * z^{-1} + r^{2} * z^{-2} + r^{3} * z^{-3} + r^{4} * z^{-4} + r^{5} * z^{-5} + r^{6} * z^{-6} + ...) \tag{16}$$

$$X(Z) = x(0) * \frac{1}{1 - r * z^{-1}} \qquad wherer * z^{-1} < 1 \tag{17}$$

Input Table:

variable	value	description
x(0)	$\sqrt{7}$	first term of the geometric progession
r	$\sqrt{3}$	common ratio of the geometeric progression
x(n)	$\sqrt{7 * 3^{(n)}}$	n^{th} term of the geometric progession
n		no of the term in the geometric progression