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
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
S_n		Sum of the n term of the geometric progression

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

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

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

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

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

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

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

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

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

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

Z-Transformation:

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

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

$$= \sum_{n=0}^{\infty} x(n)z^{-n} \tag{13}$$

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

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

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

$$= x(0)(1 + r^1 * z^{-1} + r^2 * z^{-2} + r^3 * z^{-3} + r^4 * z^{-4} + r^5 * z^{-5} + r^6 * z^{-6} + ...) \tag{17}$$

$$X(Z) = x(0) * \frac{1}{1 - r * z^{-1}} \qquad where r * z^{-1} < 1 \tag{18}$$