# 12.10.16

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**QUESTION:** Find the sum to indicated number of terms in each of the geometric progressions in 0.15, 0.015, 0.0015, ... 20 terms.

## Solution

TABLE 0
Variables and their descriptions

| Parameter | Description | Value |
|---|---|---|
| $n$ | Number of terms in the G.P (positive even integer) | 20 |
| $x(0)$ | first term in the G.P | 0.15 |
| $r$ | common ratio in the G.P | 0.1 |
| $x(n)$ | nth term in the G.P | none |
| $X(z)$ | Z transform of X(n) | none |

Let $x(0)$ denote the first term and $r$ the common ratio. The sum of a geometric progression with $n$ terms:

$$x(n) = x(0)r^n \tag{1}$$

$$X(z) = \frac{x(0)}{1 - rz^{-1}} \tag{2}$$

$$S(z) = X(z)U(z) \tag{3}$$

$$= \frac{x(0)}{(1 - rz^{-1})(1 - z^{-1})} \quad |z| > |r| \tag{4}$$

$$= \frac{x(0)(\frac{r}{1-rz^{-1}} - \frac{1}{1-z^{-1}})}{(r-1)} \tag{5}$$

The inverse of S(z) is s(n)

$$s(n) = x(0)(\frac{r^{n+1} - 1}{r - 1}) \tag{6}$$

Substitute the values in the above equation

$$s(n) = 0.15 * \frac{0.1^{20} - 1}{0.1 - 1} \tag{7}$$

$$\therefore s(n) = \frac{1}{6}[1 - 0.1^{20}] \tag{8}$$