Maths Assignment

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Problem Statement

A G.P consists of an even number of terms. If the sum of all terms is 5 times the sum of terms occupying odd places, then find its common ratio.

Solution

Parameter	Description
n	Number of terms in the G.P (positive even integer)
$x(0)$	first term in the G.P
r	common ratio in the G.P
$x(n)$	nth term in the G.P
$s(n)$	sum of G.P series
$s_o(n)$	sum of terms in odd places

Solving the Question in time domain:

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

$$s(n) = x(0)\left(\frac{r^{n+1} - 1}{r - 1}\right)u(n) \tag{2}$$

The sum of terms in odd places:

$$s_o(n) = x(0)\left(\frac{r^{n+1} - 1}{r^2 - 1}\right)u(n) \tag{3}$$

Then from (2) and (3)

$$x(0)\left(\frac{r^{n+1} - 1}{r - 1}\right)u(n) = 5x(0)\left(\frac{r^{n+1} - 1}{r^2 - 1}\right)u(n) \tag{4}$$

$$r^2 - 5r + 4 = 0 \tag{5}$$

$$r = 1 \quad \text{or} \quad r = 4 \tag{6}$$