U7D5_T Geometric Series

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U7D5 MCR 3UI **Geometric Series**

A geometric series is the **SUM** of the terms of a geometric sequence.

If the sequence is $t_1, t_2, t_3, t_4, \ldots, t_n$ then the series is

$S_1, S_2, S_3, S_4, \ldots, S_n$ where :

$$s_1 = t_1 = a$$

$$s_2 = t_1 + t_2 = a + ar$$

$$s_3 = t_1 + t_2 + t_3 = a + ar + ar^2$$

$$s_4 = t_1 + t_2 + t_3 + t_4 = a + ar + ar^2 + ar^3$$

$$\ldots$$

In general

$$s_n = \frac{a(r^n - 1)}{r - 1}, r \neq 1$$

a is first term (t_1)

r is common ratio

n is the of terms

Examples:

1. Find the sum of the first 10 terms of 5, 10, 20, 40, . . .

$a=5 \quad r=2 \quad n=10 \quad S_n = \frac{a(r^n-1)}{r-1}$

$S_{10} = \frac{5(2^{10}-1)}{2-1}$

$S_{10} = \frac{5(1023)}{1}$

$\boxed{S_{10} = 5115}$

2. Find the sum of $-4 + 12 - 36 + \ldots + 972$.

$a = -4 \quad r = -3 \quad n = ? \quad t_n = 972, \; S_n = ?$

First use t_n formula to find n.

$t_n = ar^{n-1}$

$(-4)(-3)^{n-1} = 972$

$(-3)^{n-1} = 972 \div (-4)$

$(-3)^{n-1} = -243$

$(-3)^{n-1} = (-3)^5$

$n - 1 = 5$

$n = 6$

$S_n = \dfrac{a(r^n - 1)}{r - 1}$

$S_6 = \dfrac{(-4)[(-3)^6 - 1]}{-3 - 1}$

$S_6 = \dfrac{-4(729 - 1)}{-4}$

$\boxed{S_6 = 728}$

Summary : Formula List

General Term

Geometric Sequence $t_n = ar^{n-1}$

Arithmetic Sequence $t_n = a + (n-1)d$

Series

Arithmetic $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

Arithmetic (alternate version) $S_n = \frac{n}{2}(a + t_n)$

Geometric $S_n = \frac{a(r^n - 1)}{r-1}$

U7D5 Practice: ~~p. 452 #1-7(eoo), 9, 12, **16**~~

Pg 476 #1-5 (eoo) Correction 2e)90910