LESSON MAKER PRO

Geometric Sum Quest

Use a formula to add finite geometric series.

HIGH SCHOOL · HSA-SSE.B.4

CCSS.Math.Content.HSA-SSE.B.4 "Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments. *"

NAME _____ DATE _____

SUM FORMULA

A finite geometric series has first term a, common ratio r, and n terms. If S is its sum, multiply by r and subtract: $S - rS = a - ar^n$, so $S = a(1 - r^n)/(1 - r)$ when r is not 1. Use n as the number of terms, including the first term.

WORKED EXAMPLE

Find the sum: 5 + 15 + 45 + 135

1. Identify a = 5, r = 3, and n = 4.
2. Substitute: $S = 5(1 - 3^4)/(1 - 3)$.
3. Simplify: $S = 5(-80)/(-2) = 200$.

Answer: 200

PRACTICE 6 problems

1 Find the sum: 2 + 8 + 32 + 128

ANSWER _____

2 Find the sum: 7 + 14 + 28 + 56 + 112

ANSWER _____

3 A geometric series has a = 64, r = 1/4, and n = 3. Find its sum.

ANSWER _____

4 Find the sum: 3/2 - 3 + 6 - 12

ANSWER _____

5 Find the sum of the first six terms of a geometric series with a = 4 and r = -1/2.

ANSWER _____

6 Let S = 9 + 27 + 81 + 243. Multiply by 3, subtract 3S from S, and find S. Show the subtraction equation and the value of S.

ANSWER _____

APPLY IT Show your work

1 You put $25 into a savings account this month. For each of the next three months, you deposit double the amount from the previous month. What is the total amount you deposit during the four months?

WORK SPACE

ANSWER _____

2 Your tablet downloads a 96 MB update. Each of the next four update files is half the size of the previous file. How much data do all five files use altogether?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Without listing every term, find the positive integer n: $1 + 6 + 36 + \ldots + 6^{n-1} = 259$. Explain your reasoning.

WORK SPACE AND ANSWER

Geometric Sum Quest

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the sum: 2 + 8 + 32 + 128	**170**
2	Find the sum: 7 + 14 + 28 + 56 + 112	**217**
3	A geometric series has a = 64, r = 1/4, and n = 3. Find its sum.	**84**
4	Find the sum: 3/2 - 3 + 6 - 12	**-15/2**
5	Find the sum of the first six terms of a geometric series with a = 4 and r = -1/2.	**21/8**
6	Let S = 9 + 27 + 81 + 243. Multiply by 3, subtract 3S from S, and find S. Show the subtraction equation and the value of S.	**S - 3S = 9 - 729 = -720; S = 360.**

PART 2 · APPLY IT

1. **$375** The deposits form 25 + 50 + 100 + 200. Use $S = 25(1 - 2^4)/(1 - 2) = 375$.
2. **186 MB** The file sizes are 96, 48, 24, 12, and 6 MB. Their geometric sum is 186 MB.

CHALLENGE

n = 4, because $(6^n - 1)/5 = 259$ gives $6^n = 1296 = 6^4$.

Accept equivalent forms of the sum formula, including $a(r^n - 1)/(r - 1)$. Accept equivalent fractional answers, such as 2 5/8 for 21/8.