GEOMETRIC SERIES

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- Geometric Series- the sum of the terms of a geometric sequence.
- Geometric Sequence: 1, 3, 9, 27, 81
- Geometric Series: 1 + 3 + 9 + 27 + 81

- What is the sum of the geometric series?

= 121

GEOMETRIC SERIES FORMULA

$$S_n = \frac{a_1 - a_1 r^n}{1-r} \text{ or } S_n = \frac{a_1(1-r^n)}{1-r}$$

PRACTICE

- Find S_n for each geometric series described.

1. $a_1 = 2, \quad a_6 = 486, \quad r = 3$

$$S_6 = \frac{2 - 2(3)^6}{1-3} = 728$$

2. $a_1 = 625, \quad r = \frac{3}{5}, \quad n = 5$

$$S_5 = \frac{625 - 625\left(\frac{3}{5}\right)^5}{1 - 3/5} = 1441$$

GEOMETRIC SERIES

Find

$$\sum_{n=1}^{4} -3(2)^{n-1}$$

- You can do this two ways. Let's use the long way.
- Plug in the number 1 – 4 for n and add.
- $[-3(2)^{1-1}] + [-3(2)^{2-1}] + [-3(2)^{3-1}] + [-3(2)^{4-1}] =$
- $[-3(1)] + [-3(2)] + [-3(4)] + [-3(8)] =$
- $-3 - 6 - 12 - 24 =$ -45

GEOMETRIC SERIES

- The other method is to use the sum of geometric series formula.

last term

sequence form.

$$\sum_{n=1}^{4} \underbrace{-3(2)^{n-1}}_{a_1 \cdot r^{n-1}}$$

1st term

$$S_n = \frac{a_1 - a_1 r^n}{1-r}$$

$$S_4 = \frac{-3 - (-3)(2)^4}{1-2}$$

$$\boxed{S_4 = -45}$$

PRACTICE

3. Find the sum.

$$\sum_{n=1}^{9} 5 \cdot (2)^{n-1}$$

$S_n = \dfrac{a_1 - a_1 r^n}{1-r}$

$S_9 = \dfrac{5 - 5(2)^9}{1-2} = 2555$

4. Find the sum.

$$\sum_{n=1}^{7} 144\left(-\frac{1}{2}\right)^{n-1}$$

$S_7 = \dfrac{144 - 144(-1/2)^7}{1-(-1/2)}$

$S_7 = 96.75$

EXPRESS EACH GEOMETRIC SERIES IN SIGMA NOTATION. WHAT IS THE SUM OF EACH FINITE SERIES?

5. -15 + 5 + -5/3 + 5/9 + - 5/27

$\sum_{n=1}^{5} -15(-1/3)^{n-1}$

$S_5 = \dfrac{-15 - (-15)(-1/3)^5}{1-(-1/3)} = \dfrac{-305}{27}$

5. 2 + 8 + 32 + 128

$\sum_{n=1}^{4} 2(4)^{n-1}$

$S_4 = \dfrac{2 - 2(4)^4}{1-4} = 170$