



# Geometric Sequences

Geometric Sequence: A pattern of numbers that begins with a nonzero term. The pattern is found by multiplying the previous term by a nonzero constant.

Common Ratio: The constant term,  $r$ , used to make a geometric sequence. It is found by dividing a term by the previous term. ✨ ✨

Finding the common ratio

1. Determine whether the sequence -432, 144, -48, 16, ... is geometric.

$$\frac{16}{-48} = -\frac{1}{3} \quad \frac{-48}{144} = -\frac{1}{3} \quad \frac{144}{-432} = -\frac{1}{3}$$

Yes  $r = -\frac{1}{3}$

2. Determine whether the sequence 4, 9, 25, 36, ... is geometric.

$$\frac{36}{25} = 1.44 \quad \frac{25}{9} = 2.\bar{7} \quad \frac{9}{4} = 2.25$$

No

3. Determine whether the sequence 16, 12, 8, 4, ... is geometric.

No

4. Determine whether the following sequence is geometric.

Yes

$n$	$a_n$
1	36
2	-18
3	9
4	-4.5

Handwritten annotations: A blue circle around  $a_n$  in the header. Blue curly braces on the right side of the table connect the terms 36 to -18, -18 to 9, and 9 to -4.5, with the label  $-0.5$  written next to each brace.

### Finding Terms of Geometric Sequences

5. Find the next three terms in each geometric sequence

a. 64, 16, 4, 1, ...     $0.25, 0.0625, 0.015625$   
 $r = 0.25$      $\frac{1}{4}, \frac{1}{16}, \frac{1}{64}$

b.

$n$	1	2	3	4	...
$a_n$	8	12	18	27	...

$40.5$      $60.75$      $91.125$   
 $\times 1.5$      $\times 1.5$      $\times 1.5$

$r = 1.5$

We can develop a rule to find the  $n$ th term in a geometric sequence where  $r$  is the common difference.

Let's create a general rule one step at a time

Terms	Symbol	In terms of $a_1$ and $r$	Number
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nth term			
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The  $n$  refers to the term's place in the sequence. So, when we say  $a_6$ , we are referring to the 6th term in the sequence. When we say  $a_n$ , we are creating a rule (equation) that can be used to find any term in the sequence.

6. Find the 11th term in the following sequence

512, 256, 128, 64, ...

$$r = \frac{1}{2}$$

$$a_n = a_1 \cdot r^{n-1}$$

$$a_n = 512 \cdot \left(\frac{1}{2}\right)^{n-1}$$

$$\rightarrow a_{11} = 512 \cdot \left(\frac{1}{2}\right)^{10}$$

$$a_{11} = 0.5$$

7. Find the 9th term in the following sequence

-8, 24, -72, 216,...

$$r = -3$$

$$a_n = -8(-3)^{n-1}$$

$$a_9 = -8(-3)^8 \rightarrow -52,488$$



8. North Dakota's population is increasing more quickly than any other state. In 2011, the population was 685,242 and it has been increasing by an average of 2.5% each year. If this trend continues, determine the estimated population in 2030.

$$y = 685,242 (1 + 0.025)^{19}$$

$$y = 685,242 (1.025)^{19}$$

$$y = 1,095,462.25$$

9. Although vinyl record sales make up only a small percentage of the music market, they are becoming more popular. Global record sales have been increasing at an average rate of 26% each year. Global sales in 2014 were \$267 million. Determine the estimated vinyl record sales for 2025.

$$y = 267 (1 + 0.26)^n$$

$$y = 3393 \text{ million}$$

