MATHEMATICS · GRADES 10-12

General terms of geometric sequences

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you jump straight to any term in a pattern that multiplies each time, like what your savings are worth after twenty years of interest. You do not have to work out year one, then year two, all the way to year twenty, you can go straight to the answer. That is how you check a long term investment, predict how a population grows over many generations, or work out what a debt becomes if it keeps multiplying.



Rule

General term of a geometric sequence: term n = $a \times r^{(n - 1)}$, where a is the first term and r is the common ratio.

It jumps straight to any term without multiplying step by step.

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Worked examples

EXAMPLE 1

Q Sequence 2, 6, 18. Find the 5th term.

SOLUTION

First term a = 2, common ratio r = 3.

$\text{term}_n = a \times r^{n-1}$

5th term = $2 \times 3^4 = 2 \times 81 = 162$

EXAMPLE 2

Q Sequence 100, 50, 25. Find the 4th term.

SOLUTION

Here a = 100 and r = $\frac{1}{2}$.

4th term = $100 \times (\frac{1}{2})^3 = 100 \times \frac{1}{8}$

$100 \times \frac{1}{8} = 12.5$

4th term = 12.5

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Practice questions

1. A dish starts with 3 bacteria. The count triples every hour, so it reads 3, 9, 27, and so on. How many bacteria are there in the 4th hour?

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2. A sequence goes 5, 15, 45, and so on. What is the common ratio?

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3. The 4th term of a geometric sequence is 40 and the common ratio is 2. What is the first term?

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4 In the sequence 2, 6, 18, and so on, which term is 162?

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5 Write the formula for the nth term of a geometric sequence that starts with a and multiplies by r each time.

A. Term n = $a\ r^{(n-1)}$

B. Term n = $a\ r^{n}$

C. Term n = $a + r^{(n-1)}$

D. Term n = $a\ r^{(n+1)}$

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6 Term 2 of a geometric sequence is 12 and term 4 is 108. What is the common ratio?

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7 A sequence starts with 6 and multiplies by 3 each time. What are the first three terms?

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8 A sequence goes 12, 36, 108, and so on. What is the term before 12?

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9 The sequence 3, 6, 12, and so on keeps going. What is the first term bigger than 100?

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10 **A dose of medicine halves in the body each hour: 64 mg, 32 mg, 16 mg, and so on. In which hour is there 4 mg left?**

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ANSWER KEY

1. 81

2. 3

3. $5

4. 5

5. Term n = a $r^{(n-1)}$

6. 3

7. 6, 18, 54

8. 4

9. 192

10. 5

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