

Geometric Sequences

Name: _____ Date: _____ Score: _____ / 26

Q Quick Review

A **geometric sequence** multiplies by the same number — the **common ratio** r — to get from one term to the next. **Explicit formula:** $a_n = a_1 \cdot r^{n-1}$. **Recursive:** $a_1 =$ first term; $a_n = r \cdot a_{n-1}$. If $r > 1$, the sequence *grows* (exponential growth). If $0 < r < 1$, it *shrinks* toward zero (exponential decay). If $r < 0$, signs alternate. **Arithmetic vs. geometric:** arithmetic *adds*; geometric *multiplies*. Check by dividing consecutive terms — if you get the same ratio every time, it's geometric.

PRACTICE

Find r , write the explicit formula, or find the indicated term.

- | | |
|--|--|
| 1. 3, 15, 75, 375, ...; r , a_n _____ | 11. 4, 8, 12, 16, ...; type? _____ |
| 2. 1000, 200, 40, 8, ...; r , a_n _____ | 12. 4, 8, 16, 32, ...; type? _____ |
| 3. -2, 6, -18, 54, ...; a_5 _____ | 13. 2, 6, 18, 54, ...; a_8 _____ |
| 4. $a_1 = 7$, $r = 2$; a_6 _____ | 14. $a_1 = 1$, $r = \frac{1}{2}$; a_{10} _____ |
| 5. $a_1 = 800$, $r = \frac{1}{2}$; a_5 _____ | 15. 81, 27, 9, 3, ...; r _____ |
| 6. $a_1 = 1$, $r = -3$; a_4 _____ | 16. $a_1 = 5$, $r = 2$; a_n _____ |
| 7. 5, 10, 20, 40, ...; growth or decay? _____ | 17. $a_2 = 12$, $a_4 = 48$; r _____ |
| 8. 256, 64, 16, 4, ...; growth or decay? _____ | 18. $100 \cdot (0.9)^{n-1}$; a_1 _____ |
| 9. $a_1 = 6$, $r = 10$; a_4 _____ | 19. Is 1, 3, 6, 10, 15 geometric? _____ |
| 10. $a_3 = 18$, $r = 3$; a_1 _____ | 20. $a_n = 4 \cdot (-2)^{n-1}$; a_4 _____ |

◆ VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Find the common ratio from the table.

n	1	2	3	4
a_n	6	12	24	48

Answer: _____

22. Find the common ratio from the table.

n	1	2	3	4
a_n	5	15	45	135

Answer: _____

◆ Word Problems

23. A bacterium culture doubles every hour. Starting with 500 at time 0, how many after 8 hours? _____
24. A ball dropped from 80 ft rebounds to $\frac{3}{4}$ of its previous height each bounce. Height after the 4th bounce? _____
25. A car worth \$25,000 loses 15% of its value each year. Value after 5 years? _____
26. A scholarship fund is worth \$5000 now and is expected to grow by 4% each year. Write an exponential model and estimate the fund's value after 10 years. _____



Answer Keys

- | | |
|--|-----------------------------|
| 1. $r = 5, a_n = 3 \cdot 5^{n-1}$ | 14. $\frac{1}{512}$ |
| 2. $r = \frac{1}{5}, a_n = 1000 \cdot (\frac{1}{5})^{n-1}$ | 15. $\frac{1}{3}$ |
| 3. -162 | 16. $a_n = 5 \cdot 2^{n-1}$ |
| 4. 224 | 17. $r = 2$ or $r = -2$ |
| 5. 50 | 18. 100 |
| 6. -27 | 19. no |
| 7. growth | 20. -32 |
| 8. decay | 21. 2 |
| 9. 6000 | 22. 3 |
| 10. 2 | 23. 128,000 |
| 11. arithmetic | 24. ≈ 25.3 ft |
| 12. geometric | 25. $\approx \$11,092$ |
| 13. 4374 | 26. $\approx \$7,401$ |

Step-by-Step Tutor Notes

- Use the clue in the question first, then let the arithmetic finish the job. $\frac{15}{3} = 5$. Each term multiplies by 5. So the answer is $r = 5, a_n = 3 \cdot 5^{n-1}$.
- This is a good place to slow down, check the notation, and simplify cleanly. $\frac{200}{1000} = \frac{1}{5}$. Shrinking sequence. So the answer is $r = \frac{1}{5}, a_n = 1000 \cdot (\frac{1}{5})^{n-1}$.
- Use the clue in the question first, then let the arithmetic finish the job. $r = -3$ (alternating signs). $a_5 = -2 \cdot (-3)^4 = -2 \cdot 81 = -162$. So the answer is -162.
- Take it one clear step at a time and keep the original question in mind. $a_6 = 7 \cdot 2^5 = 7 \cdot 32 = 224$. So the answer is 224.
- This is a good place to slow down, check the notation, and simplify cleanly. $a_5 = 800 \cdot (\frac{1}{2})^4 = 800 \cdot \frac{1}{16} = 50$. So the answer is 50.
- Focus on the main idea of the problem, then simplify carefully. $a_4 = 1 \cdot (-3)^3 = -27$. So the answer is -27.
- For a table question, slow down and locate the exact row, column, or cell before calculating. $r = 2 > 1$, so terms grow. Exponential growth. This gives growth.
- Use the clue in the question first, then let the arithmetic finish the job. $r = \frac{1}{4} < 1$, so terms shrink. Exponential decay. So the answer is decay.
- Take it one clear step at a time and keep the original question in mind. $a_4 = 6 \cdot 10^3 = 6 \cdot 1000 = 6000$. So the answer is 6000.
- Use the clue in the question first, then let the arithmetic finish the job. $a_3 = a_1 \cdot r^2$, so $18 = a_1 \cdot 9$, giving $a_1 = 2$. So the answer is 2.
- Differences: 4, 4, 4. But ratios: $2, \frac{3}{2}, \frac{4}{3}$ — not constant. So arithmetic, not geometric.
- Ratios: 2, 2, 2 — constant. Geometric with $r = 2$. (And differences are 4, 8, 16 — not constant, so not arithmetic.)
- Focus on the main idea of the problem, then simplify carefully. $r = 3$. $a_8 = 2 \cdot 3^7 = 2 \cdot 2187 = 4374$. So the answer is 4374.
- Take it one clear step at a time and keep the original question in mind. $a_{10} = 1 \cdot (\frac{1}{2})^9 = \frac{1}{512}$. So the answer is $\frac{1}{512}$.
- Use the clue in the question first, then let the arithmetic finish the job. $\frac{27}{81} = \frac{1}{3}$. Confirm: $\frac{9}{27} = \frac{1}{3}$. Decaying sequence. So the answer is $\frac{1}{3}$.
- The first term is 5 and the common ratio is 2. In $a_n = a_1 r^{n-1}$, that gives $a_n = 5 \cdot 2^{n-1}$.
- Take it one clear step at a time and keep the original question in mind. $\frac{a_4}{a_2} = r^2 = \frac{48}{12} = 4$, so $r = \pm 2$. So the answer is $r = 2$ or $r = -2$.
- Focus on the main idea of the problem, then simplify carefully. At $n = 1$: $100 \cdot (0.9)^0 = 100 \cdot 1 = 100$. So the answer is 100.
- Ratios: 3, 2, $\frac{5}{3}, \frac{3}{2}$. Not constant, so not geometric. (These are triangular numbers — differences increase.)
- Take it one clear step at a time and keep the original question in mind. $a_4 = 4 \cdot (-2)^3 = 4 \cdot (-8) = -32$. So the answer is -32.
- Each term is multiplied by 2 to get the next term, so the common ratio is 2.
- Start with the definition the problem is testing, then apply it directly. Each term is multiplied by 3 to get the next term. So the answer is 3.
- $N(t) = 500 \cdot 2^t$. At $t = 8$: $500 \cdot 2^8 = 500 \cdot 256 = 128,000$ bacteria.
- First bounce: $80 \cdot \frac{3}{4} = 60$. After n bounces: $h_n = 60 \cdot (\frac{3}{4})^{n-1}$. At $n = 4$: $h_4 = 60 \cdot (\frac{3}{4})^3 = 60 \cdot \frac{27}{64} = \frac{1620}{64} \approx 25.3$ feet.
- Losing 15% keeps 85%, so $r = 0.85$. $V(t) = 25000 \cdot 0.85^t$. At $t = 5$: $25000 \cdot 0.85^5 \approx 25000 \cdot 0.4437 = \$11,092$.
- $r = 1.04$. $V(t) = 5000 \cdot 1.04^t$. At $t = 10$: $5000 \cdot 1.04^{10} \approx 5000 \cdot 1.4802 = \$7,401$.



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