4-5 Geometric Sequences

Name _____ Date _____

Determine if each sequence is geometric. If it is, find the next term and the 10th term of the sequence.

6, 6, 12, 36, …

$6 \div 6 = 1$

$12 \div 6 = 2$ ← $2 \neq 1$; no common ratio.

The sequence is *not* geometric.

Remember: In a geometric sequence, each term after the first is found by *multiplying* the previous term by a constant (called the common ratio, r, with $r \neq 0$ or 1).

If a_1 is the first term, the nth term of a geometric sequence is: $a_n = a_1 \bullet r^{n-1}$

40, 20, 10, 5, …

$\frac{a_2}{a_1} = \frac{20}{40} = \frac{1}{2}; \frac{a_3}{a_2} = \frac{10}{20} = \frac{1}{2}; \frac{a_4}{a_3} = \frac{5}{10} = \frac{1}{2}$

So the sequence appears to be geometric.

Next term: $5 \bullet \frac{1}{2} = \frac{5}{2}$.

nth term: $a_n = a_1 r^{(n-1)}$

$a_{10} = 40\left(\frac{1}{2}\right)^{10-1}$ ← Substitute 10 for n, 40 for a_1, and $\frac{1}{2}$ for r.

$a_{10} = 40\left(\frac{1}{512}\right) = \frac{5}{64}$

Determine whether each sequence could be geometric, arithmetic, or neither. If geometric, use a pattern to write the next four terms.

1. 380, 38, 3.8, 0.38, …

$\frac{38}{380} = \frac{1}{10}, \frac{3.8}{38} = \frac{1}{10}, \frac{0.38}{3.8} = \frac{1}{10}$

$0.38 \bullet \frac{1}{10} = 0.038, 0.038 \bullet \frac{1}{10} = 0.0038$

$0.0038 \bullet \frac{1}{10} = 0.00038, 0.00038 \bullet \frac{1}{10} = 0.000038$

geometric; 0.038, 0.0038, 0.00038, 0.000038

2. 0.13, 1.3, 13, 130, …

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3. 5, 6, 8, 11, …

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4. $\frac{1}{2}, \frac{1}{6}, -\frac{1}{6}, -\frac{1}{2}, \ldots$

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Find the indicated term of each geometric sequence.

5. a_7 of $\frac{1}{16}, \frac{1}{4}, 1, 4, \ldots$

$\frac{\frac{1}{4}}{\frac{1}{16}} = 4; a_n = a_1 \bullet r^{n-1}$

$a_7 = \frac{1}{16}(4)^{7-1} = \frac{1}{16}(4)^6 = \frac{4096}{16}$

256

6. a_8 of $\frac{1}{81}, \frac{1}{27}, \frac{1}{9}, \frac{1}{3}, \ldots$

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7. a_9 of 800, 400, 200, 100, …

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8. a_9 of 1600, 400, 100, 25, …

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9. a_{10} of $1, -2, 4, -8, \ldots$

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10. a_{10} of $-2, 8, -32, 128, \ldots$

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Find the indicated term of each geometric sequence.

11. a_7 of $9, 45, 225, 1125, \ldots$

12. a_7 of $96, 144, 216, 324, \ldots$

13. a_6 of $82, -123, 184.5, -276.75, \ldots$

14. a_6 of $18, 5.4, 1.62, 0.486, \ldots$

15. a_6 of $24, 9.6, 3.84, 1.536, \ldots$

16. a_{20} of $b, b^5, b^9, b^{13}, \ldots$

Write a recursive formula for the *n*th term of each geometric sequence.

17. $16, -12.8, 10.24, -8.192, \ldots$

$a_n = ra_{n-1}$
$r = -12.8 \div 16 = -0.8$
$a_n = -0.8 \bullet a_{n-1}$

18. $2, \frac{10}{3}, \frac{50}{9}, \frac{250}{27}, \ldots$

19. $z^{12}, z^8, z^4, 1, \ldots$

Solve.

20. The population of a town decreases by one third each year for 3 years. If it starts with a population of 540,000, what will be the population after 3 years?

21. Biology The number of cells in a sample doubles every half-hour. If a lab sample started with 2 cells, how many cells are in the sample 10 hours later?

Problem Solving

22. A ball is dropped from a height of 36 ft. After 2 bounces it reaches a height of 4 ft. What height will the ball reach after another bounce?

23. Sono marks the middle of a board. He makes another mark half-way between the first mark and the end of the board. He makes more marks using the same pattern 6 more times. If the distance between the end of the board and the nearest mark is $\frac{1}{2}$ in., how many feet long is the board?

SPIRAL REVIEW

24. Solve. $3x + 19 = 10$

25. Solve. $|x + 8| = -12$

26. Solve. $11b + 13 \geq -4b + 28$