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Arithmetic and Geometric sequences and series

1. Do the following sequence seem arithmetic, geometric, or neither? If they are arithmetic, state the common difference, d. If they are geometric, state the common ratio, r.

   (a) (1 point) $4, 8, 12, 16, \ldots$

   (b) (1 point) $5, 10, 16, 21, \ldots$

   (c) (1 point) $-6, 12, -24, \ldots$

   (d) (1 point) $5, -6, 7, -8, \ldots$

   (e) (1 point) $11, 7, 3, -1, \ldots$

   (f) (1 point) $0.1, 0.01, 0.001, 0.0001, \ldots$

2. (2 points) Does there exist a sequence which is both arithmetic **and** geometric? If so, provide an example. If not, explain why not.

3. For the following arithmetic sequences, find the first term, a, the common difference, d, and a formula for the nth term, a_n. Simplify your answers.

   (a) (2 points) $3, 12, 21, \ldots$

   (b) (2 points) $18, 11, 4, \ldots$

   (c) (3 points) $a_4 = 6, a_{10} = 9$

   (d) (3 points) $a_{11} = 17, a_5 = 31$

4. For the following geometric sequences, find the first term, a, the common ratio, r, and a formula for the nth term, a_n. Simplify your answers.

   (a) (2 points) $3, 12, 48, \ldots$

   (b) (2 points) $18, 6, 2, \ldots$

   (c) (3 points) $a_4 = 16, a_7 = 54$

   (d) (3 points) $a_{11} = 640, a_5 = 10$

5. For the following arithmetic sequences, find the indicated partial sum. Simplify your answers.

(a) (2 points) $3, 12, 21, \ldots$. Find S_{10}.

(b) (3 points) Find $18 + 11 + \cdots + (-59)$.

(c) (3 points) $a_4 = 6, a_{10} = 14$. Find S_9.

(d) (3 points) $a_{12} = -8, a_6 = 34$. Find S_{21}.

6. For the following geometric sequences, find the indicated partial sum. Simplify your answers.

(a) (2 points) $3, -6, 12, \ldots$. Find S_8.

(b) (3 points) Find $54 + 18 + 6 + \cdots + \left(\frac{2}{3}\right)$.

(c) (3 points) $a_4 = 16, a_7 = 0.016$. Find S_5.

(d) (3 points) $a_7 = 80, a_5 = 20$. Find S_7.

7. For the following geometric sequences, find the infinite sum, if possible. If the sum does not converge, explain why not. Simplify your answers.

   (a) (2 points) $4, -8, 16, \ldots$

   (b) (2 points) $45, 15, 5, \ldots$

   (c) (2 points) $400, -40, 4, \ldots$

8. (4 points) A child arranges Ogel blocks in rows on the floor. There are 78 blocks in the fifth row and 156 blocks in the eleventh row. Assuming the number of blocks in the rows form an arithmetic sequence, how many blocks were used in the first 11 rows?

9. (4 points) A rubber ball is dropped from a height of 10 m. Each time the ball bounces, it bounces back up to 80% of its previous height. Calculate, to the nearest cm, the distance the ball has travelled in total when it touches the ground for the 10th time.

10. (3 points) The sum of the first 23 terms of an arithmetic series with common difference of 3 is 322. What is the first term?

11. (3 points) If the sum of the first n terms of an arithmetic series is given by $S_n = 3n^2 + 5n$, find the first term, a, and the common difference, d, of the sequence.

12. (4 points) Consider an arithmetic series where the sum of the first 10 terms is -16 and the sum of the first 30 terms is 312. Find the 21st term.

13. (3 points) The sum of the first 6 terms of a geometric series with common ratio of -2 is $-35/2$. What is the first term?

14. (3 points) If the sum of the first n terms of a geometric series is given by $S_n = 12(1 - 3^n)$, find the first term, a, and the common ratio, r, of the sequence.

15. (4 points) Consider a geometric series where the sum of the first 5 terms is 93 and the sum of the first 8 terms is 765. Find the 6th term.

16. (3 points) The sum of an infinite geometric series is 5/2, and the sum of the first two terms is 25/18. Find the first term.

17. (5 points) In an arithmetic series, the 5th term is four times as large as the 3rd term, and the sum of the first 10 terms is 1330. Find the 10th term.