

Worksheet 04 - Geometric Sequences and Series

Common ratio, geometric sums and exponential growth or decay

Corrected notation: formulas use proper superscripts and subscripts, and sigma notation uses vertically stacked upper and lower limits.

Time	45 minutes
Total marks	35
Calculator	Allowed unless stated
Level	IB SL/HL mixed

Instructions: Show sufficient working for non-multiple-choice questions. Where appropriate, define variables, state restrictions and interpret results in context.

Section A - Multiple choice (5 marks)

1. The common ratio of 81, 27, 9, 3, ... is:

- A. $\frac{1}{3}$
- B. 3
- C. -3
- D. 9

Answer: _____

2. For a geometric sequence $u_n = 5(2)^{n-1}$, the 6th term is:

- A. 80
- B. 160
- C. 320
- D. 640

Answer: _____

3. The sum of the first n terms of a geometric sequence is:

- A. $a + (n-1)d$
- B. $\frac{n}{2}(a+l)$
- C. $\frac{a(1-r^n)}{(1-r)}$, $r \neq 1$
- D. $\frac{a}{(1-r)}$, $|r| < 1$

Answer: _____

4. The sequence 3, -6, 12, -24, ... has common ratio:

- A. -3
- B. -2
- C. 2
- D. 3

Answer: _____

5. If $a = 200$ and $r = 0.9$, the sequence models:

- A. linear increase
- B. quadratic growth
- C. exponential decay

D. constant change

Answer: _____

Section B - Short answer (12 marks)

1. Find the 8th term of 6, 18, 54, ... (2 marks)
2. Find a and r for a geometric sequence with $u_2 = 12$ and $u_5 = 96$. (4 marks)
3. Evaluate $5 + 10 + 20 + \dots + 640$. (3 marks)

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4. Write $7 - 14 + 28 - 56 + 112$ in sigma notation. (3 marks)

Section C - Data response / case study (10 marks)

Case study: Computer value

A school buys a computer for EUR 1200. It is expected to lose 18% of its value each year. Let V_n be the value after n years.

Years n

0

1

2

3

4

Value model /

EUR

1200

984

806.88

661.64

542.54

1. Write V_n in the form $V_n = ar^n$. (2 marks)
2. Estimate the value after 6 years. (2 marks)
3. Find the first year when the value is below EUR 300. (3 marks)
4. Explain why a geometric model may become unrealistic over a very long time. (3 marks)

Section D - Extended response (8 marks)

Compare arithmetic and geometric models. Your answer should include their general term formulas, how to identify each type from a table of values, and one real-world situation where each model is appropriate.

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Answer Key and Marking Guidance

Award marks for valid mathematical reasoning, clear notation and correctly interpreted results. Equivalent methods should receive full credit unless the question specifies a method.

Section A

1: A

2: B

3: C

4: B

5: C

Section B

1: $u_8 = 6(3)^7 = 13122$.

2: $ar = 12$ and $ar^4 = 96$, so $r^3 = 8$, $r = 2$, $a = 6$.

3: $5(1 + 2 + \dots + 2^7)$, $n=8$. $S = 5(2^8 - 1) = 1275$.

4: $\sum_{r=1}^5 7(-2)^{r-1}$.

Section C

1: $V_n = 1200(0.82)^n$.

2: $V_6 = 1200(0.82)^6 = 365.56$ EUR approximately.

3: Solve $1200(0.82)^n < 300$. By checking, $n=6$ gives 365.56, $n=7$ gives 299.76. First year: 7.

4: Objects may have a minimum resale/scrap value, technology changes irregularly, and percentage loss may not remain constant.

Section D

8 marks: 2 for arithmetic formula and constant difference; 2 for geometric formula and constant ratio; 2 for table-identification methods; 2 for suitable contextual examples and clear comparison.