

# Sequences and Series: Patterns That Add Up

Grade 11 – Algebra 2 math · Worksheet · Standards: A-SSE.B.4, F-BF.A.2, F-IF.A.3

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

These problems train arithmetic and geometric sequences, explicit and recursive rules, sigma notation and finite series, aligned with standards A-SSE.B.4, F-BF.A.2 and F-IF.A.3.

Early problems build fluency with rules and terms. The last six use seating, savings, salary, bouncing balls and loans, so keep units and rounding in mind.

**Standards:** A-SSE.B.4, F-BF.A.2, F-IF.A.3 · **Level:** Grade 11 Algebra 2

## Problem 1 Classify the sequence (easy)

Decide whether 14, 9, 4,  $-1$ , ... is arithmetic or geometric. Give the common difference or ratio and the next term.

## Problem 2 Explicit rule from a first term (easy)

An arithmetic sequence has first term 11 and common difference 6. Write the explicit rule and find  $a_{12}$ .

## Problem 3 Find the common ratio (easy)

Find the common ratio and the next term of 405, 135, 45, ...

## Problem 4 List terms from a recursive rule (easy)

A sequence is defined by  $a_1 = 3$  and  $a_n = 2a_{n-1} + 1$ . Write the first five terms.

## Problem 5 Arithmetic term from two terms (medium)

In an arithmetic sequence  $a_4 = 17$  and  $a_9 = 42$ . Find  $a_1$ ,  $d$  and  $a_{30}$ .

## Problem 6 Geometric term (medium)

Find  $a_7$  of the geometric sequence 12, 18, 27, ...

## Problem 7 Evaluate a sigma sum (medium)

Evaluate  $\sum_{k=1}^5 (3k - 2)$  by writing out the terms.

## Problem 8 Geometric sigma sum (medium)

Evaluate  $\sum_{k=1}^6 2 \cdot 3^{k-1}$ .

**Problem 9 Sum of an arithmetic series** (medium)

Find the sum  $6 + 10 + 14 + \dots + 70$ .

**Problem 10 Alternating geometric series** (medium)

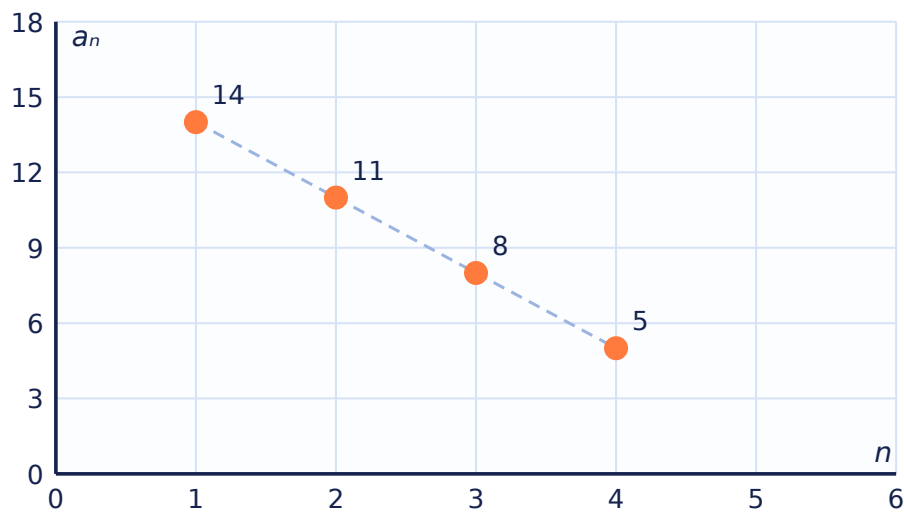
Find the sum of the first 5 terms of  $8 - 12 + 18 - 27 + \dots$

**Problem 11 Write sigma notation** (medium)

Write  $4 + 7 + 10 + \dots + 40$  in sigma notation.

**Problem 12 Rule from a graph (arithmetic)** (medium)

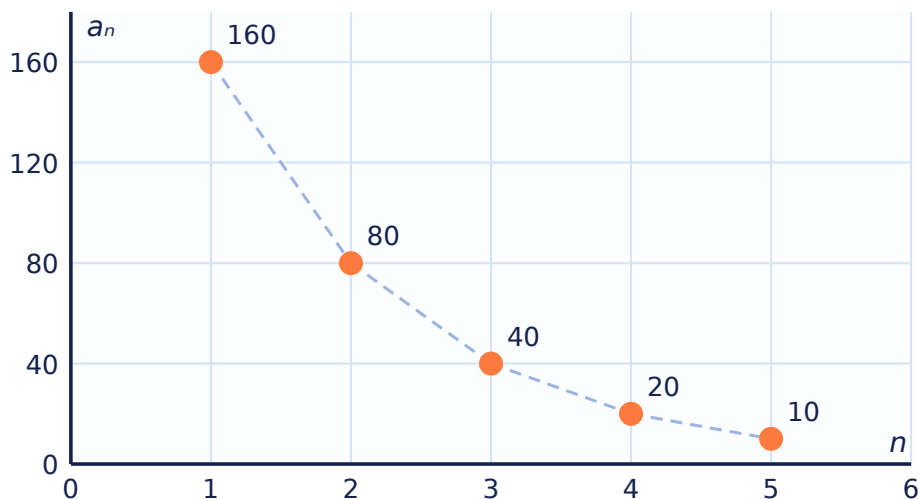
The graph shows the first four terms of an arithmetic sequence. Write the explicit rule.



Four terms of an arithmetic sequence.

**Problem 13 Rule from a graph (geometric)** (medium)

The graph shows a geometric sequence. Find  $r$  and write the explicit rule.



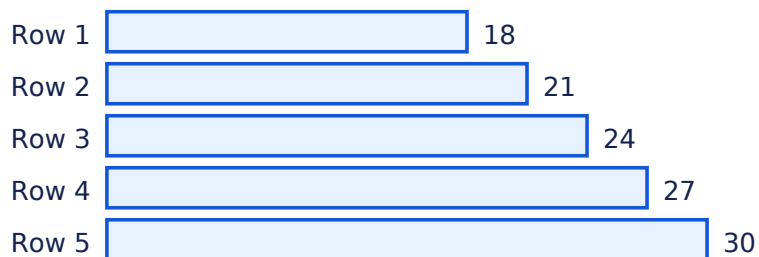
Five terms of a geometric sequence.

**Problem 14 Number of terms** (hard)

How many terms are in the geometric sequence 3, 6, 12, ..., 1536?

**Problem 15 Theater seating** (hard)

A theater has 18 seats in row 1, and each later row has 3 more seats than the row before. The bars show the first five rows. How many seats are in row 22, and how many seats are in all 22 rows?



*Seats in the first five rows.*

**Problem 16 Monthly savings plan** (hard)

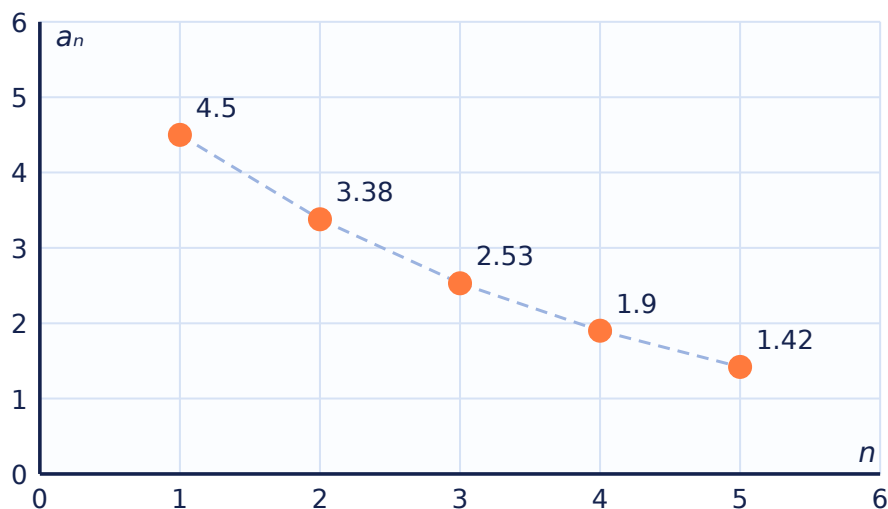
Mina deposits \$200 at the end of each month into an account that earns 0.5% per month. Use the sum of a geometric series to find the balance after 24 deposits.

**Problem 17 Salary with yearly raises** (hard)

A job pays \$42,000 the first year and the pay rises 3% each year. Find the total pay over the first 10 years, to the nearest dollar.

**Problem 18 Bouncing ball heights** (hard)

A ball dropped from 6 feet rebounds to 75% of its previous height after each bounce. Find the height after the 5th bounce, and write the recursive rule for the rebound height (heights in the graph are rounded).



*Rebound height (feet) after each bounce.*

**Problem 19 Car loan payment** (hard)

A \$15,000 loan at 6% annual interest is repaid in 48 equal monthly payments. The payment is  $M = Pr/(1 - (1 + r)^{-n})$ , where  $r$  is the monthly rate. Find  $M$ .

**Problem 20 Sum of odd numbers** (hard)

Show that the sum of the first  $n$  odd numbers  $1 + 3 + 5 + \dots$  is  $n^2$ , then use it to find  $1 + 3 + 5 + \dots + 49$ .