8th Grade Algebra Knoblock/Zuhn
Objective 76-80

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Recursive and Explicit Formulas

EXPLICIT VS. RECURSIVE RULE

- Explicit rule gives a_n as a function of the term's position number n in the sequence.
- Recursive rule gives the beginning term or terms of a sequence and then a recursive equation that tells how a_n is related to one or more preceding terms.

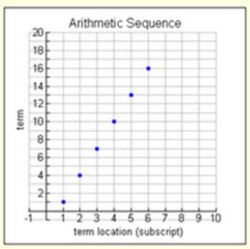
A sequence is an ordered list of numbers.
The **sum** of the terms of a sequence is called a **series.**

While some sequences are simply random values, other sequences have a **definite pattern** that is used to arrive at the sequence's terms. Two such sequences are the **arithmetic** and **geometric** sequences. Let's investigate the arithmetic sequence.

Arithmetic Sequences ADD

If a sequence of values follows a pattern of **adding a fixed amount** from one term to the next, it is referred to as an **arithmetic sequence.** The number added to each term is constant (always the same).

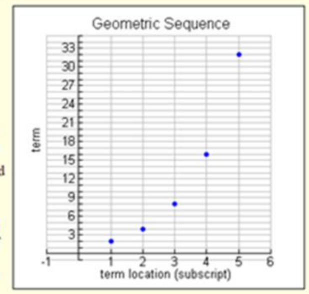
The fixed amount is called the **common difference, *d*,** referring to the fact that the difference between two successive terms yields the constant value that was added. To find the common difference, subtract the first term from the second term.



Geometric Sequences MULTIPLY

If a sequence of values follows a pattern of **multiplying a fixed amount** (not zero) times each term to arrive at the following term, it is referred to as a **geometric sequence.** The number multiplied each time is constant (always the same).

The fixed amount multiplied is called the **common ratio, *r*,** referring to the fact that the ratio (fraction) of the second term to the first term yields this common multiple. To find the common ratio, divide the second term by the first term.



Determine an explicit formula for an arithmetic sequence given the first term and the common difference

1. The first term of an arithmetic sequence is -1.8 and the common difference is 0.7. Which explicit formula defines this sequence for $n = 1, 2, 3, \ldots$?

[A] $a_n = -1.8 + 0.7(n-1)$ [B] $a_n = -1.8 - 0.7n$

[C] $a_n = -2.5 - 0.7(n-1)$ [D] $a_n = -2.5 + 0.7n$

2. The first term of an arithmetic sequence is 2.4 and the common difference is -2.1. Write an explicit formula that defines this sequence for $n = 1, 2, 3, \ldots$.

Determine a recursive formula for an arithmetic sequence

1. Which recursive formula defines this arithmetic sequence for $n = 1, 2, 3, \ldots$?
$-1, 2, 5, 8, 11, \ldots$

[A] $a_1 = -1,\ a_n = a_{n-1} + 3$ [B] $a_1 = -1,\ a_n = a_{n-1} - 3$

[C] $a_1 = 3,\ a_n = a_{n-1} - 1$ [D] $a_1 = 3,\ a_n = a_{n-1} + 1$

2. Write a recursive formula that defines this arithmetic sequence for $n = 1, 2, 3, \ldots$.
4, 10, 16, 22, 28, . . .

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Determine an explicit formula for a geometric sequence

1. Which explicit formula defines this geometric sequence for $n = 1, 2, 3, \ldots$?

$-3, -\frac{9}{5}, -\frac{27}{25}, -\frac{81}{125}, -\frac{243}{625}, \ldots$

[A] $a_n = -3\left(\frac{3}{5}\right)^{n-1}$ [B] $a_n = -3\left(\frac{2}{5}\right)^{n}$ [C] $a_n = -3\left(\frac{2}{5}\right)^{n-1}$ [D] $a_n = -3\left(\frac{3}{5}\right)^{n}$

2. Write an explicit formula that defines this geometric sequence for $n = 1, 2, 3, \ldots$.

$4, \frac{16}{7}, \frac{64}{49}, \frac{256}{343}, \frac{1024}{2401}, \ldots$

Determine a recursive formula for a geometric sequence

1. Which recursive formula defines this geometric sequence for $n = 1, 2, 3, \ldots$?

5, 15, 45, 135, . . .

[A] $a_1 = 5,\ a_n = 3a_{n-1}$

[B] $a_1 = 5,\ a_n = \frac{1}{3}a_{n-1}$

[C] $a_1 = 5,\ a_n = a_{n-1} + 10$

[D] $a_1 = 3,\ a_n = a_{n-1} + 5$

2. Write a recursive formula that defines this geometric sequence for $n = 1, 2, 3, \ldots$.

64, 48, 36, 27, . . .