12-1 Introduction to Sequences

GOALS: 1 4 7 10 . . .

Find the *n*th term of a sequence.

Write rules for sequences. a_{531}

A **sequence** is a list of numbers that often forms a pattern. Each number in a sequence is a **term**.

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A **sequence** is an ordered set of numbers. Each number in the sequence is a **term of the sequence**. A sequence may be an **infinite sequence** that continues without end, such as the natural numbers, or a **finite sequence** that has a limited number of terms, such as {1, 2, 3, 4}.

Infinite sequence {1, 2, 3, 4, 5, 6, 7 ...}

The three dots at the end of a sequence are called an ellipsis. They mean that the sequence continues and can read as "and so on."

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Instead of function notation, such as $a(n)$, sequence values are written by using subscripts. The first term is a_1, the second term is a_2, and the *n*th term is a_n.

Term number	n	1	2	3	4	5	Domain
Term value	a_n	1	1	2	3	5	Range

In the Fibonacci sequence, the first two terms are 1 and each term after that is the sum of the two terms before it. This can be expressed by using the rule $a_1 = 1$, $a_2 = 1$, and $a_n = a_{n-2} + a_{n-1}$, where $n \geq 3$. This is a ~~recursive formula~~. A **recursive formula** is a rule in which one or more previous terms are used to generate the next term.

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Find the first 5 terms of the sequence.

1. $a_1 = -5$, $a_n = a_{n-1} - 8$

$a_2 = a_{2-1} - 8$ $a_3 = a_{3-1} - 8$

$a_2 = a_1 - 8$ $a_3 = a_2 - 8$ $-5, -13, -21, -29, -37$

$a_2 = -5 - 8$ $a_3 = -13 - 8$

$a_2 = -13$ $a_3 = -21$

2. $a_1 = 2$, $a_n = -3a_{n-1}$

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In some sequences, you can find the value of a term when you do not know its preceding term. An **explicit formula** defines the *n*th term of a sequence as a function of *n*.

3. **Find the first 5 terms of the sequence.**

$a_n = 3n - 5$

$a_1 = 3(1) - 5$

$a_1 = 3 - 5$

$a_1 = -2$

$a_8 = 3(8) - 5$

$24 - 5$

$a_8 = 19$

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4. **Find the first 5 terms of the sequence.**

$a_n = n^2 - 2n$

$a_1 = (1)^2 - 2(1)$ $1 - 2$ $a_1 = -1$

$a_2 = (2)^2 - 2(2)$ $4 - 4$ $a_2 = 0$

5. **Find the first 5 terms of the sequence** $a_n = 3^n - 1$.

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The Cantor set is a fractal formed by repeatedly removing the middle third of a line segment as shown. Find the number of segments in the next 2 iterations.

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Review:

Find the first 5 terms of each sequence.

1. $a_1 = 4$ *and* $a_n = 0.5\, a_{n-1} + 1$

Ignore the man behind the box.

2. $a_n = 2^n - 5$

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Assignment:

pages 865-866

problems: 2-10,15-18, 25, 26, 28-30, 41,42

2. $a_1 = 1$ $a_n = 4a_{n-1} - 1$

$a_2 = 4a_{2-1} - 1$

$a_2 = 4a_1 - 1$

$a_2 = 4 \cdot 1 - 1 = 3$

$4 - 1$

$a_3 = 4a_2 - 1$

1, 3, 11, 43, 171

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