TOPIC: INTRO TO SEQUENCES

Intro to Sequences

◆ A **sequence** is a function represented as the *general term* ____, whose domain is all _____ integers.

► Inputs are called **Indexes**, represented by ____.

► Ouputs are called **Terms**, represented by ____.

New

$$a_n = \{a_1, a_2, a_3, \ldots\}$$

(Sequence Notation)

EXAMPLE Find the first three terms and the tenth term of the sequence whose general term is given below.

$$a_n = 2^n$$

1st term, $n = 1$: $a\ = 2^{(\ )} =$

2nd term

3rd term

.

.

.

10th term

◆ A sequence can be *infinite* (go on _____) or *finite* (_____ after a certain number).

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PRACTICE List the first four terms of each sequence whose general term is given.

(A)

$$a_n = 5 - 2n$$

(B)

$$a_n = n^2 - 4n + 2$$

EXAMPLE List the first 4 terms of the following alternating sequence.

(A)

$$a_n = (-1)^n 2^{n-1}$$

(B)

$$a_n = (-1)^{n+1} n^2$$

PRACTICE What is the value of the term being asked for?

$$a_n = \frac{2n+1}{n+4}$$

$$a_4 = ?$$

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EXAMPLE List all the terms of the finite sequence defined by:

$(\boldsymbol{A})$

$a_n = 4 - n$ for $1 \leq n \leq 6$

$(\boldsymbol{B})$

$$a_n = \frac{n}{2n+1}$$

for $n = \{1, 2, 3, 4, 5\}$

EXAMPLE For each sequence given below, find the term being asked.

$(\boldsymbol{A})$

$2, 5, 8, 11, 14, \ldots$

Find the 10th term.

$(\boldsymbol{B})$

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \ldots$$

Find the 12th term.

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Writing a General Formula

◆ The **General** ("explicit") **Formula** of a sequence is an equation for a_n ("general term") containing n. ($n = 1, 2, 3, \ldots$)

► To determine the general formula, find the _____ between the numbers.

Common Patterns in General Formulas of Sequences				
If sequences…	**Increase by 1 or 2 or 3…**	**Alternating signs**	**Contain fractions**	**Increase exponentially**
Formula contains…*	n *or* $2n$ *or* $3n\ldots$	$(-, +, -, \ldots) \rightarrow (-1)^n$ $(+, -, +, \ldots) \rightarrow (-1)^{n+1}$	Fractions (top & bottom may be different)	$(\#)^n$
EXAMPLE	$\{5, 6, 7, 8, 9\}$	$\{-5, 5, -5, 5, -5\}$	$\left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \ldots\right\}$	$\{2, 4, 8, 16, 32\}$

*Note: You will often have to adjust your formula by $+, -, \times, \div$ constants to get the desired sequence!

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EXAMPLE

Given the first 4 terms of a sequence shown below, write the general formula for the nth term and use it to calculate the 15th term.

$$\left\{\frac{1}{1\cdot 2}, \frac{1}{2\cdot 3}, \frac{1}{3\cdot 4}, \frac{1}{4\cdot 5}, \ldots\right\}$$

EXAMPLE

Given the first 5 terms of a sequence shown below, write the general formula for the nth term and use it to calculate the 18th term.

$\{-2, 4, -6, 8, -10, \ldots\}$

EXAMPLE

Carla saves money by increasing the amount she saves each week by $10. She saved $50 in the first week, $60 in the following week, $70 the next week, and so on…

How much will she have saved in Week 8?