Edgenuity

Warm-Up | Recognizing Patterns

Lesson Question

Lesson Goals

Analyze patterns to ______ if a sequence is arithmetic, geometric, or neither.

Calculate a ______ of a sequence.

Create a recursive ______ for a sequence.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

arithmetic sequence	a sequence in which the ______ between any two consecutive terms is constant
geometric sequence	a sequence in which the ______ between any two consecutive terms is ______
recursive formula	the formula used to ______ the terms of a recursive sequence

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Words to Know

recursive sequence	a sequence in which any term is determined by a function of ______ terms
sequence	a set of ______ numbers
term	the sequence value at a specific ______

Evaluating Functions

- Table

x	y
1	1
2	3
3	5
4	7

- Function rule

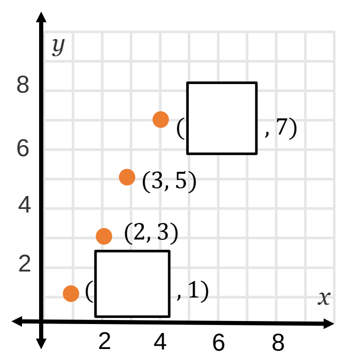
$f(x) = 2x - 1$

$$f(1) = 2(\square) - 1$$

$$= 2 - 1$$

$$= \square$$

- Graph



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Sequences

- A **sequence** is a set of [ ] numbers.
- [ ] sequence:
  - 4.5, 5.6, 6.7, 7.8

    add 1.1
- [ ] sequence:
  - 4.5, 5.6, 6.7, 7.8, … [ ], [ ] …

Sequence Notation

- A [ ], a_n, is the sequence value at a specific position, n.

4.5	5.6	6.7	7.8
[ ] term	2nd term	3rd [ ]	4th term
$n = 1$	$n =$ [ ]	$n = 3$	$n = 4$
$a_1 = 4.5$	$a_2 = 5.6$	$a_3 = 6.7$	$a_4 =$ [ ]

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Graphing a Sequence

A sequence can be graphed as a ________ function where the:

- domain is a subset of the ________ numbers.

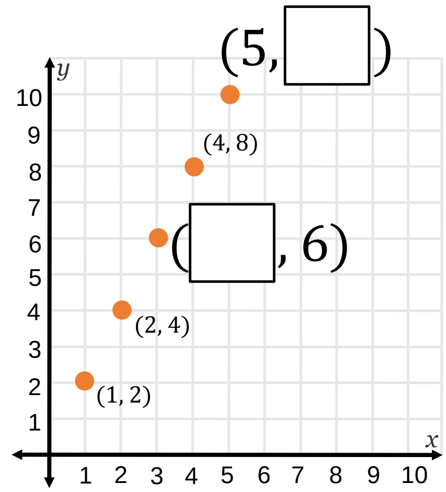
  {1, 2, 3, 4, 5}

- range is the ________ of the sequence.

  {2, 4, 6, 8, 10}

The sequence is 2, 4, 6, 8, 10.

Each coordinate can be thought of as (n, a_n).



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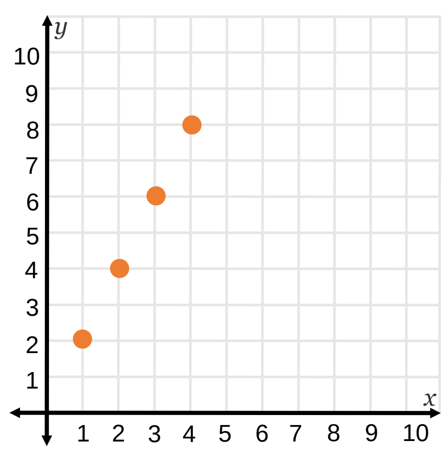
Relating Sequences and Functions

n ________ $a_n = f(n)$

x	y	
1	2	$f($____$)$
2	4	$f(2)$
3	6	$f(3)$
4	8	$f(4)$
5	10	________



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Identifying Patterns

Describe the relationship between the numbers in the sequences. Then, extend the patterns.

pattern	rule	next term
2, –4, 8, –16, …	multiply by ☐	32
1, 2, 2, 4, 8, 32, …	multiply two previous terms	☐
2, 3, 5, 7, 11, 13, …	☐ numbers	17
1, $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$, $\frac{1}{25}$, …	$\frac{1}{☐}$	☐

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Recursive Sequences

- In a **recursive sequence**, any term is determined by a function of ☐ terms.
  - 1, 1, 2, 3, 5, 8, 13, 21, … Fibonacci sequence

Recursive formula: $a_3 = a_1 +$ ☐

Function notation: $f(3) = f(1) + f(2)$

$= 1 + 1$

$=$ ☐

$a_4 = a_2 + a_3$

$f(4) = f(2) + f(3)$

$= 1 + 2$

$= 3$

- A recursive sequence can be defined by a **recursive** ☐.

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A recursive formula allows us to find the *n*th term, any term a_n, as long as you know the two terms before it.

Recursive formula: $a_n = a_{n-2} + a_{n-1}, a_1 = 1 \quad a_2 = 2$

Function notation: $f(n) = f(n-2) + f(n-1)$ for $n \geq$ ______

$f(1) = 1, f(2) = 1$

We could also state: $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$

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Arithmetic and Geometric Sequences

ARITHMETIC SEQUENCES

In an **arithmetic sequence**, there is a common ______ between any two consecutive terms.

6.9, 1.9, –3.1, –8.1, …

–3.1 – 1.9 = ______

–1.9 – 6.9 = ______

To get to the next term, I have to ______ 5 for each one of these terms.

GEOMETRIC SEQUENCES

In a **geometric sequence**, there is a common ______ between any two consecutive terms.

- 2, –4, 8, –16 … $\frac{-4}{2} =$ ______ $\frac{8}{-4} =$ ______
- 100, 20, 4, $\frac{4}{5}$ $\frac{20}{100} =$ ______ $\frac{4}{5} \div 4 = \frac{4}{5} \cdot \frac{1}{4} =$ ______

Not every sequence is arithmetic or geometric. Some sequences don't have a pattern, like the digits of π. In order for the sequence to be arithmetic or geometric, remember you're looking for either a common difference, or a common ratio.

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Recursive Formulas for Arithmetic and Geometric Sequences

Arithmetic Sequences

$$f(n+1) = f(n) + \square, \; n \geq 1$$

$$f(n) = c$$

- $\frac{4}{5}, 1, 1\frac{1}{5}, 1\frac{2}{5}$

Find the common difference:

$$1 - \frac{4}{5} = \frac{5}{5} - \frac{4}{5} = \frac{1}{5}$$

$$d = \square$$

Write the general form:

$$f(n+1) = \square + \frac{1}{5}, \; n \geq 1$$

$$f(1) = \square$$

Geometric Sequences

$$f(n+1) = \square \; f(n), \; n \geq 1$$

$$f(n) = c$$

- 2, –4, 8, –16 …

Find the common ratio:

$$r = \square$$

Write the general form:

$$f(n+1) = \square \cdot (-2)$$

$$f(n+1) = (-2)\, f(n), \; n \geq \square$$

$$f(n) = 2$$

Summary | Recognizing Patterns

Lesson Question

How are functions used to describe patterns?

Answer

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Review: Key Concepts

- A sequence can be ________ as a discrete function where the domain is a subset of the natural numbers.
- $f(n) = a_n$
- A term of a recursive sequence is determined by a ________ of previous terms.
  - ________ sequences: $f(n+1) = f(n) + d$
  - Geometric sequences: $f(n+1) = rf(n)$

Summary | Recognizing Patterns

Use this space to write any questions or thoughts about this lesson.