4.4: Tables & Sequences

SWBAT:

Identify patterns in function tables and use them to write function definitions

Distinguish between arithmetic and geometric sequences

Write function definitions based on sequences of numbers

Assignments:

HW27B

Review

- Function:
  - A relationship in which one value from the domain is matched with ***exactly*** one value from the range
- Domain: The set of input values to a function
- Range: The set of output values
- Function notation:

$$\overbrace{\overbrace{\overset{name}{\overbrace{f}}\left(\underbrace{x}_{input}\right)}^{output} = \underbrace{4x^2 - 8x + 6}_{rule}}^{definition}$$

Remember: the variable used for the input must be the *same* variable used in the function rule.

Tables

- Tables give us lists of input and output values.
- They are useful when we want specific points of data, or for giving us a starting point to graphing a function.
- Remember, that in function notation, a single variable (e.g. x) represents an *input* value. *Output* values are represented using the *name* and the *input* (e.g. $f(x)$)

Determine whether the relation is a function.

x	y
1	-3
6	-2
9	-1
1	3

Complete the table.

$C(x) = 3x + 1$

x	$C(x)$
5	
-2	
6	
	-26
	-14
	19

1. $f(t) = 4t + 3$
2. $g(n) = -n + 7$
3. $A(l) = \frac{1}{2}l$
4. $B(a) = \frac{1}{2}a - 3$

t	$f(t)$
0	
	-13
	11
	23

l	$A(l)$
4	
	3
	-9
	2

n	$g(n)$
-2	
	4
	-2
	13

a	$B(a)$
6	
	0
	-3
	-4

Writing the function definition from a table

- To find the function rule, look for a pattern relating the input to the output.
- Question to ask: How do I get from the input to the output?
- *Be sure to check that the rule works for every pair of values in the table!*

x	$f(x)$
0	5
1	6
2	7
3	8

x	$g(x)$
0	0
1	5
2	10
3	15

n	$h(n)$
0	2
1	3
2	4
3	5

Write the function definition

x	$g(x)$
-1	-5
0	-4
1	-3
2	-2

x	$f(x)$
-2	8
0	0
2	-8
5	-20

k	$j(k)$
-10	-5
0	5
25	30
41	46

t	$h(t)$
4	6
12	14
15	17
31	33

Write the function definition

x	$g(x)$
-13	13
-4	4
2	2
15	15

d	$A(d)$
-3	-12
-2	-10
-1	-8
0	-6

x	$t(x)$
0	-7
1	-5
2	-3
3	-1

k	$p(k)$
0	0
2	1
4	2
6	3

Sequences

- A **sequence** is a list of numbers in a specific order.
- Example: $1, 1, 2, 3, 5, 8, 13, 21, \ldots$

- Question: Is a sequence a function? Discuss with a partner.
- Answer: Yes!
  - The domain of a sequence is the set of whole numbers and indicates the position in the sequence (e.g. first, third, twentieth…)
  - The range of a sequence is the actual numbers in the sequence
  - So in the Fibonacci sequence, the ordered pairs would be $\{(1,1), (2, 1), (3, 2), (4, 3), (5, 5), (6, 8), (7, 13), \ldots\}$

- There are many, many types of sequences, but we're only looking at a few today.

Arithmetic Sequences

- Figure out the pattern.
- $1, 4, 7, 10 \ldots$

- An **arithmetic sequence** is a sequence made by adding the same number every time
- The number added each time is called the **common difference**

- *Identify the common difference and find the next three terms.*
- $3, 15, 27, \ldots$
- $10, 8, 6, 4, \ldots$
- $-4, -1.5, 1, 3.5, 6, \ldots$
- $10, -13, -36, -59, \ldots$

Geometric Sequences

- Figure out the pattern.
- $4, 8, 16, \ldots$

- An **geometric sequence** is a sequence made by multiplying the same number every time
- The number multiplied each time is called the **common ratio**
- The common ratio can be a fraction, but is never 0 or 1

- *Identify the common ratio and find the next three terms.*
- $3, 1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \ldots$
- $2, 20, 200, 2000, \ldots$
- $-4, 20, -100, 500, \ldots$
- $400, 200, 100, 50, \ldots$

Writing Functions of Sequences

There are a *lot* of functions and formulas that can be written to describe sequences. Today we're focusing on *explicit* functions for two kinds of sequences.

Arithmetic Sequences

- $a(n) = I + d(n - 1)$

- n is the input
- I is the initial or starting value
- d is the common difference
- $(n - 1)$ is the previous term
- Note: this is a linear function

Geometric Sequences

- $g(n) = I * r^{n-1}$

- n is the input
- I is the initial or starting value
- r is the common ratio
- $(n - 1)$ is the previous term

Write the explicit function definitions for the sequences

- $1, 4, 7, 10 \ldots$

1. $3, 15, 27, \ldots$
2. $10, 8, 6, 4, \ldots$
3. $-4, -1.5, 1, 3.5, 6, \ldots$
4. $10, -13, -36, -59, \ldots$

- $4, 8, 16, \ldots$

1. $3, 1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \ldots$
2. $2, 20, 200, 2000, \ldots$
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