

3.1 Functions

Essential Question: What is a function?

Lesson Objectives:

- Students will determine whether relations are functions
- Students will find the domain and range of a function.
- Students will identify the independent and dependent variables of a function.

Oct 3-1:54 PM

Relation - pairs inputs with outputs - it is a set of ordered pairs, for example $\{(1,2), (1,3), (-2,7), (6,5.25)\}$ (x,y)

The inputs (x) are $\{1, -2, 6\}$
independant

The outputs (y) are $\{2, 3, 7, 5.25\}$
dependant

Function - a relation in which each element in the domain (x) is paired with **exactly one** element in the range (y).

In other words a **function** is a relation that pairs each **input with exactly one output.**

Why isn't the original relation listed above a function?

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3.1 Functions with work

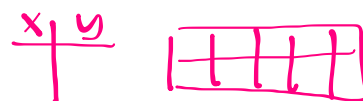
Y	Hat size	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8
X	Inches	$20\frac{1}{2}$	$20\frac{7}{8}$	$21\frac{1}{4}$	$21\frac{5}{8}$	22	$22\frac{1}{2}$	$22\frac{7}{8}$	$23\frac{1}{4}$	$23\frac{5}{8}$	24	$24\frac{3}{8}$	$24\frac{3}{4}$	$25\frac{1}{4}$
X	Centimeters	52	53	54	55	56	57	58	59	60	61	62	63	64
		X-SMALL		SMALL		MEDIUM		LARGE		X-LARGE		XX-LARGE		

- ? "What is the input for determining your hat size?" measurement in in. or cm.
- ? "What are the outputs?" Hat sizes
- **Discuss:** A *relation* pairs inputs and outputs. The information in this example could be written as the ordered pair (measurement of head, hat size). Each head measurement is paired with exactly one hat size, and we call it a *function*.

Oct 3-1:59 PM

Ways to describe a function:

- by an equation
- by an input-output table
- using words
- by a graph
- as a set of ordered pairs

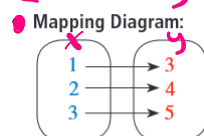


- Words: $x + 2 = y$
adding 2 to input to get output

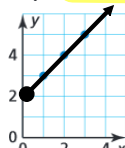
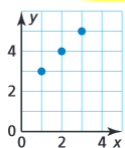
- Listing Ordered Pairs:
{(1, 3), (2, 4), (3, 5)}

• Input-Output Table:

Input, x	1	2	3
Output, y	3	4	5



- Graph: Discrete
- Graph: Continuous



- Equation:
 $y = x + 2$

Oct 3-2:06 PM

3.1 Functions with work

Determine which are functions. Justify!

a.

Input, x	0	1	2	3	4
Output, y	8	8	8	8	8

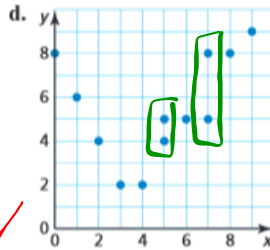
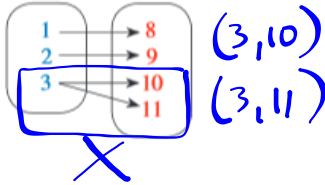
✓ all unique inputs (x)

b.

Input, x	8	8	8	8	8
Output, y	0	1	2	3	4

✗ 8 goes to 5 different y -values

c. Input, x Output, y



$(5,4) \nmid (5,5)$
 $(7,5) \nmid (7,8)$

✗

e. $(-2, 5), (-1, 8), (0, 6), (1, 6), (2, 7)$ ✓

f. $(-2, 0), (-1, 0), (-1, 1), (0, 1), (1, 2), (2, 2)$ ✗

g. Each radio frequency x in a listening area has exactly one radio station y . ✓

h. The same television station x can be found on more than one channel y . ✗

i. $x = 2$ ↓ $\{(2,0); (2,1); (2,-2)\} \dots$

j. $y = 2x + 3$

x	0	1	-1
y	3	5	1

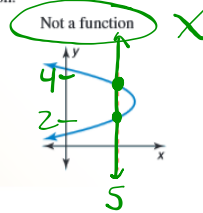
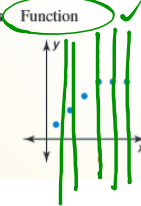
Oct 3-2:08 PM

Core Concept

Vertical Line Test

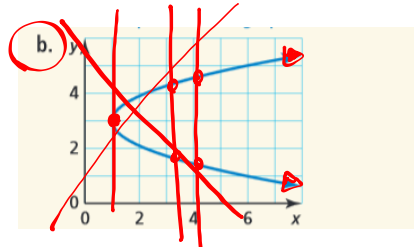
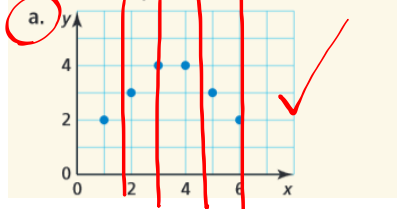
Words A graph represents a function when no vertical line passes through more than one point on the graph.

Examples



$(5,2) \nmid (5,4)$

Determine whether each graph represents a function. Explain.



Which graph is continuous and which is discrete?

Oct 3-2:16 PM

3.1 Functions with work

Finding the Domain and Range of a Function

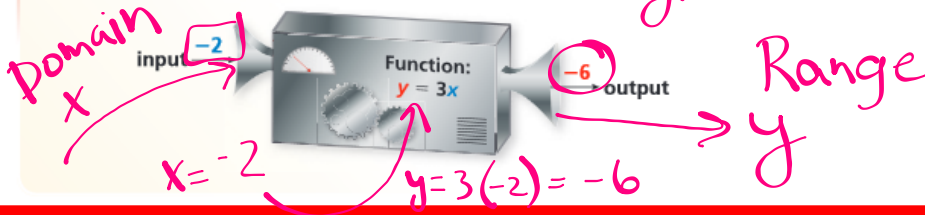
Core Concept

The Domain and Range of a Function

The **domain** of a function is the set of all possible input values.

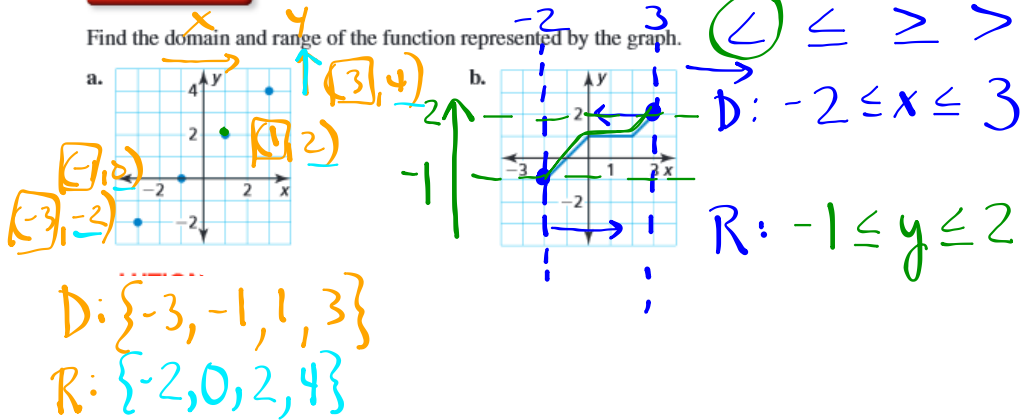
The **range** of a function is the set of all possible output values.

x independent
 y dependant



EXAMPLE 3 Finding the Domain and Range from a Graph

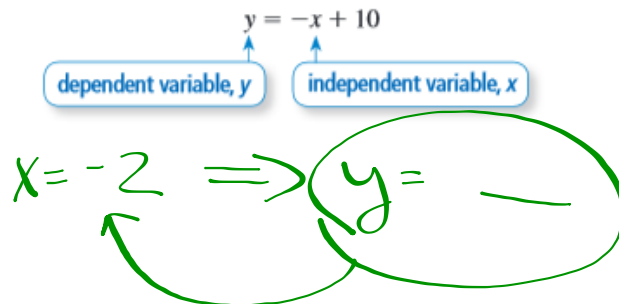
Find the domain and range of the function represented by the graph.



Oct 3-2:22 PM

Identifying Independent and Dependent Variables

The variable that represents the input values of a function is the **independent variable** because it can be any value in the domain. The variable that represents the output values of a function is the **dependent variable** because it depends on the value of the independent variable. When an equation represents a function, the dependent variable is defined in terms of the independent variable. The statement “y is a function of x” means that y varies depending on the value of x.



Oct 3-2:24 PM

3.1 Functions with work

Assign: 3.1 Functions

3.1 WS A & B

Pg. 108: 18, 21 - 23

Oct 3-2:29 PM