

Objective: TSWBAT define and evaluate functions

Oct 11-7:15 AM

Vocabulary

- ① relation - any set of ordered pairs
- ② function - a relation that assigns exactly one y value for each x-value
- ③ function rule - an equation that describes a function
- ④ domain - the set of all possible input values for a function
- ⑤ range - the set of all possible output values for a function

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range  
vertical line test  
function notation

**Essential Understanding** A function is a special type of relation in which each value in the domain is paired with exactly one value in the range.

**Problem 1 Identifying Functions Using Mapping Diagrams**  
Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

**A**  $\{(-2, 0.5), (0, 2.5), (4, 6.5), (5, 2.5)\}$   
The domain is  $\{-2, 0, 4, 5\}$ .  
The range is  $\{0.5, 2.5, 6.5\}$ .

**B**  $\{(6, 5), (4, 3), (6, 4), (5, 8)\}$   
The domain is  $\{4, 5, 6\}$ .  
The range is  $\{3, 4, 5, 8\}$ .

**Think**  
When is a relation not a function?  
A function maps each domain value to exactly one range value. So a relation that maps a domain value to more than one range value cannot be a function.

Each domain value is mapped to only one range value. The relation is a function.

The domain value 6 is mapped to two range values. The relation is not a function.

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Determine if Each relation is a function

x	y
11	-2
12	-1
13	0
20	7

x	y
-2	-1
-3	0
6	3
-2	1

x	y
3	2
5	-11
-7	13
15	4

x	y
4	3
7	-10
-12	9
7	4

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**Got It?** 1. Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

a.  $\{(4, 2), (1, 5), (5, 2), (7, 4), (8, 4), (2, 0)\}$     b.  $\{(-1, 1), (-2, 2), (4, -4), (7, -7)\}$

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Determine if each relation is a function.

1.	x	y
	10	-5
	15	1
	27	6
	29	7
	36	8

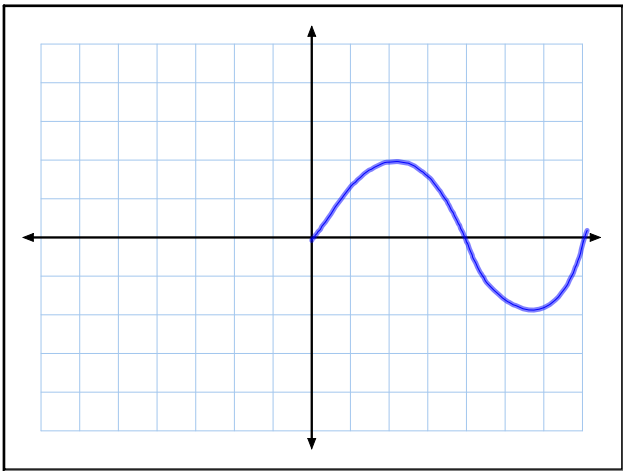
2.	x	y
	2	2
	6	4
	4	8
	0	0
	2	6

3.	x	y
	-6	6
	-3	6
	4	6
	8	6
	9	6

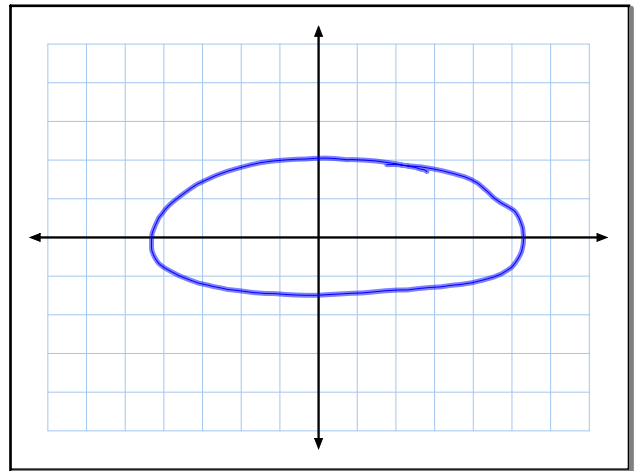
4.	x	y
	-6	2
	-4	2
	-2	4
	-3	4
	-4	4

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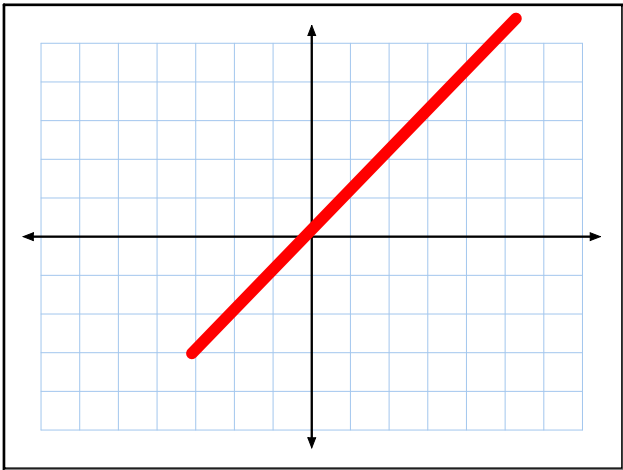




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**Lesson Check**

**Do you know HOW?**

- Identify the domain and range of the relation  $\{(-2, 3), (-1, 4), (0, 5), (1, 6)\}$ . Represent the relation with a mapping diagram. Is the relation a function?
- Is the relation in the graph shown at the right a function? Use the vertical line test.
- What is  $f(2)$  for the function  $f(x) = 4x + 1$ ?
- The domain of  $f(x) = \frac{1}{2}x$  is  $\{-4, -2, 0, 2, 4\}$ . What is the range?

**Do you UNDERSTAND?**

- Vocabulary** Write  $y = 2x + 7$  using function notation.
- Compare and Contrast** You can use a mapping diagram or the vertical line test to tell if a relation is a function. Which method do you prefer? Explain.
- Error Analysis** A student drew the dashed line on the graph shown and concluded that the graph represented a function. Is the student correct? Explain.

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**Practice and Problem-Solving Exercises**

**A Practice** Identify the domain and range of each relation. Use a mapping diagram to determine whether the relation is a function.

- $\{(3, 7), (3, 8), (3, -2), (3, 4), (3, 1)\}$
- $\{(0.04, 0.2), (0.2, 1), (1, 5), (5, 25)\}$
- $\{(6, -7), (5, -8), (1, 4), (7, 5)\}$
- $\{(4, 2), (1, 1), (0, 0), (1, -1), (4, -2)\}$

Use the vertical line test to determine whether the relation is a function.

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**STEM 16. Physics** Light travels about 186,000 mi/s. The function  $d(t) = 186,000t$  gives the distance  $d(t)$ , in miles, that light travels in  $t$  seconds. How far does light travel in 30 s?

**17. Shopping** You are buying orange juice for \$4.50 per container and have a gift card worth \$7. The function  $f(x) = 4.50x - 7$  represents your total cost  $f(x)$  if you buy  $x$  containers of orange juice and use the gift card. How much do you pay to buy 4 containers of orange juice?

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Find the range of each function for the given domain.

- $f(x) = 2x - 7; \{-2, -1, 0, 1, 2\}$
- $g(x) = -4x + 1; \{-5, -1, 0, 2\}$
- $h(x) = x^2; \{-1.2, 0, 0.2, 1.2, 4\}$
- $f(x) = 8x - 3; \left\{-\frac{1}{2}, \frac{1}{4}, \frac{3}{8}\right\}$

Find a reasonable domain and range for each function. Then graph the function.

- Fuel** A car can travel 32 mi for each gallon of gasoline. The function  $d(x) = 32x$  represents the distance  $d(x)$ , in miles, that the car can travel with  $x$  gallons of gasoline. The car's fuel tank holds 17 gal.
- Nutrition** There are 98 International Units (IUs) of vitamin D in 1 cup of milk. The function  $V(c) = 98c$  represents the amount  $V(c)$  of vitamin D, in IUs, you get from  $c$  cups of milk. You have a 16-cup jug of milk.

Determine whether the relation represented by each table is a function. If the relation is a function, state the domain and range.

- |   |   |   |    |   |
|---|---|---|----|---|
| x | 0 | 3 | 3  | 5 |
| y | 2 | 1 | -1 | 3 |
- |   |    |    |    |    |
|---|----|----|----|----|
| x | -4 | -1 | 0  | 3  |
| y | -4 | -4 | -4 | -4 |

- Open-Ended** Make a table that represents a relation that is not a function. Explain why the relation is not a function.
- Reasoning** If  $f(x) = 6x - 4$  and  $f(a) = 26$ , what is the value of  $a$ ? Explain.
- Think About a Plan** In a factory, a certain machine needs 10 min to warm up. It takes 15 min for the machine to run a cycle. The machine can operate for as long as 6 h per day including warm-up time. Draw a graph showing the total time the machine operates during 1 day as a function of the number of cycles it runs.
  - What domain and range are reasonable?
  - Is the function a linear function?

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29. **Carwash** A theater group is having a carwash fundraiser. The group can only spend \$34 on soap, which is enough to wash 40 cars. Each car is charged \$5.

- If  $c$  is the total number of cars washed and  $p$  is the profit, which is the independent variable and which is the dependent variable?
- Is the relationship between  $c$  and  $p$  a function? Explain.
- Write an equation that shows this relationship.
- Find a reasonable domain and range for the situation.

30. **Open-Ended** What value of  $x$  makes the relation  $\{(1, 5), (x, 8), (-7, 9)\}$  a function?

Determine whether each relation is a function. Assume that each different variable has a different value.

31.  $\{(a, b), (b, a), (c, c), (e, d)\}$

32.  $\{(b, b), (c, d), (d, c), (c, a)\}$

33.  $\{(c, e), (c, d), (c, b)\}$

34.  $\{(a, b), (b, c), (c, d), (d, e)\}$

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