Name _____ Date _____ Class _____

LESSON 1-6

Challenge

Relating Relations

A relation is said to be **reflexive** if for every element r in the relation, the ordered pair (r, r) is in the relation. For example, if 3 is an element in a relation, then the relation is reflexive if the ordered pair (3, 3) is in the relation.

A relation is said to be **symmetric** if whenever the ordered pair (r, s) is in the relation, then (s, r) is also in the relation. For example, if (5, 6) is an ordered pair in a relation, then the relation is symmetric if the ordered pair (6, 5) is in the relation.

A relation is said to be **transitive** if whenever the ordered pairs (r, s) and (s, t) are in the relation, then the ordered pair (r, t) is in the relation. For example, if (3, 7) and (7, 12) are ordered pairs in a relation, then the relation is transitive if the ordered pair (3, 12) is in the relation.

Any relation that has all 3 properties is called an **equivalence relation**.

The following relations are described in words. Use these relations for Exercises 1–4.

V is a set of ordered pairs such that each first element is a factor of each second element, and every element in the relation is a whole number.

W is a set of ordered pairs such that each first element is congruent to each second element, and every element in the relation is a geometric figure.

X is a set of ordered pairs such that each first element is a multiple of each second element, and every element in the relation is a whole number.

Y is a set of ordered pairs such that each first element is greater than each second element, and every element in the relation is a whole number.

Z is a set of ordered pairs such that each first element is similar to each second element, and every element in the relation is a geometric figure.

1. Which of the relations are reflexive? Explain why the other relations are not reflexive.

_____

2. Which of the relations are symmetric? Explain why the other relations are not symmetric.

_____

_____

3. Which of the relations are transitive? Explain why the other relations are not transitive.

_____

4. Which, if any, of the relations are equivalence relations? _____

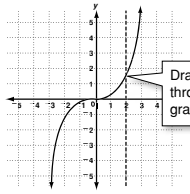
LESSON 1-6

Reteach

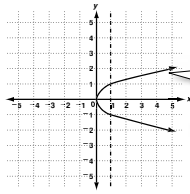
Relations and Functions (continued)

A **function** is a special type of relation.
A function has only one output for each input.

Use the **vertical-line test** to decide whether a relation is a function.



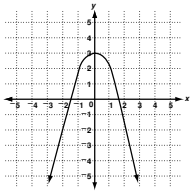
Draw a vertical line. The line passes through no more than one point on the graph. This *is* a function.



Draw a vertical line. The line passes through two points on the graph, at (1, −1) and (1, 1). This is *not* a function.

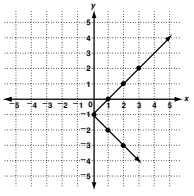
Use the vertical-line test to determine whether each relation is a function. If not, identify two points a vertical line would pass through.

3.



Function

4.



Not a function; possible answer: (1, 0), (1, −2)

LESSON 1-6

Challenge

Relating Relations

A relation is said to be **reflexive** if for every element r in the relation, the ordered pair (r, r) is in the relation. For example, if 3 is an element in a relation, then the relation is reflexive if the ordered pair (3, 3) is in the relation.

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Y is a set of ordered pairs such that each first element is greater than each second element, and every element in the relation is a whole number.

Z is a set of ordered pairs such that each first element is similar to each second element, and every element in the relation is a geometric figure.

1. Which of the relations are reflexive? Explain why the other relations are not reflexive.

V, *W*, *X*, *Z*; *Y*: (3, 3) does not exist because 3 is not greater than 3.

2. Which of the relations are symmetric? Explain why the other relations are not symmetric.

W, *Z*; *V*: 10 is a factor of 20, but 20 is not a factor of 10; *X*: 8 is a multiple of 4 but 4 is not a multiple of 8; *Y*: 3 > 2 but 2 is not greater than 3.

3. Which of the relations are transitive? Explain why the other relations are not transitive.

V, *W*, *X*, *Y*, *Z*

4. Which, if any, of the relations are equivalence relations? *W*, *Z*

LESSON 1-6

Problem Solving

Relations and Functions

In order to make a nutrition plan, Richard wants to compare different types of milk. Use the table for Exercises 1–7.

1. Is the relation from calories to saturated fat a function? Explain why or why not.

Yes; each calorie value has only one fat value.

2. Is the relation from calories to carbohydrates a function? Explain why or why not.

Yes; each calorie value has only one carbohydrate value.

3. Is the relation from carbohydrates to calories a function? Explain why or why not.

No; the carbohydrate value 12.2 has two calorie values, 102 and 83.

MILK FACTS (1 cup)			
A	B	C	D
Type	Calories	Carbo-hydrates (g)	Saturated Fat (g)
Whole	146	11	4.4
2%	122	11.4	3.1
1%	102	12.2	1.5
Nonfat	83	12.2	0.3

Choose the letter for the best answer.

4. Richard is drawing graphs of some of the relations from the table above. Which of these graphs fails the vertical-line test if he graphs the data as follows?

A column B along the *x*-axis, column C along the *y*-axis
B column D along the *x*-axis, column B along the *y*-axis
C column D along the *x*-axis, column C along the *y*-axis
(D) column C along the *x*-axis, column B along the *y*-axis

5. For the function (B, D) that relates calories to saturated fat, which column shows the domain?

F column A
(G) column B
H column C
J column D

6. Which column shows the range of a function that relates the type of milk to the number of calories?

A column A
(B) column B
C column C
D column D

7. Richard makes a mapping diagram from each type of milk to the number of students in his class of 25 who prefer that type of milk. Which is the best statement about this diagram?

F It is a relation, but not a function.
G It is a function, but not a relation.
(H) It is a function and a relation.
J It is not a relation or a function.

LESSON 1-6

Reading Strategies

Read a Table

A **function** is a **relation** in which the input is never repeated. A relation is a pairing of 2 sets of numbers, such as pairing a year with the number of students enrolled in school. Use a table to help you determine if a relation is a function.

The **domain** is the set of input values. The domain is the *x* values.

Lakeside School Enrollment	
Year	Number of Students
2000	356
2001	372
2002	422
2003	455

The **range** is the set of output values. The range is the *y* values.

Because no input values are repeated, the relation is a function.

x	−10	−5	−1	−1	0
y	2	3	4	5	6

−1 is an input value. It is repeated. The relation is not a function.

Use the table for Exercises 1–3.

x	−2	−2	0	1	2
y	4	2	0	−4	−6

1. What is the domain of the relation? How do you know?

−2, 0, 1, 2; domain is the set of *x* values.

2. What is the range of the relation? How do you know?

4, 2, 0, −4, −6; range is the set of *y* values.

3. Is the relation a function? Explain.

Not a function because the *x* value −2 is repeated

4. Make a table to show the ordered pairs in the set. Is the relation a function? Explain.
{(9, 6), (1, 4), (0, 2), (1, 4), (4, 6)}

The relation is a function because no input values are repeated.