

Module 10: Linear and Quadratic Function Families

Topic 1 Content: Determining if a Relation is a Function Notes

Introduction



Today's Lesson

- You will investigate relations and functions

Hi there! I'm so glad to have you here for this lesson in Algebra I, where you will investigate relations and functions.

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Anticipatory Set

REVIEW OF RELATIONS

A relation is a pairing of input values and output values.

Can be represented by:

- a table
- a set of ordered pairs
- a graph
- a mapping

Domain: $\{-4, 1, 3, 6\}$

Range: $\{-2, 0, 1, 5\}$

MAPPING

Input **Output**

[Click here to view the other representations](#)

A relation is a pairing of input values and output values. It can be represented by a table, a set of ordered pairs, a graph, or a mapping.

Consider the given relation. Here, it is represented by a table. It can also be represented by a set of ordered pairs, a graph, or a mapping.

Notice in the mapping that an arrow is drawn from each input value to its corresponding output value.

The domain consists of all input values.

The range consists of all output values.

For this relation, the domain is $\{-4, 1, 3, 6\}$. The range is $\{-2, 0, 1, 5\}$.

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Determining If A Relation Is A Function

DETERMINING IF A RELATION IS A FUNCTION

Click the Examples Below to Learn More

Example 1

Example 2

Example 3

Self-Check

Click the examples below to learn more.

- Example 1
- Example 2
- Example 3
- Self-Check

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Example 1

EXAMPLE 1

Find the domain and the range of the relation.

Enter the coordinate values for each point. Then, click submit.

Submit

Find the domain and range of the relation.

To determine the domain and range of a relation represented by a discrete graph, you may find it helpful to begin by representing the relation as a set of ordered pairs.

Enter the coordinate values for each point. Then, click submit.

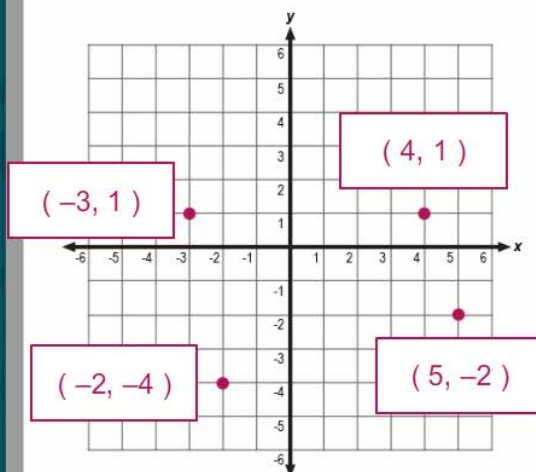
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Example 1 (continued)

EXAMPLE 1

Find the domain and the range of the relation.

The coordinates of each point are $(-3, 1)$, $(-2, -4)$, $(4, 1)$, and $(5, -2)$.



Next

Find the domain and range of the relation.

The coordinates for each point are $(-3, 1)$, $(-2, -4)$, $(4, 1)$, and $(5, -2)$.

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Example 1 (continued)

EXAMPLE 1

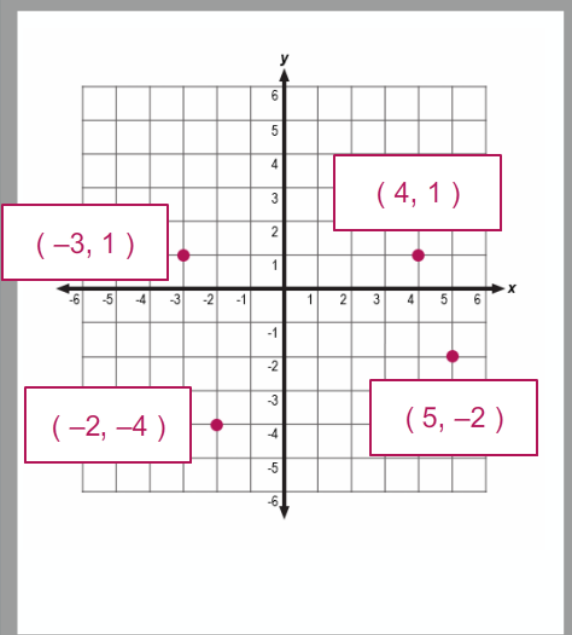
Find the domain and the range of the relation.

$\{ (-3, 1), (-2, -4), (4, 1), (5, -2) \}$

Which of the following is the domain of the relation?

$\{ -3, -2, 4, 5 \}$

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



Find the domain and range of the relation.

Now that you have determined the coordinates of each point, you can represent the relation as a set of ordered pairs.

$$\{(-3, 1), (-2, -4), (4, 1), (5, -2)\}$$

Which of the following is the domain of the relation?

- A) $\{-3, -2, 4, 5\}$
- B) $\{-4, -2, 1\}$

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Example 1 (continued)

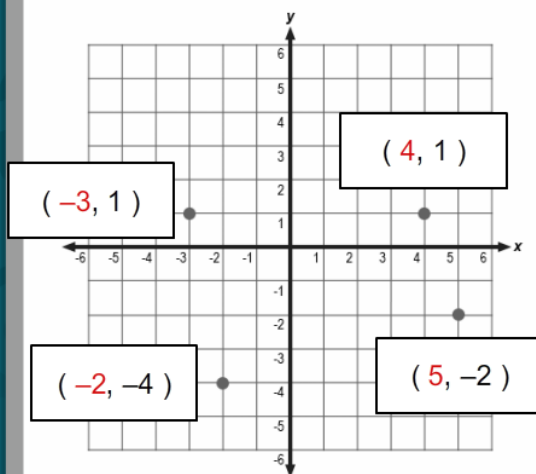
EXAMPLE 1

Find the domain and the range of the relation.

$$\{(-3, 1), (-2, -4), (4, 1), (5, -2)\}$$

The domain of the relation is $\{-3, -2, 4, 5\}$.

$$\{-3, -2, 4, 5\}$$



Next

Find the domain and range of the relation.

$$\{(-3, 1), (-2, -4), (4, 1), (5, -2)\}$$

The domain of the relation is $\{-3, -2, 4, 5\}$.

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Example 1 (continued)

EXAMPLE 1	KEY POINTS
<p>Find the domain and the range of the relation.</p> $\{(-3, 1), (-2, -4), (4, 1), (5, -2)\}$ <p>The domain is the set of numbers that includes each x-coordinate of the relation: $\{-3, -2, 4, 5\}$.</p> <p>The range is the set of numbers that includes each y-coordinate of the relation: $\{-4, -2, 1\}$.</p>	<ul style="list-style-type: none">• When listing the elements of a set, it is a common practice to list the elements in ascending order.• Although 1 is an output value that occurs more than once, it is only necessary to list it once in the set of elements. <p>Menu</p>

Find the domain and range of the relation.

$$\{(-3, 1), (-2, -4), (4, 1), (5, -2)\}$$

The **domain** is the set of numbers that includes each x -coordinate of the relation: $\{-3, -2, 4, 5\}$.

The **range** is the set of numbers that includes each y -coordinate of the relation: $\{-4, -2, 1\}$.

A couple of things to notice:

- When listing the elements of a set, it is a common practice to list the elements in ascending order.
- Although 1 is an output value that occurs more than once, it is only necessary to list it once in the set of elements.

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Example 2

EXAMPLE 2

Is the relation a function?

A function is a relation in which each element of the **domain** is paired with only one element of the **range**.

Each **input** has only one **output**.

x	y
-2	-3
3	7
5	11
8	17

The relation above is a function.

Is the relation a function?

A function is a relation in which each element of the **domain** is paired with only one element of the **range**.

Consider the relation represented by the table of values. This relation is a function because each element of the domain is paired with only one element of the range. Or in other words, each **input** has only one **output**.

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Example 2 (continued)

EXAMPLE 2

Is the relation a function?

A function is a relation in which each element of the **domain** is paired with only one element of the **range**.

Each **input** has only one **output**.



$\{(-2, 3), (-2, 5), (6, 7), (8, 12)\}$

The relation above is not a function, because -2 is paired with both 3 and 5 .

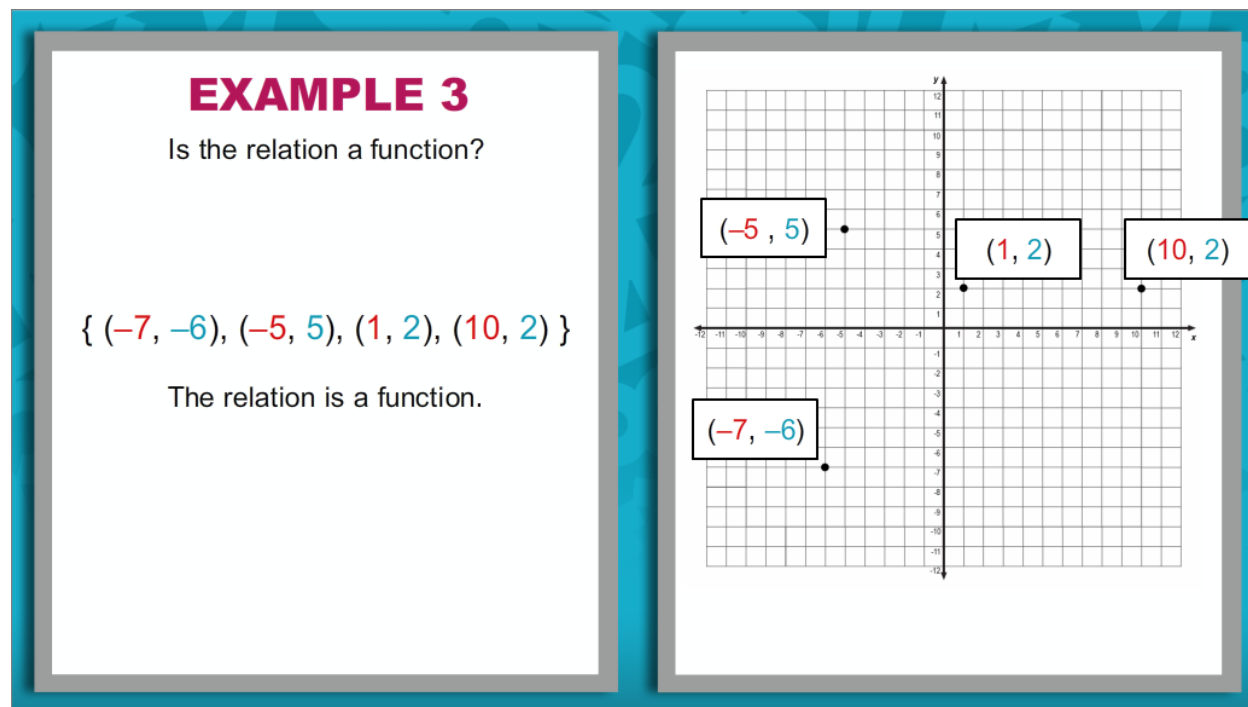
Is the relation a function?

The relation represented by the set of ordered pairs, however, is not a function. Notice that one of the elements of the domain is paired with two different elements of the range. Or, in other words, one of the input values has two different outputs.

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Example 3



Is the relation a function?

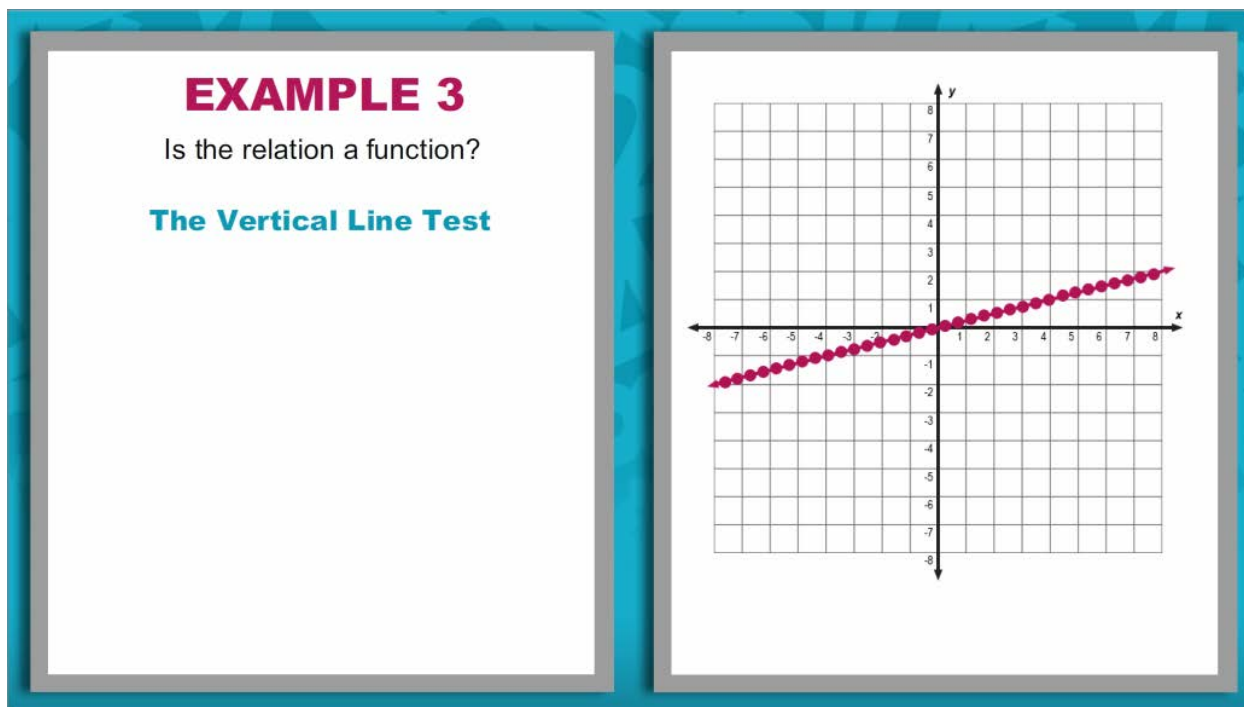
$$\{(-7, -6), (-5, 5), (1, 2), (10, 2)\}$$

The relation is a function.

You can determine if a relation represented by a discrete graph is a function by finding the location of each point. You can then verify that each input value is paired with only one output value.

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Example 3 (continued)



Is the relation a function?

When given a continuous graph, however, it is impossible to identify each point on the graph – as there are an infinite number of points.

So how can you determine if a continuous graph represents a function? You can use the vertical line test.

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Example 3 (continued)

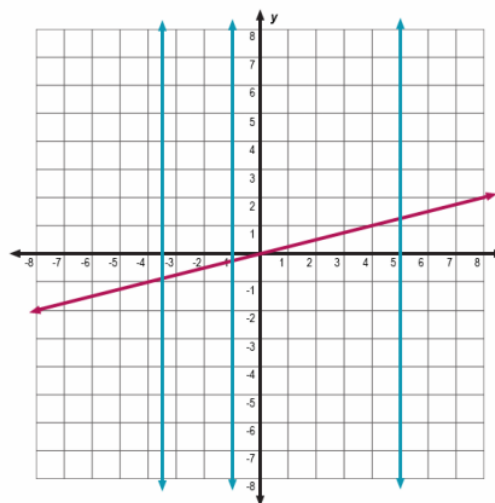
EXAMPLE 3

Is the relation a function?

The Vertical Line Test

A strategy to determine graphically whether an element of the domain is paired with more than one element of the range.

A relation is a function if no vertical line passes through more than one point on the graph.



The relation above is a function.

Is the relation a function?

The Vertical Line Test

The vertical line test is a strategy to determine graphically that there exists an element of the domain that is paired with more than one element of the range.

When given a relation represented by a graph, the relation is a function if no vertical line passes through more than one point on the graph.

The relation represented by this graph is a function because there is no vertical line that passes through more than one point on the graph.

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Example 3 (continued)

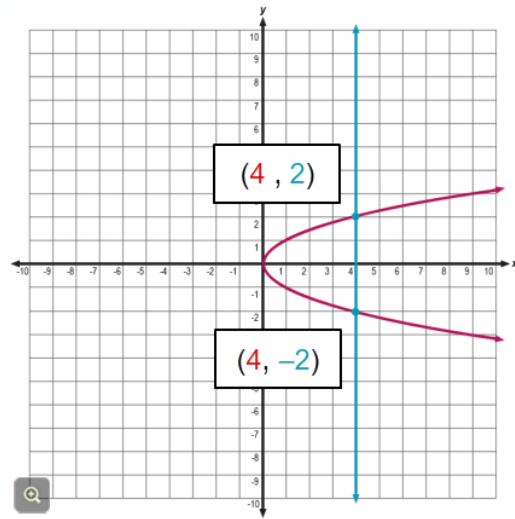
EXAMPLE 3

Is the relation a function?

The Vertical Line Test

A strategy to determine graphically whether an element of the domain is paired with more than one element of the range.

A relation is a function if no vertical line passes through more than one point on the graph.



The relation above is not a function.


Is the relation a function?

Now, consider this relation. This relation is not a function because there is a vertical line that passes through more than one point on the graph.

This relation failed the vertical line test. Therefore, it is not a function.

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Self-Check 1

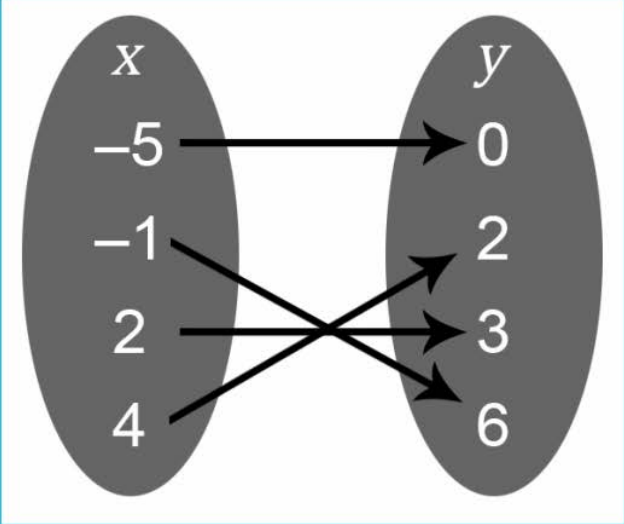
 **Self-Check**

Which relation does **NOT** have a range of $\{0, 2, 3, 6\}$?

- Relation A
- Relation B
- Relation C
- Relation D

SUBMIT

Relation A



CLICK HERE to view additional options.

Solve the problem in the image above to check your understanding of the content.

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Topic 1 Content: Determining if a Relation is a Function Notes

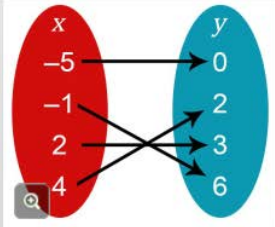
Self-Check 1: Answer

Self-Check **Relation A**

Correct

That's correct! The correct answer is relation D.

Relation A



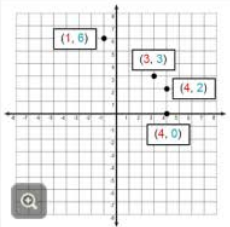
Range: $\{0, 2, 3, 6\}$

Relation B

input	output
9	6
1	2
4	3
8	0

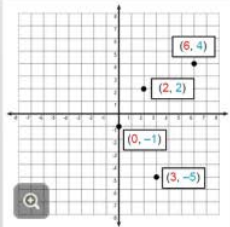
Range: $\{0, 2, 3, 6\}$

Relation C



Range: $\{0, 2, 3, 6\}$

Relation D



Range: $\{-5, -1, 2, 4\}$


Continue

SUBMIT [CLICK HERE to view additional options.](#)

For your reference, the image above shows the correct solution to the self-check problem.

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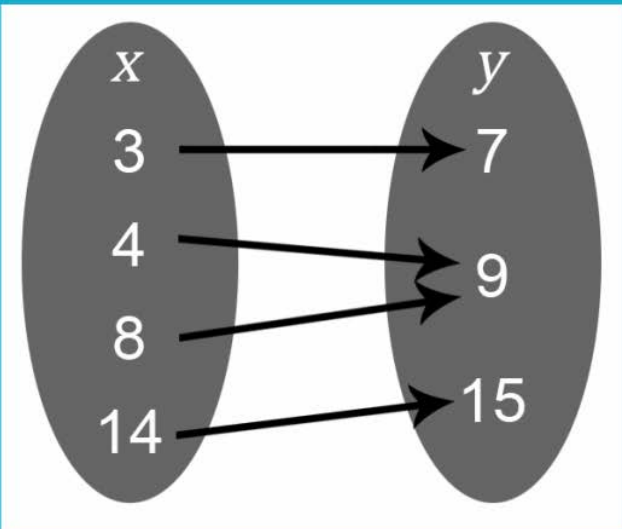
Self-Check 2

 **Self-Check**

Is the relation a function?

- Yes
- No

SUBMIT



The diagram shows two sets, X and Y, each enclosed in a grey oval. Set X contains the numbers 3, 4, 8, and 14. Set Y contains the numbers 7, 9, and 15. Arrows indicate the following mappings: 3 maps to 7, 4 maps to 9, 8 maps to 9, and 14 maps to 15. This represents a relation where the domain is X and the codomain is Y.

Solve the problem in the image above to check your understanding of the content.

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Self-Check 2: Answer

Correct

That's correct!

$\{(3, 7), (4, 9), (8, 9), (14, 15)\}$

The relation is a function. Each input has only one output.


Continue

SUBMIT

For your reference, the image above shows the correct solution to the self-check problem.

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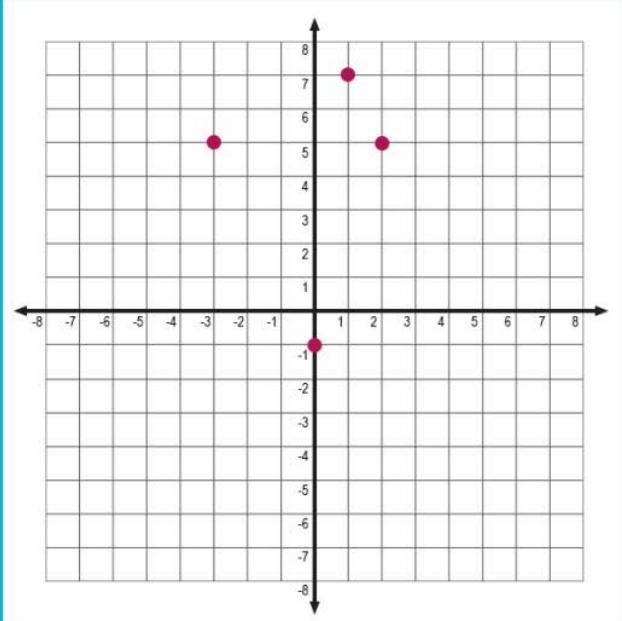
Self-Check 3

**Self-Check**

Is the relation a function?

- Yes
- No

SUBMIT



Solve the problem in the image above to check your understanding of the content.

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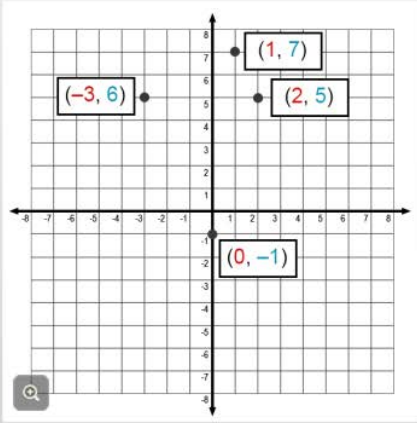
Self-Check 3: Answer

Correct

That's correct!

$$\{(-3, 6), (0, -1), (1, 7), (2, 5)\}$$

The relation is a function. Each input has only one output.



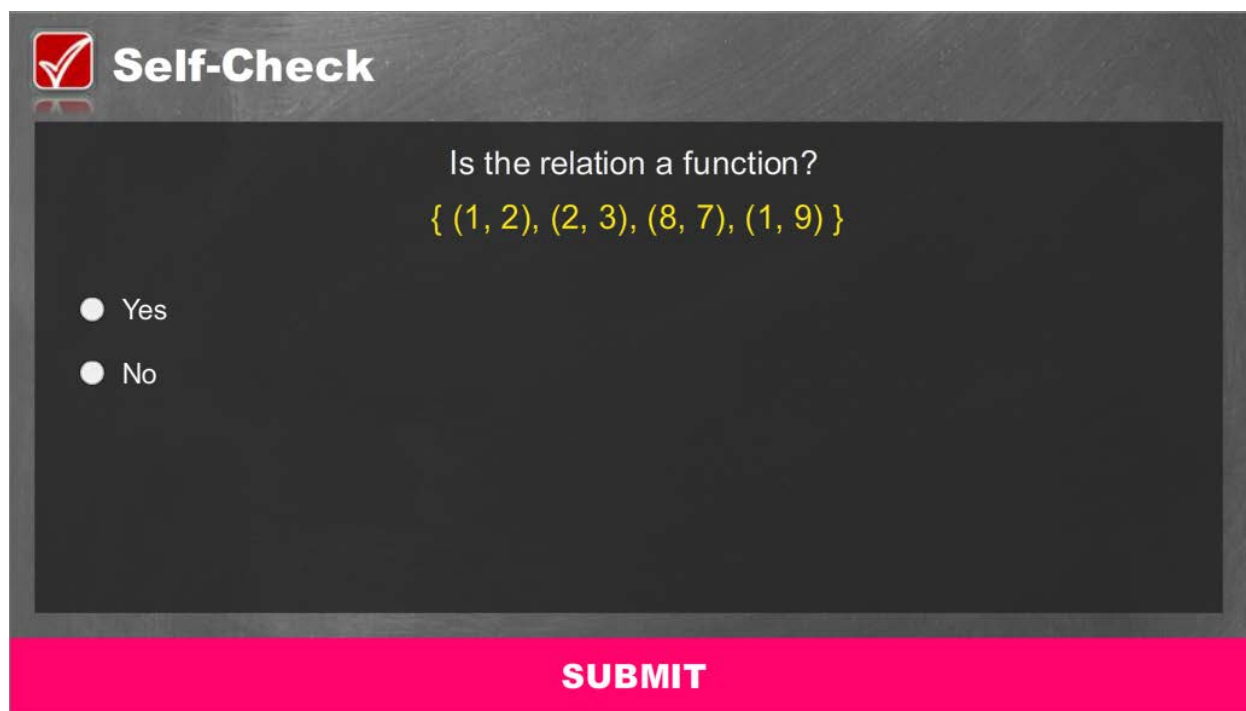
Continue

SUBMIT

For your reference, the image above shows the correct solution to the self-check problem.

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Self-Check 4

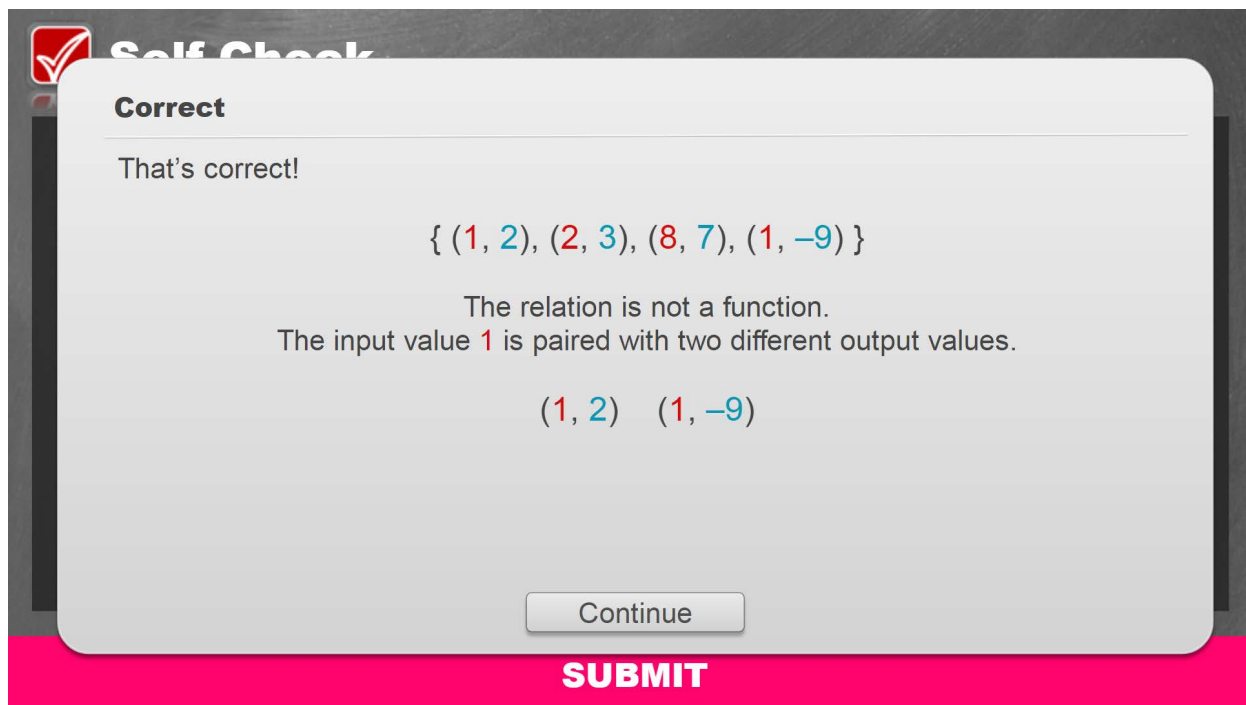


The image shows a digital interface for a self-check. At the top left, there is a red checkmark icon followed by the text "Self-Check". The main area is a dark grey rectangle containing the question "Is the relation a function?" and the set of ordered pairs $\{(1, 2), (2, 3), (8, 7), (1, 9)\}$ in yellow text. Below the question are two radio button options: "Yes" and "No". At the bottom of the interface is a bright pink bar with the word "SUBMIT" in white capital letters.

Solve the problem in the image above to check your understanding of the content.

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Self-Check 4: Answer

A screenshot of a self-check feedback screen. At the top left, there is a red checkmark icon and the text "Self Check". Below this, the word "Correct" is displayed in bold. The text "That's correct!" follows. A set of ordered pairs is shown: $\{(1, 2), (2, 3), (8, 7), (1, -9)\}$. Below this, it states "The relation is not a function." and "The input value 1 is paired with two different output values." Two ordered pairs, $(1, 2)$ and $(1, -9)$, are listed below. At the bottom of the feedback box is a "Continue" button. Below the feedback box, the word "SUBMIT" is written in bold white text on a red background.

Correct

That's correct!

$\{(1, 2), (2, 3), (8, 7), (1, -9)\}$

The relation is not a function.
The input value 1 is paired with two different output values.

$(1, 2)$ $(1, -9)$


Continue

SUBMIT

For your reference, the image above shows the correct solution to the self-check problem.

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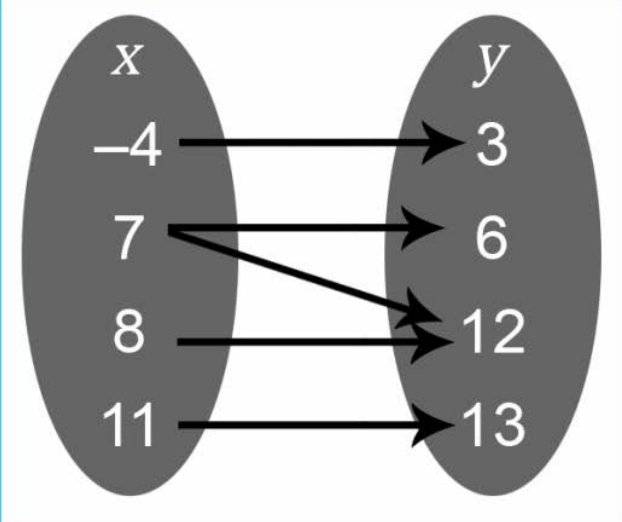
Self-Check 5

 **Self-Check**

Is the relation a function?

- Yes
- No

SUBMIT



Solve the problem in the image above to check your understanding of the content.

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Self-Check 5: Answer

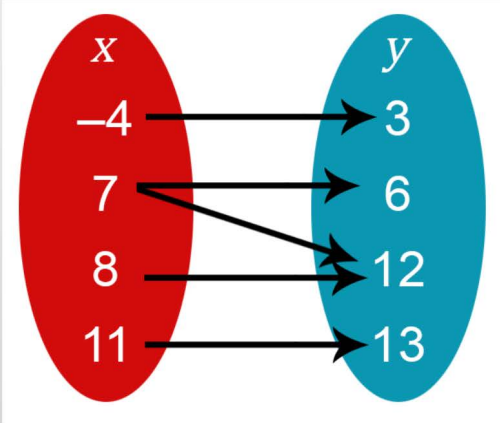
Correct

That's correct!

$\{(3, 7), (4, 9), (8, 9), (14, 15)\}$

The relation is not a function. The input value **7** is paired with two different output values.

$(7, 6)$ $(7, 12)$




Continue

SUBMIT

For your reference, the image above shows the correct solution to the self-check problem.

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Self-Check 6

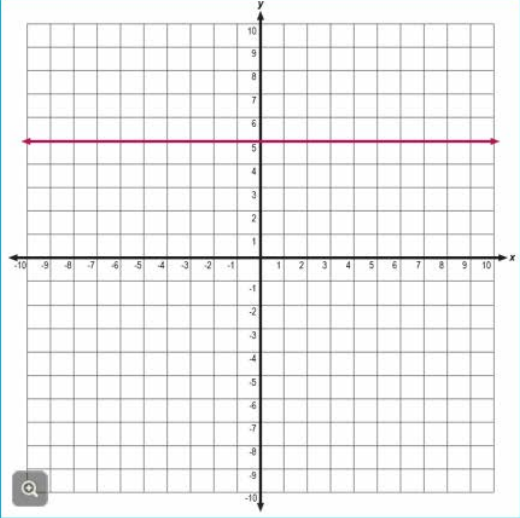
 **Self-Check**

Which relation is **NOT** a function?

- Relation A
- Relation B
- Relation C
- Relation D

SUBMIT

Relation A



[CLICK HERE](#) to view additional options.

Solve the problem in the image above to check your understanding of the content.

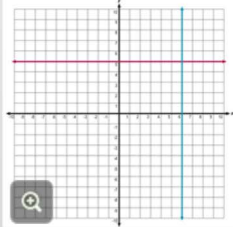
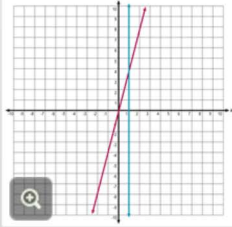
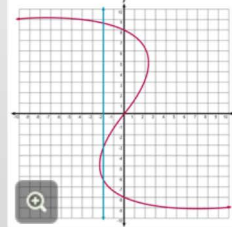
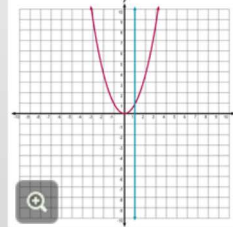
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Self-Check 6: Answer

Self Check **Relation A**

Correct

That's correct! The correct answer is relation C.

Relation A	Relation B	Relation C	Relation D
			
This relation passes the vertical line test. Therefore, it is a function.	This relation passes the vertical line test. Therefore, it is a function.	This relation fails the vertical line test. It is not a function.	This relation passes the vertical line test. Therefore, it is a function.

[Continue](#)

SUBMIT [CLICK HERE to view additional options.](#)

For your reference, the image above shows the correct solution to the self-check problem.

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Conclusion



You have reached the conclusion of this lesson where you explored relations and function.