8.5G Identify Functions Using Sets of Ordered Pairs, Tables, Mappings and Graphs

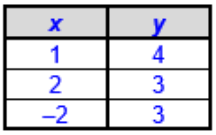
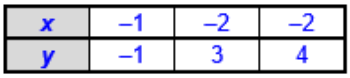
Definitions:

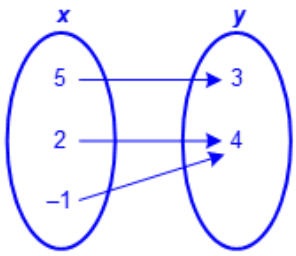
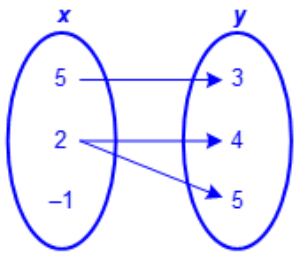
Relation – a set of ordered pairs (x, y) where the x is associated with a specific y.

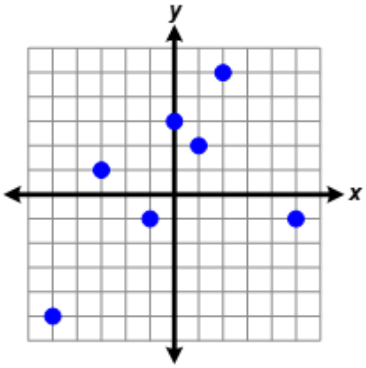
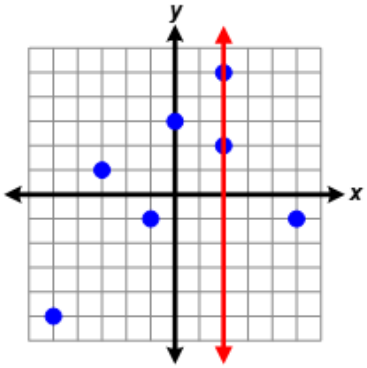
Function – relation in which each element of the input(x) is paired with exactly one element of the output(y).

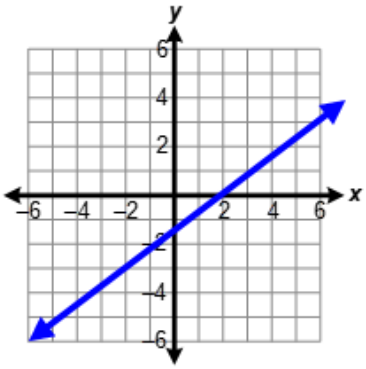
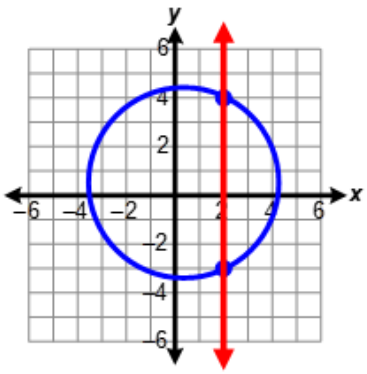
- All functions are relations but not all relations are functions.

Example of a Relation that is a Function	Example of a Relation that is NOT a Function
{(5, 4), (–2, 6), (0, 5), (1, 3)} The set of ordered pairs represents a function because each input value (x) corresponds with exactly one output value (y).	{(4, 3), (1, 5), (2, –2), (1, –2)} The set of ordered pairs does not represent a function because the input value 1 corresponds with more than one output value, 5 and –2.

Example of a Relation that is a Function	Example of a Relation that is NOT a Function
 The table of related data represents a function because each input value (x) corresponds with exactly one output value (y).	 The table of related data does not represent a function because the input value –2 corresponds with more than one output value, 3 and 4.

Example of a Relation that is a Function	Example of a Relation that is NOT a Function
 The mapping represents a function because each input value (x) corresponds with exactly one output value (y).	 The mapping does not represent a function because the input value 2 corresponds with more than one output value, 4 and 5.

Example of a Relation that is a Function	Example of a Relation that is NOT a Function
	
The graph represents a function because each input value (x) corresponds with exactly one output value (y). The relation passes the vertical line test because no one vertical line exists that would contain more than one ordered pair.	The graph does not represent a function because the input value 2 corresponds with more than one output value, 2 and 5. The relation fails the vertical line test for a function because there exists at least one vertical line that contains more than one output value for the same input value: (2, 2) and (2, 5).

Example of a Relation that is a Function	Example of a Relation that is NOT a Function
	
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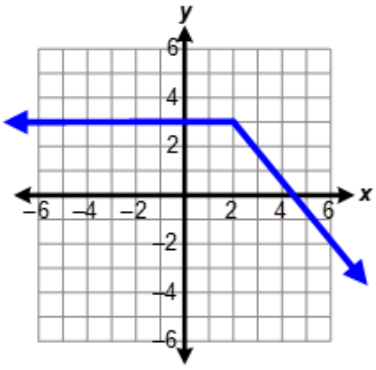
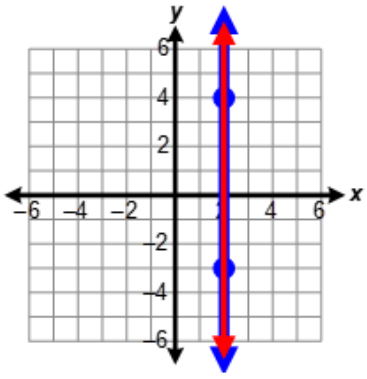
Example of a Relation that is a Function	Example of a Relation that is NOT a Function
	
The graph represents a function because each input value (x) corresponds with exactly one output value (y). The relation passes the vertical line test because no one vertical line exists that would contain more than one ordered pair.	The graph does not represent a function because the input value 2 corresponds with more than one output value, 4 and –3. In fact, the input value 2 will have an infinite number of output values associated with it. The relation fails the vertical line test for a function because there exists at least one vertical line that contains more than one output value for the same input value.

1 Which set of ordered pairs does not show *y* as a function of *x*?

A {(3,–2);(5,–3);(7,–4);(9,–5)}

B {(3,–2);(6,–2);(9,–2);(12,–2)}

C {(4,–2);(5,–3);(6,–4);(7,–5)}

D {(4,–2);(5,–3);(4,–8);(5,–9)}

To find out which set of ordered pairs does not represent a function let us revisit the definition of a function. A function is a relation in which each element of the input(x) is paired with exactly one element of the output(y).

In other words, the definition is saying that for each x-value I will get one and only one y-value.

Answer choice A is a function as each x-value is paired with only one y-value.

Answer choice B is a function as each x-value is paired with only one y-value.

Answer choice C is a function as each x-value is paired with only one y-value.

Answer choice D is not a function as the x-value 4 is paired with the y-values -2 and -8.

2 The set of ordered pairs represents a relationship between *x* and *y*.

$$\left\{\left(\frac{2}{5}, 3\right), (0.4, 4), \left(\frac{4}{5}, 5\right), (0.8, 4)\right\}$$

Which statement about the set of ordered pairs is true?

F The relationship represents *y* as a function of *x*, because each *x*-value is associated with exactly one *y*-value.

G The relationship does not represent *y* as a function of *x*, because at least one *x*-value is associated with more than one *y*-value.

H The relationship represents *y* as a function of *x*, because two different *y*-values are associated with the same *x*-value.

J The relationship does not represent *y* as a function of *x*, because one *y*-value is associated with two *x*-values.

Looking at the answer choices I know that I am trying to determine if the relation is a function or not a function. This question is trying to be tricky by writing x-values in fractional form and decimal form. However, $\frac{2}{5} = 0.4$ and $\frac{4}{5} = 0.8$. I notice that my x-value $\frac{2}{5}$ or 0.4 is paired with the y-values 3 and 4 and my x-value $\frac{4}{5}$ or 0.8 is paired with the y-values 5 and 5. In order for a relation to be a function each x-value can only be paired with exactly one and only one y-value. Therefore, the relationship does not represent a function of x. So we are able to eliminate answer choices F and H. Lastly, we just need to remember why the relation was not a function and we found the relation to not be a function because in this case two of the x-values where associated with more than one y-value but it only takes at least one x-value to be associated with a more than one y-value to not be a function. A relation is not eliminated from being a function if one y-value is associated with two x-values.

Answer choice G would be the correct answer.

3 Which of the following represents a function?

F

x	1	2	1	2	4
y	6	7	8	1	9

{(1, 6), (2, 7), (1, 8), (2, 1), (4, 9)}

G

x	1	2	2	2	5
y	7	11	15	18	24

{(1, 7), (2, 11), (2, 15), (2, 18), (5, 24)}

H

x	1	2	3	4	5
y	3	3	3	3	3

{(1, 3), (2, 3), (3, 3), (4, 3), (5, 3)}

J

x	1	1	1	1	1
y	3	4	5	6	7

{(1, 3), (1, 4), (1, 5), (1, 6), (1, 7)}

This question is very similar to questions #1 and #2 except that are answer choices are in tables. If we needed we could rewrite the tables into an ordered pair format but if the reader is familiar with tables then it isn't necessary. For this example I went ahead and wrote out the tables in ordered pair format shown above next to the corresponding table.

Answer choice F is **not** a function as the x-value 1 is associated with the y-values 6 and 8. Also, the x-value 2 is associated with the y-values 1 and 7.

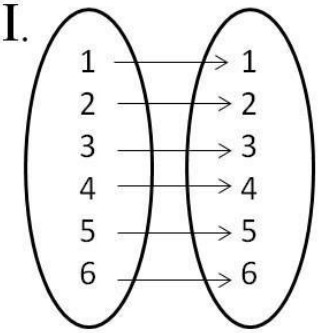
Answer choice G is **not** a function as the x-value 2 is associated with the y-vales 11, 15, and 18.

Answer choice H is a function as each x-value is associated with only one y-value. This answer choice tries to trick you by having the y-value 3 being associated with the x-values 1, 2, 3, 4, and 5 but a y-value associated with 1 or more x-values does not eliminate the relation from being a function.

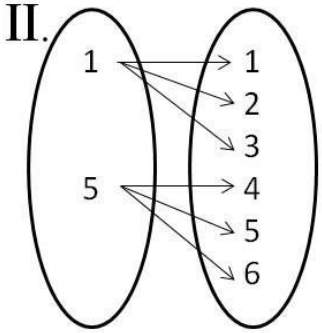
Answer choice J is **not** a function as the x-value 1 is associated with the y-values 3, 4, 5, 6, and 7.

4 Which of the following represents a function?

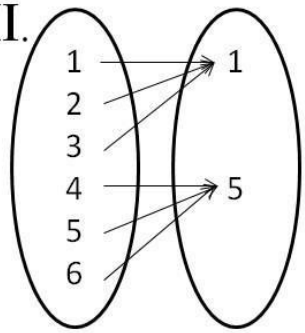
I.



II.



III.



A I only

B I and III only

C II only

D II and III only

A mapping diagram is very similar to ordered pairs and tables. Once again, we can rewrite the mapping diagram into ordered pairs but it is not necessary if the reader is familiar with mapping diagrams.

I. {(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)}

We can see that the mapping diagram I is a function as each x-value is associated with one and only one y-value.

II. {(1, 1), (1, 2), (1, 3), (5, 4), (5, 5), (5, 6)}

Mapping diagram II is **not** a function as the x-value 1 is associated with the y-values 1, 2, and 3 as well as the x-value 5 is associated with the y-values 4, 5, and 6.

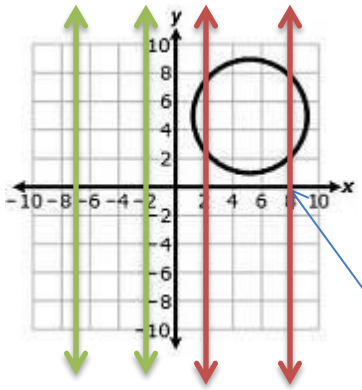
III. {(1, 1), (2, 1), (3, 1), (4, 5), (5, 5), (5, 6)}

Mapping diagram III is a function as each x-value is associated with one and only one y-value.

Answer choice B is the correct answer.

5 Which graph represents y as a function of x?

F



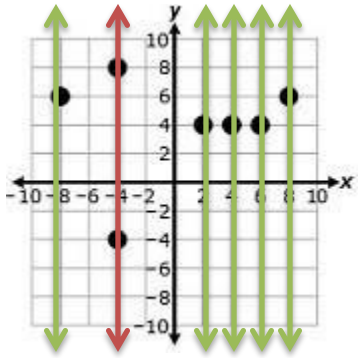
For a graph to be a function the same rules still apply. However, we can do a vertical line test to decide if a graph represents a function or not.

Vertical Line Test – We can draw an infinite amount of vertical lines(up and down) on the graph and if even one of those vertical lines crosses our graph more than once, then the graph is not a function.

This test works as it helps us identify if one of the x-values on the graph is associated with one or more y-values as this graph has the x-value 8 associated with the y–values 2 and 8.

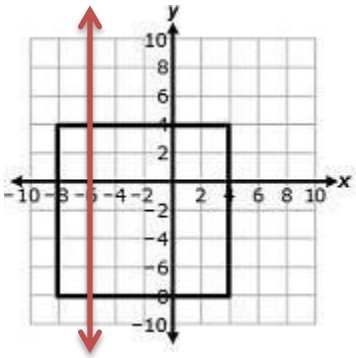
This graph is **not** a function as it fails the vertical line test.

G



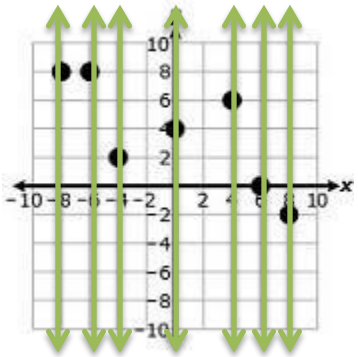
This graph is **not** a function as it fails the vertical line test.

H



This graph is **not** a function as it fails the vertical line test.

J



This graph is a function as it passes the vertical line test.

Answer choice J is the correct answer.

6 Which representation does **not** show *y* as a function of *x*?

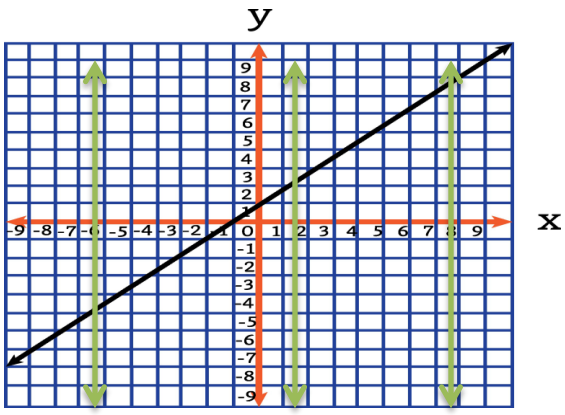
F

x	1	3	5	7
y	-6	-18	-30	-42

{(1, -6), (3, 18), (5, -30), (7, -42)}

This table represents a function as each x-value is associated with one and only one y-value.

G



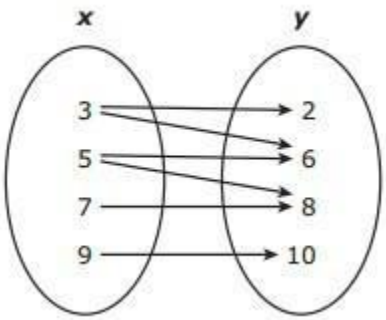
The graph represents a function as it passes the vertical line test.

H

{(2, -2), (3, -2), (7, -2), (11, -2)}

The relation is a function as each x-value is associated with one and only one y-value.

J



The mapping diagram is **not** a function as the x-value 3 is associated with the y-values 2 and 6.

The x-value 5 is also associated with two or more y-values.

Answer choice J is the correct answer.