

2.1

Represent Relations and Functions

Goal • Represent relations and graph linear functions.

Your Notes

VOCABULARY

Relation

Domain

Range

Function

Equation in two variables

Linear function

REPRESENTING RELATIONS

A relation can be represented in the following ways:

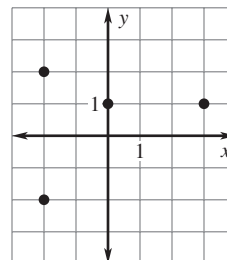
Ordered Pairs

$(-2, 2)$
 $(-2, -2)$
 $(0, 1)$
 $(3, 1)$

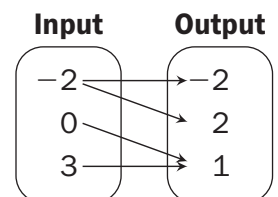
Table

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

Graph



Mapping Diagram



2.1

Represent Relations and Functions

Goal • Represent relations and graph linear functions.

Your Notes

VOCABULARY

Relation A mapping, or pairing, of input values with output values

Domain The set of input values in a relation

Range The set of output values in a relation

Function A relation for which each input has exactly one output

Equation in two variables An equation that has an independent or input variable and a dependent or output variable that depends on the value of the input variable

Linear function A function that can be written in the form $y = mx + b$, where m and b are constants

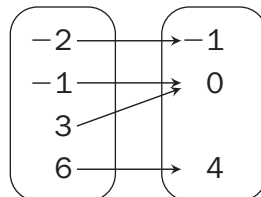
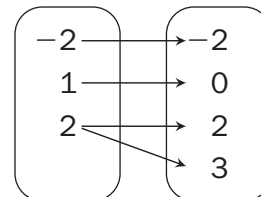
REPRESENTING RELATIONS

A relation can be represented in the following ways:

Ordered Pairs	Table	Graph	Mapping Diagram																		
$(-2, 2)$ $(-2, -2)$ $(0, 1)$ $(3, 1)$	<table><tr><th>x</th><th>y</th></tr><tr><td>-2</td><td>2</td></tr><tr><td>-2</td><td>-2</td></tr><tr><td>0</td><td>1</td></tr><tr><td>3</td><td>1</td></tr></table>	x	y	-2	2	-2	-2	0	1	3	1		<table><tr><th>Input</th><th>Output</th></tr><tr><td>-2</td><td>-2</td></tr><tr><td>0</td><td>2</td></tr><tr><td>3</td><td>1</td></tr></table>	Input	Output	-2	-2	0	2	3	1
x	y																				
-2	2																				
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Example 1 Identify functions

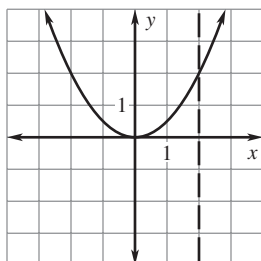
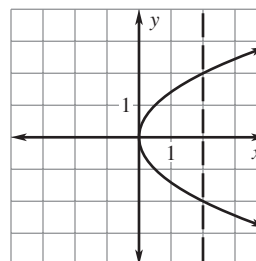
Tell whether each relation is a function. Explain.

a. Input Output**b.** Input Output**Solution****a.** The relation _____ a function because each input is mapped onto _____ output.**b.** The relation _____ a function because the input _____ is mapped onto _____ and _____.**✓ Checkpoint** Complete the following exercise.

- 1.** Is the relation given by the ordered pairs $(-5, 2)$, $(-3, -1)$, $(0, 0)$, $(0, 2)$ and $(0, 5)$ a function? Explain.

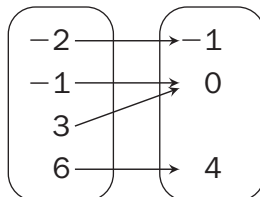
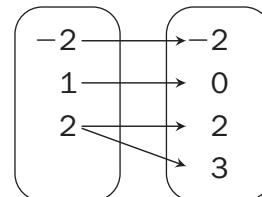
VERTICAL LINE TEST

A relation is a function if and only if no _____ line intersects the graph of the relation at more than _____.

Function**Not a function**

Example 1 Identify functions

Tell whether each relation is a function. Explain.

a. Input Output**b.** Input Output**Solution**

- a.** The relation is a function because each input is mapped onto exactly one output.
- b.** The relation is not a function because the input 2 is mapped onto 2 and 3.

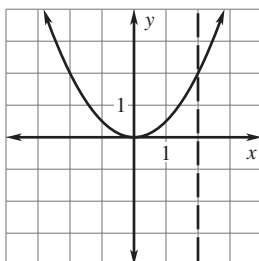
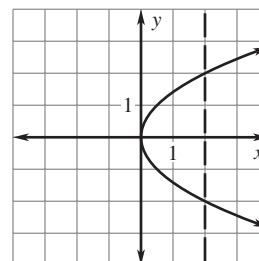
✓ **Checkpoint** Complete the following exercise.

- 1.** Is the relation given by the ordered pairs $(-5, 2)$, $(-3, -1)$, $(0, 0)$, $(0, 2)$ and $(0, 5)$ a function? Explain.

No, the relation is not a function because the value 0 maps to 0, 2, and 5.

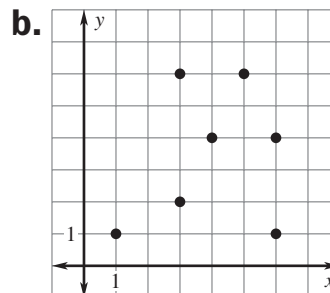
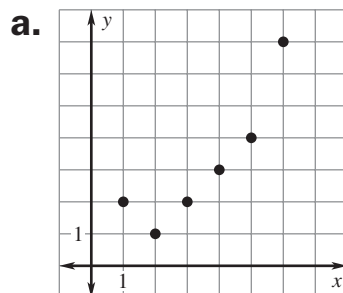
VERTICAL LINE TEST

A relation is a function if and only if no vertical line intersects the graph of the relation at more than one point.

Function**Not a function**

Example 2 Use the vertical line test

Is the relation represented by the graph a function? Explain.

**Solution**

- a. This graph _____ represent a function because no vertical line intersects the graph at more than _____.
- b. This graph _____ represent a function because the vertical lines at $x = \underline{\hspace{1cm}}$ and at $x = \underline{\hspace{1cm}}$ intersect the graph at more than one point.

GRAPHING EQUATIONS IN TWO VARIABLES

To graph an equation in two variables, follow these steps:

Step 1 Construct a table of _____.

Step 2 Plot enough points from the table to recognize a _____.

Step 3 Connect the points with a _____ or _____.

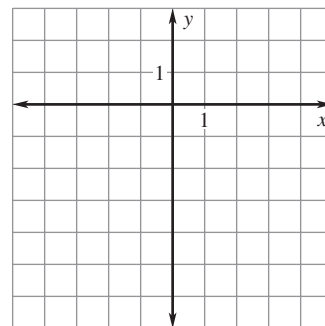
Example 3 Graph an equation in two variables

Graph the equation $y = -2x - 2$.

Solution

Step 1 Construct a table of values.

x	-2	-1	0	1	2
y	___	___	___	___	___

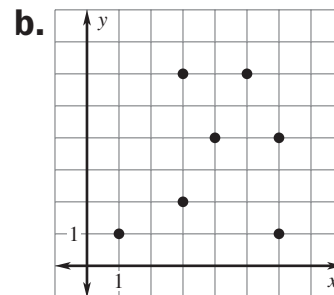
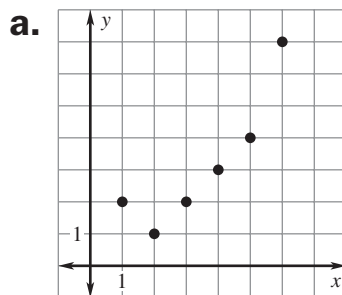


Step 2 Plot the points. Notice that they all lie on a _____.

Step 3 _____ the points with a line.

Example 2**Use the vertical line test**

Is the relation represented by the graph a function? Explain.

**Solution**

- a. This graph does represent a function because no vertical line intersects the graph at more than one point.
- b. This graph does not represent a function because the vertical lines at $x = \underline{3}$ and at $x = \underline{6}$ intersect the graph at more than one point.

GRAPHING EQUATIONS IN TWO VARIABLES

To graph an equation in two variables, follow these steps:

Step 1 Construct a table of values.

Step 2 Plot enough points from the table to recognize a pattern.

Step 3 Connect the points with a line or curve.

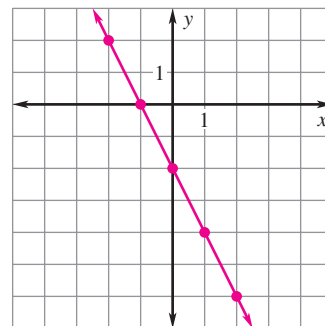
Example 3**Graph an equation in two variables**

Graph the equation $y = -2x - 2$.

Solution

Step 1 Construct a table of values.

x	-2	-1	0	1	2
y	<u>2</u>	<u>0</u>	<u>-2</u>	<u>-4</u>	<u>-6</u>



Step 2 Plot the points. Notice that they all lie on a line.

Step 3 Connect the points with a line.

Example 4 Classify and evaluate functions

Tell whether the function is linear. Then evaluate the function when $x = -3$.

a. $f(x) = 6x + 10$

b. $g(x) = 2x^2 + 4x - 1$

Solution

- a. The function f is _____ because it has the form $f(x) = mx + b$.

$$f(x) = 6x + 10$$

Write function.

$$f(\text{____}) = 6(\text{____}) + 10$$

$$= \text{____}$$

Substitute _____ for x .

Simplify.

- b. The function g is _____ because it has an x^2 -term.

$$g(x) = 2x^2 + 4x - 1$$

Write function.

$$g(\text{____}) = 2(\text{____})^2 + 4(\text{____}) - 1$$

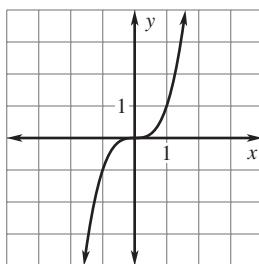
$$= \text{____}$$

Substitute _____ for x .

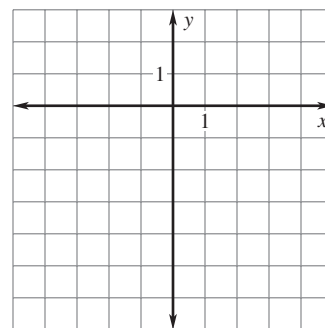
Simplify.

✓ **Checkpoint** Complete the following exercises.

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



3. Graph the equation $y = 2x - 3$.

**Homework**

Tell whether the function is linear. Then evaluate the function when $x = -1$.

4. $f(x) = 2x^3 + 6 - x$

5. $g(x) = 4x + 9$

Example 4 Classify and evaluate functions

Tell whether the function is linear. Then evaluate the function when $x = -3$.

a. $f(x) = 6x + 10$

b. $g(x) = 2x^2 + 4x - 1$

Solution

- a. The function f is linear because it has the form $f(x) = mx + b$.

$$f(x) = 6x + 10$$

Write function.

$$f(-3) = 6(-3) + 10$$

$$= -8$$

Substitute -3 for x .

Simplify.

- b. The function g is not linear because it has an x^2 -term.

$$g(x) = 2x^2 + 4x - 1$$

Write function.

$$g(-3) = 2(-3)^2 + 4(-3) - 1$$

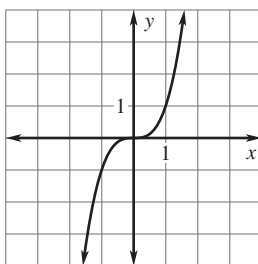
$$= 5$$

Substitute -3 for x .

Simplify.

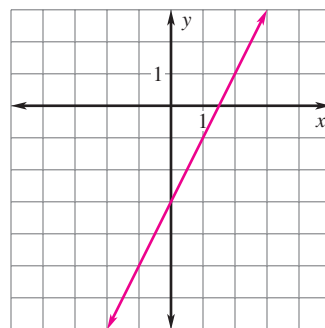
✓ **Checkpoint** Complete the following exercises.

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



is a function

3. Graph the equation $y = 2x - 3$.

**Homework**

Tell whether the function is linear. Then evaluate the function when $x = -1$.

4. $f(x) = 2x^3 + 6 - x$
not linear; 5

5. $g(x) = 4x + 9$
linear; 5