

2.1 – Represent Relations and Functions

Relation – a pairing of input values to output values

Domain – the set of input values

Range – the set of output values

KEY CONCEPT

For Your Notebook

Representing Relations

A relation can be represented in the following ways.

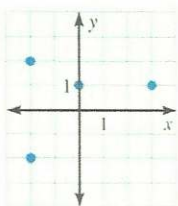
Ordered Pairs

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

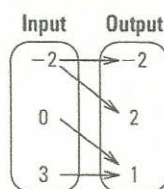
Table

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

Graph



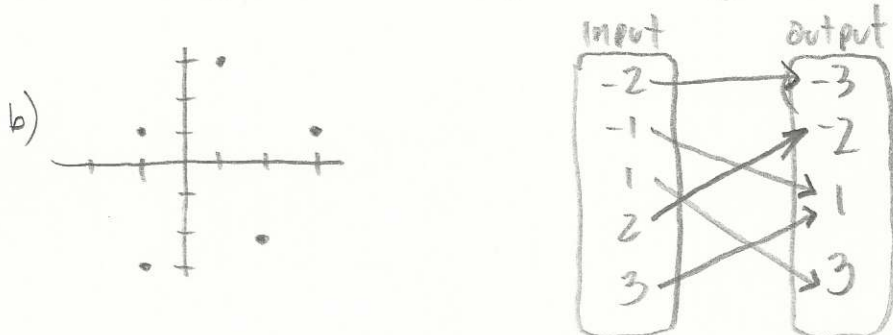
Mapping Diagram



Example 1 Consider the relation given by the ordered pairs $(-2, -3)$, $(-1, 1)$, $(1, 3)$, $(2, -2)$, and $(3, 1)$

- Identify the domain and range
- Represent the relation using a graph and a mapping diagram

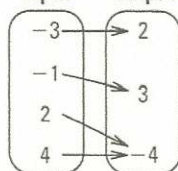
a) $d: \{-2, -1, 1, 2, 3\}$ $r: \{-3, -2, 1, 3\}$



Function – a relation where each input has exactly one output, if any input has more than one output, the relation is NOT a function

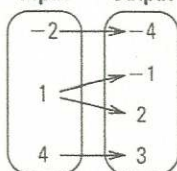
Example 2 Tell whether the relation is a function. Explain

a. Input Output



yes

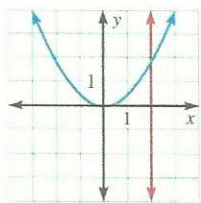
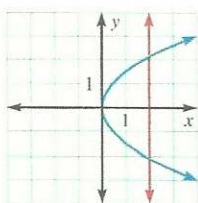
b. Input Output



NO. Input 1 has 2 different outputs

KEY CONCEPT*For Your Notebook***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****Graphing an equation in two variables****KEY CONCEPT***For Your Notebook***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 a curve.

Example 4 Graph the equation $y = -2x - 1$

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

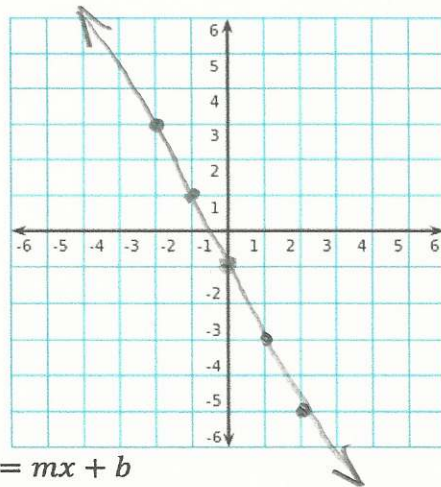
$$y = -2(-2) - 1 = 3$$

$$y = -2(-1) - 1 = 1$$

$$y = -2(0) - 1 = -1$$

$$y = -2(1) - 1 = -3$$

$$y = -2(2) - 1 = -5$$



Linear Function – a function that can be written in the form $y = mx + b$

Functional Notation – written $f(x)$, meaning “the value of the function at x .”

Example 5 Tell whether the function is linear. Then evaluate the function when $x = -4$

a. $f(s) = -x^2 - 2x + 7$

$$f(-4) = -(-4)^2 - 2(-4) + 7$$

$$= -16 + 8 + 7$$

$$f(-4) = -1$$

Non linear

b. $f(x) = 5x + 8$

$$f(-4) = 5(-4) + 8$$

$$= -20 + 8$$

$$f(-4) = -12$$

Linear

HW: 3-8, 10-13, 16-23, 28-32 even, 34-39

EXAMPLE 1

on p. 72
for Exs. 3-9

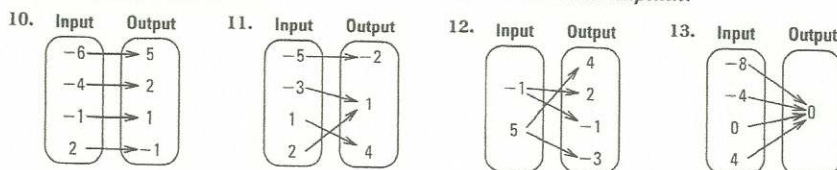
REPRESENTING RELATIONS Identify the domain and range of the given relation. Then represent the relation using a graph and a mapping diagram.

3. $(-2, 3), (1, 2), (3, -1), (-4, -3)$
4. $(5, -2), (-3, -2), (3, 3), (-1, -1)$
5. $(6, -1), (-2, -3), (1, 8), (-2, 5)$
6. $(-7, 4), (2, -5), (1, -2), (-3, 6)$
7. $(5, 20), (10, 20), (15, 30), (20, 30)$
8. $(4, -2), (4, 2), (16, -4), (16, 4)$


EXAMPLE 2

p. 73
Exs. 10-20

IDENTIFYING FUNCTIONS Tell whether the relation is a function. Explain.




ERROR ANALYSIS Describe and correct the error in the student's work.

14. The relation given by the ordered pairs $(-4, 2), (-1, 5), (3, 6),$ and $(7, 2)$ is not a function because the inputs -4 and 7 are both mapped to the output 2 . 

15.

x	0	1	2	1	0
y	5	6	7	8	9

The relation given by the table is a function because there is only one value of x for each value of y . 

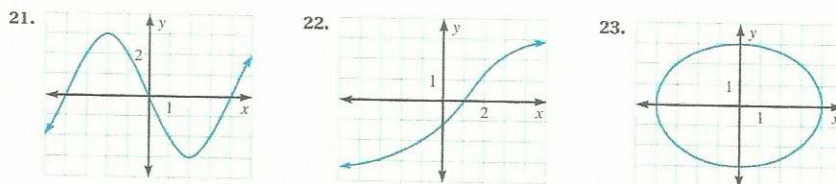
IDENTIFYING FUNCTIONS Tell whether the relation is a function. Explain.

16. $(3, -2), (0, 1), (1, 0), (-2, -1), (2, -1)$
17. $(2, -5), (-2, 5), (-1, 4), (-2, 0), (3, -4)$
18. $(0, 1), (1, 0), (2, 3), (3, 2), (4, 4)$
19. $(-1, -1), (2, 5), (4, 8), (-5, -9), (-1, -5)$
20. **★ MULTIPLE CHOICE** The relation given by the ordered pairs $(-6, 3), (-2, 4), (1, 5),$ and $(4, 0)$ is a function. Which ordered pair can be included with this relation to form a new relation that is also a function?
 (A) $(1, -5)$ (B) $(6, 3)$ (C) $(-2, 19)$ (D) $(4, 4)$

EXAMPLE 3

p. 74
Exs. 21-23

VERTICAL LINE TEST Use the vertical line test to tell whether the relation is a function.



24. **★ SHORT RESPONSE** Explain why a relation is not a function if a vertical line intersects the graph of the relation more than once.

EXAMPLE 4

p. 75
Exs. 25-33

GRAPHING EQUATIONS Graph the equation.

25. $y = x + 2$
26. $y = -x + 5$
27. $y = 3x + 1$
28. $y = 5x - 3$
29. $y = 2x - 7$
30. $y = -3x + 2$
31. $y = -2x$
32. $y = \frac{1}{2}x + 2$
33. $y = -\frac{3}{4}x - 1$

EXAMPLE 5

on p. 75
for Exs. 34-39

EVALUATING FUNCTIONS Tell whether the function is linear. Then evaluate the function for the given value of x .

34. $f(x) = x + 15; f(8)$
35. $f(x) = x^2 + 1; f(-3)$
36. $f(x) = |x| + 10; f(-4)$
37. $f(x) = 6; f(2)$
38. $g(x) = x^3 - 2x^2 + 5x - 8; g(-5)$
39. $h(x) = 7 - \frac{2}{3}x; h(15)$