

## 2.1 Relations and Functions

- **RELATION:** any collection of points
- **FUNCTION:** a relation where each  $x$  is paired with only 1  $y$ .
  - **DOMAIN-**  $x$ 's, input
  - **RANGE-**  $y$ 's, output

**Take note** → **Key Concept** Four Ways to Represent Relations

**Ordered Pairs**  
(input, output)

$(x, y)$   
 $(-3, 4)$   
 $(3, -1)$   
 $(4, -1)$   
 $(4, 3)$

**Mapping Diagram**

Input      Output

Arrows show how to pair each input with an output.

**Table of Values**

$x$ Input	$y$ Output
-3	4
3	-1
4	-1
4	3

**Graph**

Function  $\rightarrow$  each  $x$  is paired with only  $1 y_i$

Not

Yes



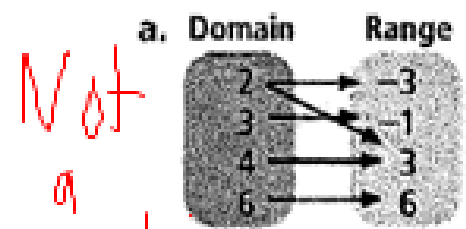
$\{(1,3), (1,4)\}$



$\{(3,6), (4,6)\}$



Ex. 1 What are the domain and range of each relation? Is the relation a function?



Not a function

$D: \{2, 3, 4, 6\}$   
 $R: \{-3, -1, 3, 6\}$

b.  $\{(-7, 14), (9, -7), (14, 7), (7, 14)\}$

$D: \{-7, 7, 9, 14\}$   
 $R: \{-7, 7, 14\}$

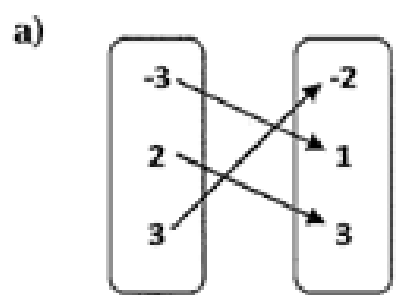
Yes Function

c. How does mapping diagram of a relation that is not a function differ from a mapping diagram of a function?

not: an x is paired with multiple y's

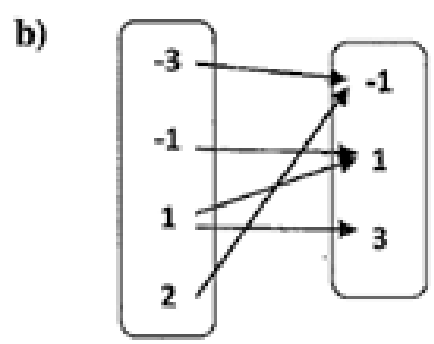
x-value is paired with 1 y-value

Example 2: Identify the domain and range. Then tell whether the relation is a function.



Domain:  
Range:

Yes

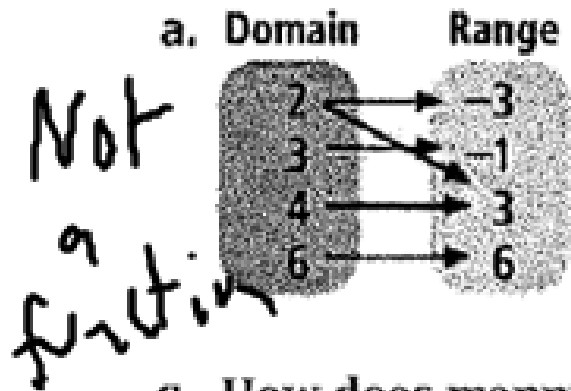


Domain:  
Range:

NO

:

Ex. 1 What are the domain and range of each relation? Is the relation a function?



D: {2, 3, 4, 6}  
R: {-3, -1, 3, 6}

b.  $\{(-7, 14), (9, -7), (14, 7), (7, 14)\}$

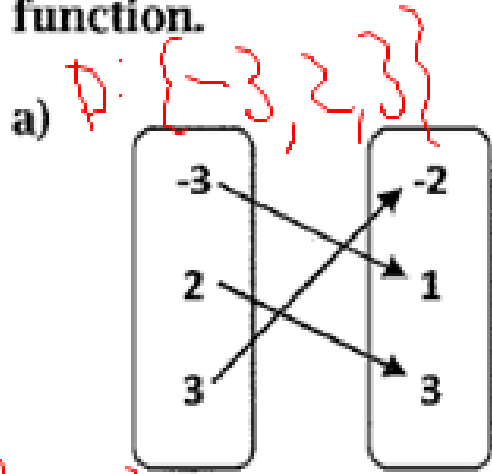
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function

c. How does mapping diagram of a relation that is not a function differ from a mapping diagram of a function?

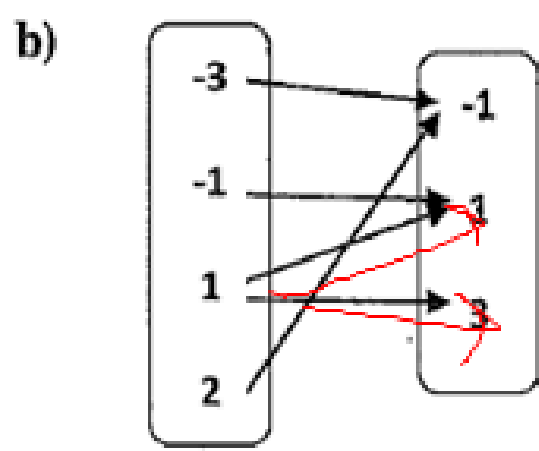
not a funct: an x would be paired with more than 1 y.

Example 2: Identify the domain and range. Then tell whether the relation is a function.



R:  $\{-2, 1, 3\}$

Domain:  
Yes  
Range:

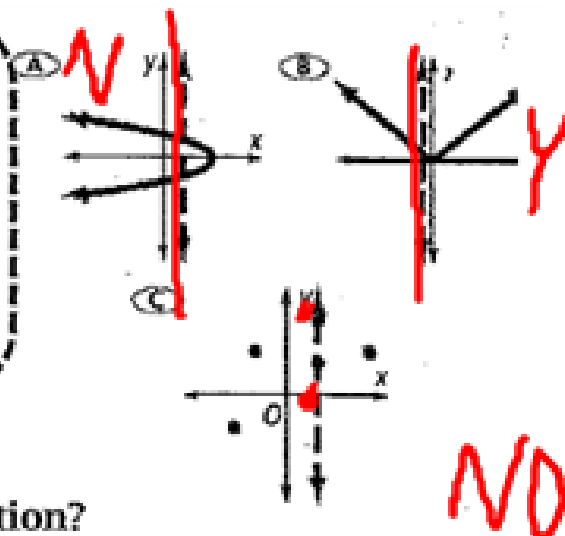


Domain:  
Range:

NO

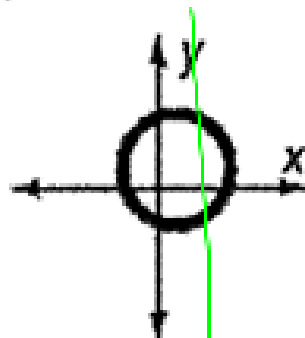
### VERTICAL LINE TEST FOR FUNCTIONS

A relation is a function if and only if no vertical line intersects the graph of the relation at more than one point (It is a function if a vertical line only crosses the graph in one place).



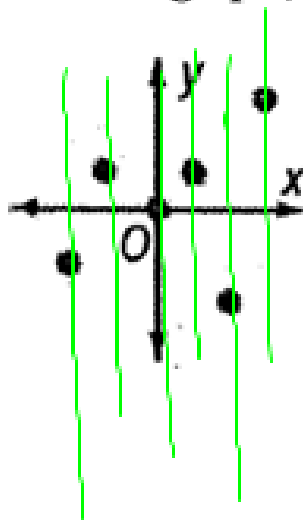
Ex. 3 Use the vertical line test. Which graph(s) represents a function?

a.



NO

b.



Yes

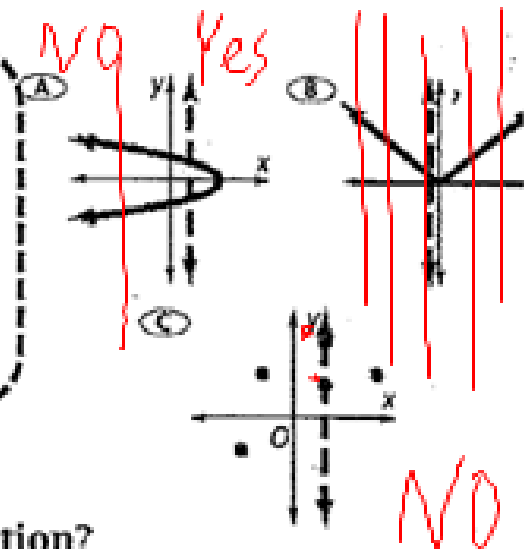
c.



Yes

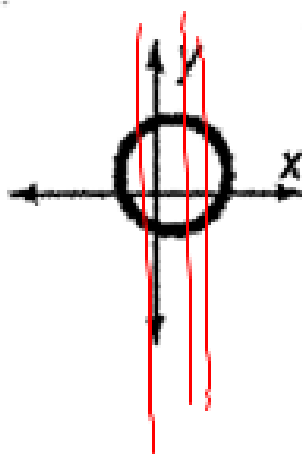
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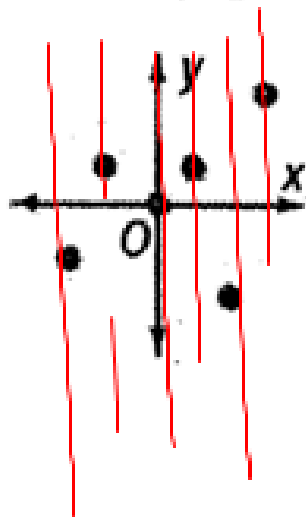
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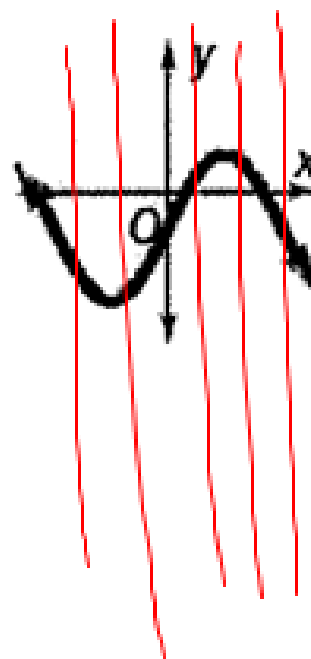
not

b.



yes

c.



Yes

## FUNCTION NOTATION:

$$y = 3x + 2$$

Output    Input

$$f(x) = 3x + 2$$

Read as "f of x"  
or "function f of x."

$$f(1) = 3(1) + 2$$

"f of 1" is the output  
when 1 is the input.

$$f(1) = 5$$

(1, 5)  
is on  
graph

Ex. 4 For  $f(x) = -2x + 5$ , what is the output for the given input?

a)  $x = -3$

$$f(-3) = -2(-3) + 5$$

b)  $x = 0$

c)  $x = \frac{1}{4}$

$$f(-3) = 11$$

(-3, 11) is  
on graph

Ex. 5 Tickets to a concert are available online for \$35 each plus a shipping and handling fee of \$2.50. The total cost of the function of the number of tickets bought. What function rule models the cost of the concert tickets? Evaluate the function for 4 tickets.

$$f(x) = 35x + 2.50$$

## FUNCTION NOTATION:

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(1, 5)  
is on  
graph

$$f(x) = y$$

$$f(1) = 5$$

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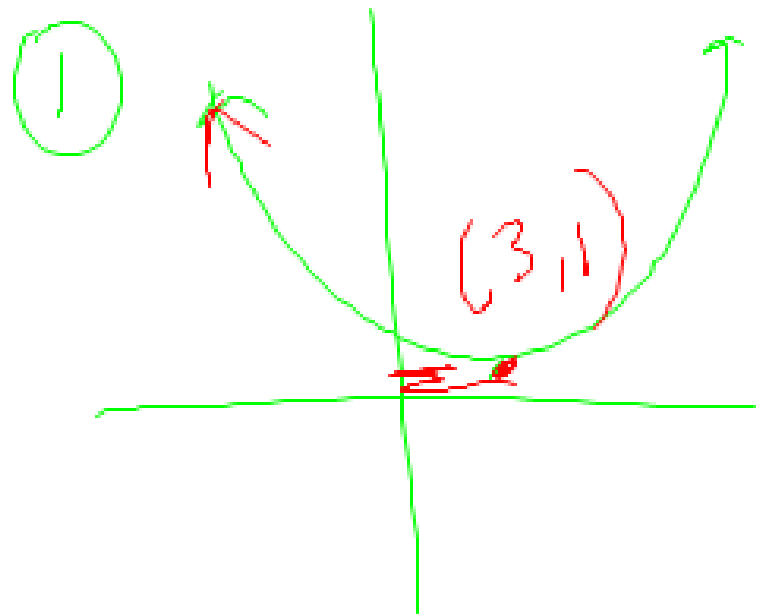
$x = \# \text{ of tickets}$   $f(x) = 35x + 2.50$   
 $f(4) = 142.50$   $f(4) = 35(4) + 2.50$



$$f(4) = \text{\$} 142,50$$

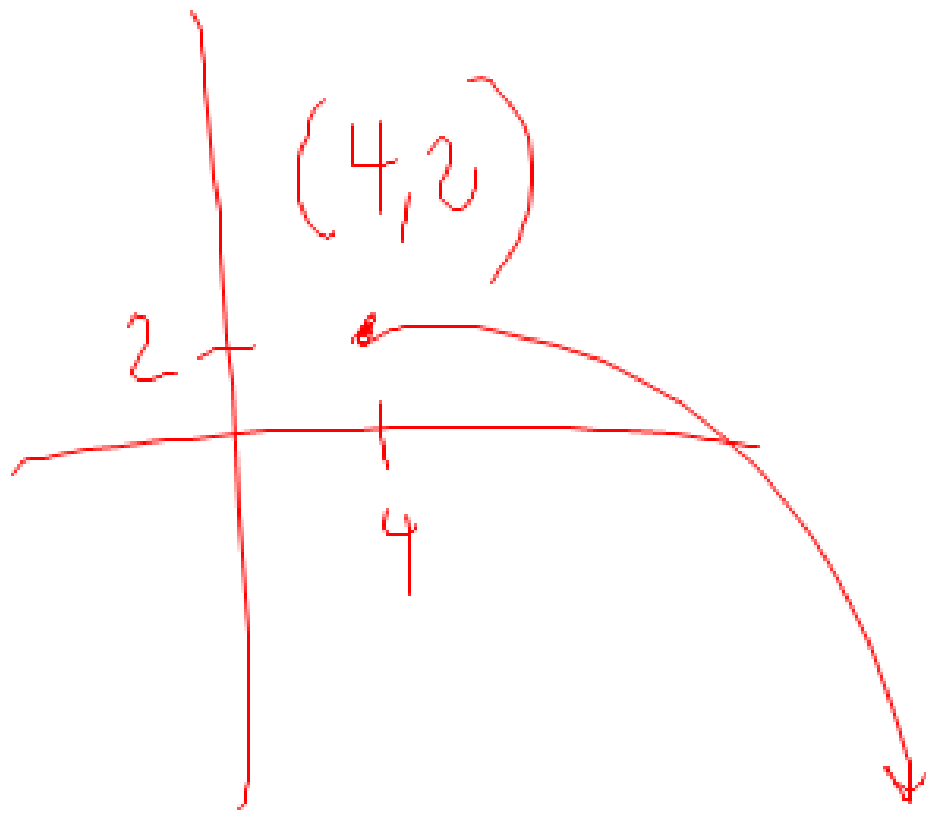
Domain  $\rightarrow$  Left to Right

Range  $\rightarrow$  Bottom to Top



D: All real numbers  
 $(-\infty, \infty)$

R:  $y \geq 1$   
 $[1, \infty)$



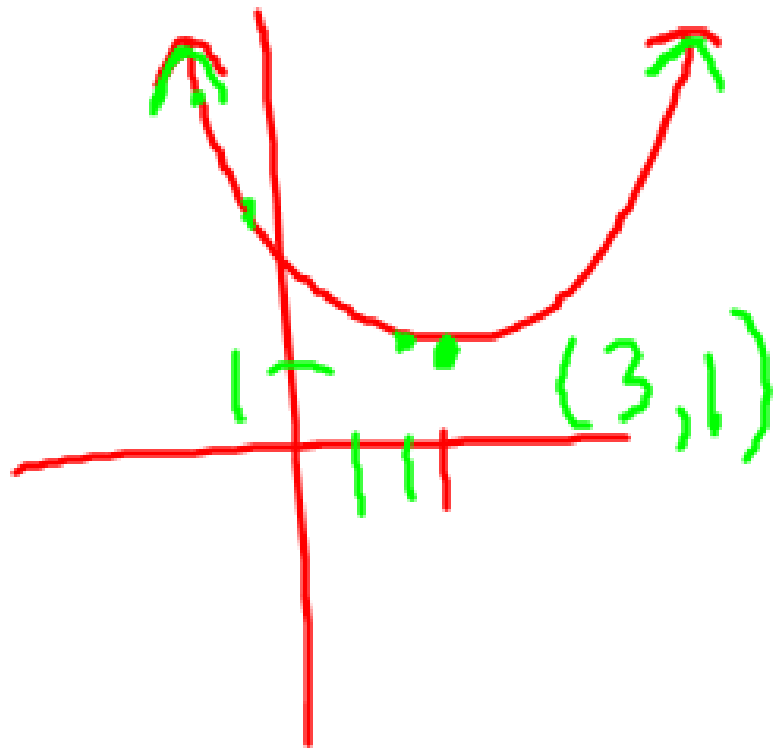
$$D: x \geq 4$$
$$[4, \infty)$$

$$R: y \leq 2$$

$$f(4) = 35(4) + 2.50$$

$$f(4) = \text{\$}142.50$$

Find domain and range.



D: All real numbers  
 $(-\infty, \infty)$

R:  $y \geq 1$   
 $[1, \infty)$

Function  $\rightarrow$  each  $x$  is paired with  $1-y$

Yes

No

Map

