A RELATION

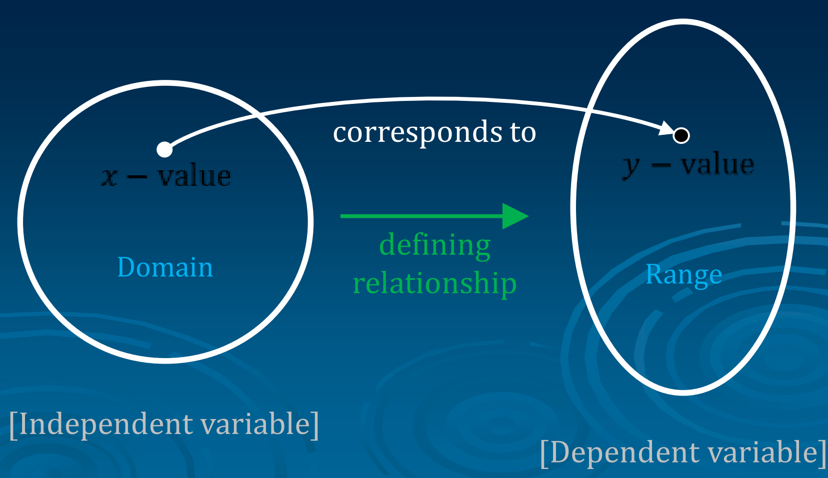
Consider the relationship between the weight of five students and their ages as shown below.

Age (years)	Weight (kg)
10	31
12	36
14	48
16	53
18	65

We can represent this information as a ***set of ordered pairs***.
An age of 10 years would correspond to a weight of 31 kg. An age of 16 years would correspond to a weight of 53 kg and so on.
This type of information represents a relation between two sets of data. This in formation could then be represented as a set of ordered pairs.

$$\{(10, 31), (12, 36), (14, 48), (16, 53), (18, 65)\}$$

The ***set of all first elements*** of the ordered pair is called the ***domain*** of the relation and is referred to as the ***independent variable***. The ***set of all second elements*** is called the ***range*** and is referred to as the dependent variable.
For the above example,
the domain $= \{10, 12, 14, 16, 18\}$
the range $= \{31, 36, 48, 53, 65\}$

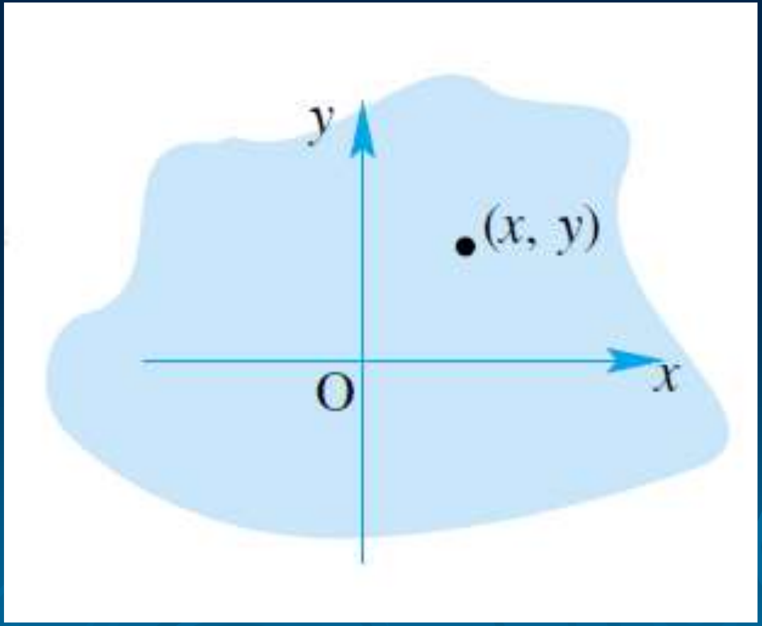


A RELATION

Relation

A **relation** is a correspondence between a first set, called the **domain**, and a second set, called the **range**, such that each member of the domain corresponds to *at least one* member of the range.

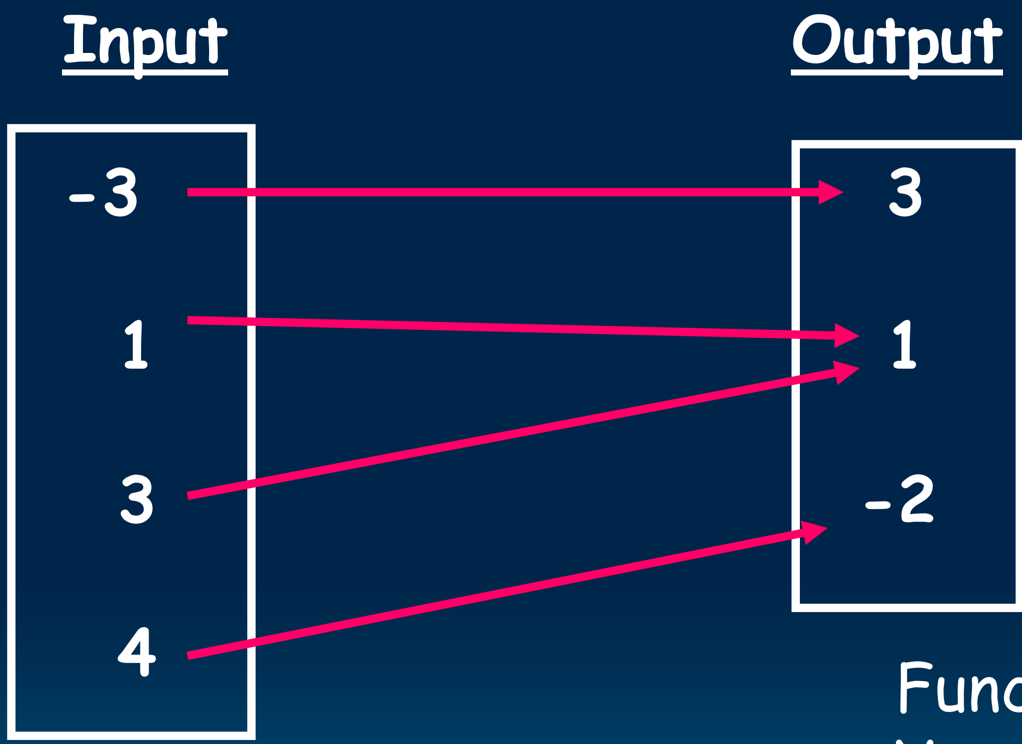
A relation is any subset of the Cartesian plane and can be represented by a set of ordered pairs $\{(x, y)\}$.



B FUNCTIONS

- Functions are special relations.
- Every set of ordered pairs is a relation, but every relation is not a function
- Functions make up a subset of all relations.
- A function is defined as a relation that is either one to one or many to one., i.e. no ordered pairs have the same first element.

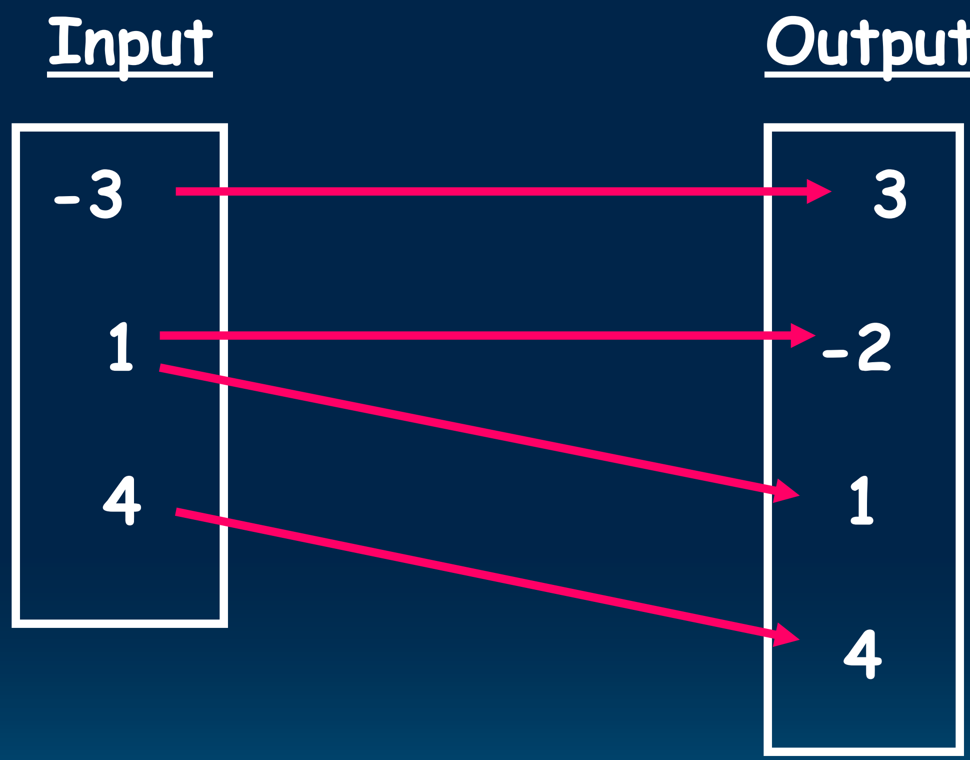
Identify the Domain and Range. Then tell if the relation is a function.



Function?
Yes: each input is mapped onto exactly one output

Domain = {-3, 1,3,4}
Range = {-2,1,3}

Identify the Domain and Range. Then tell if the relation is a function.



Domain = {-3, 1,4} → Function?

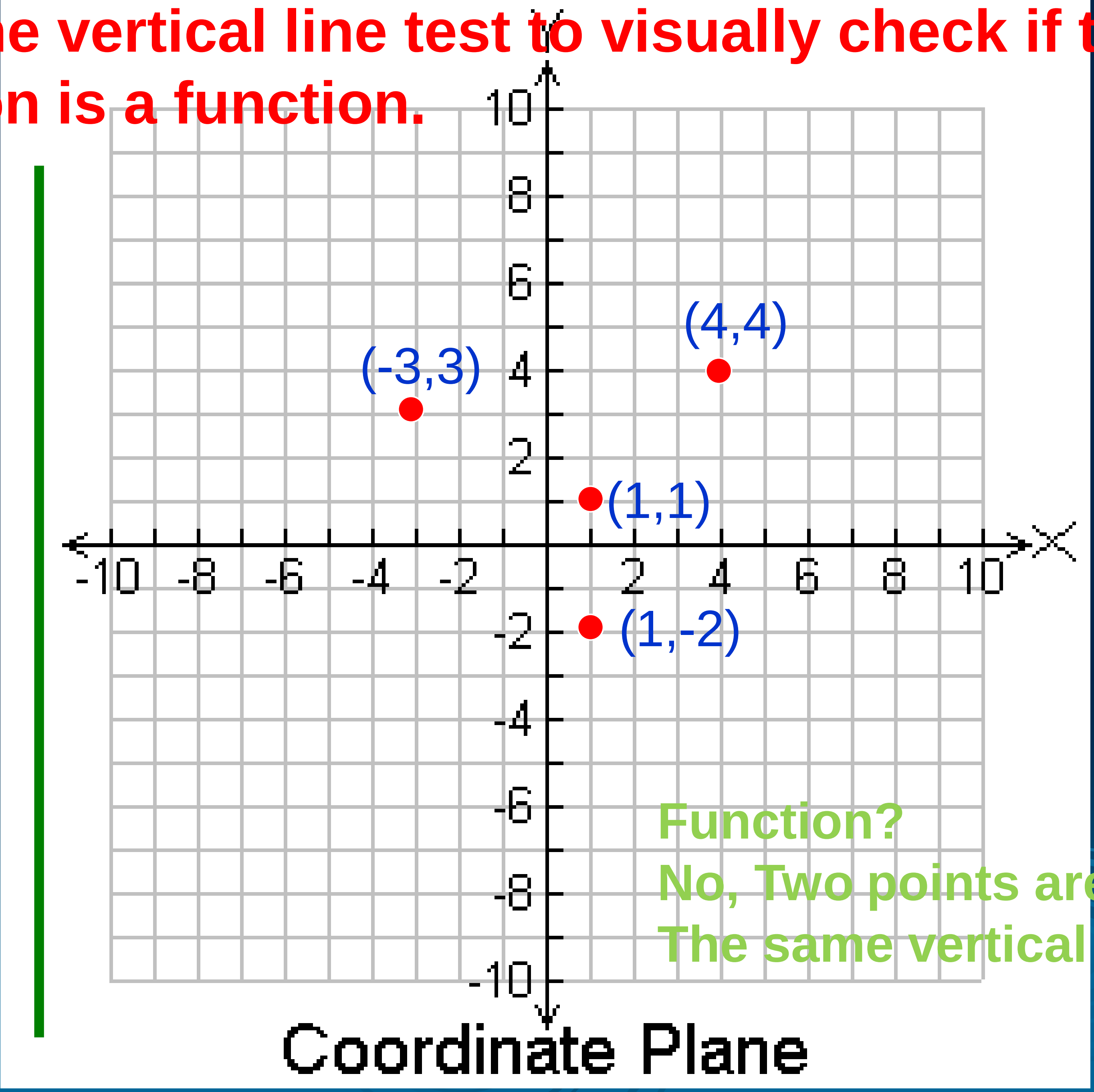
Range = {3,-2,1,4}

No: input 1 is mapped onto Both -2 & 1

The Vertical Line Test

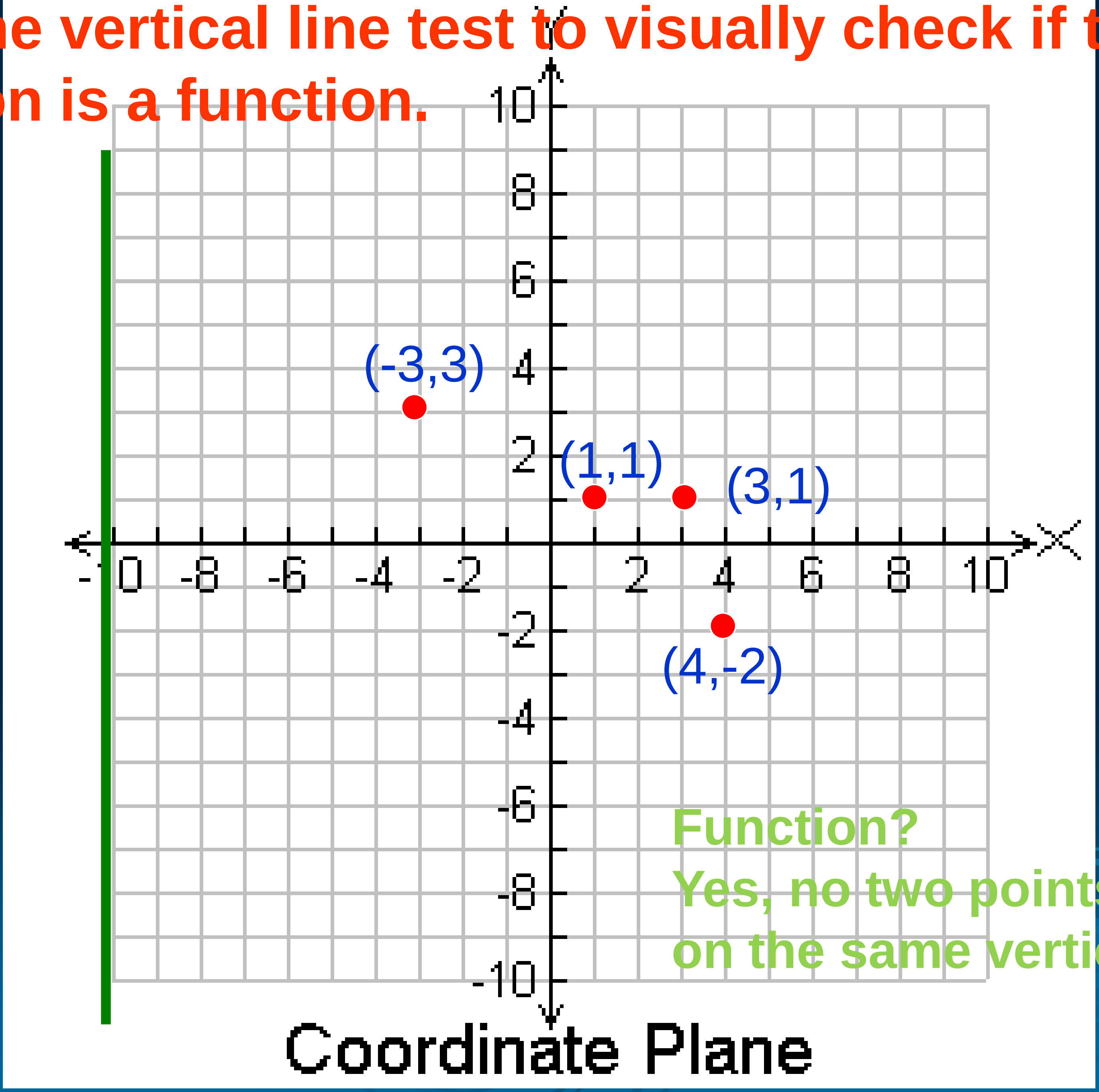
If it is possible for a vertical line to intersect a graph at more than one point, then the graph is NOT the graph of a function.

Use the vertical line test to visually check if the relation is a function.



Function?
No, Two points are on
The same vertical line.

Use the vertical line test to visually check if the relation is a function.



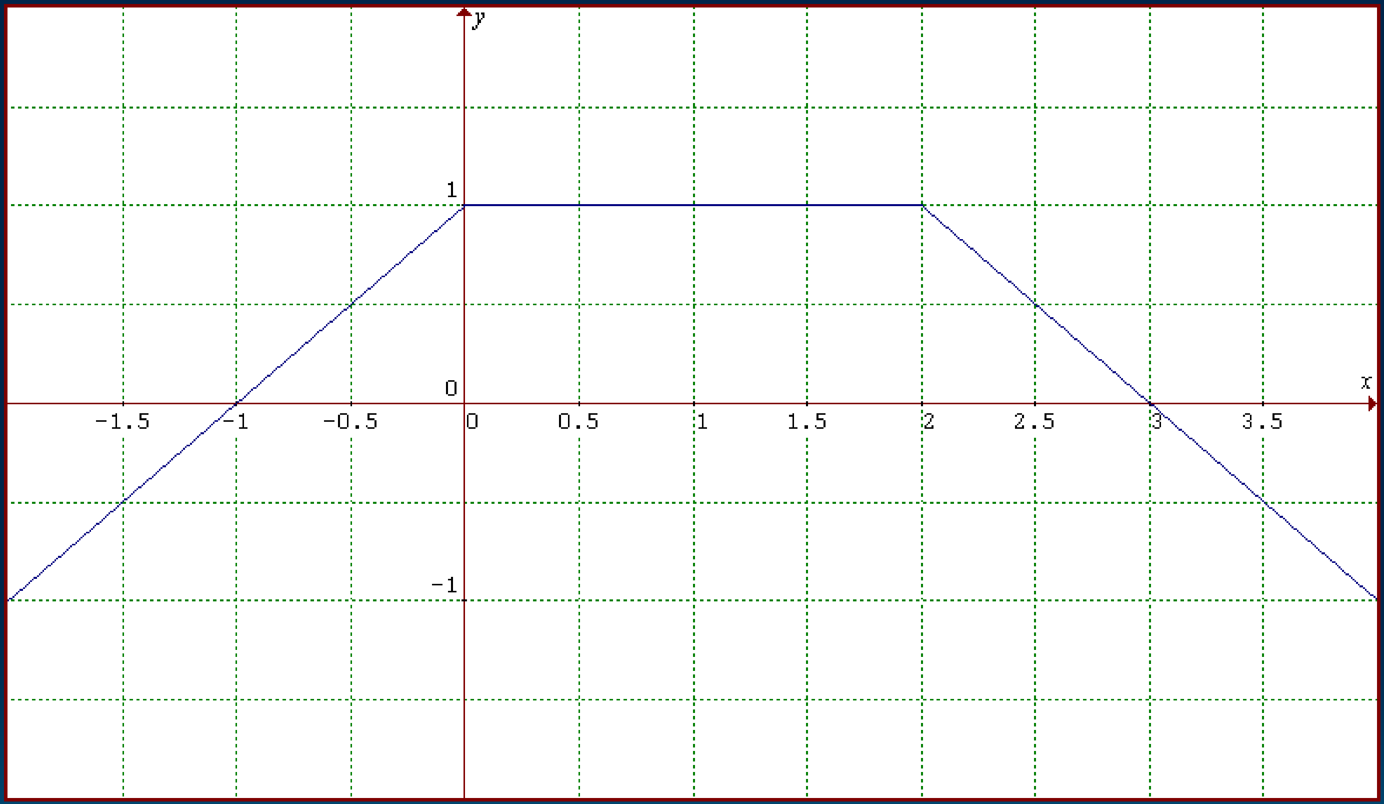
Function?

Yes, no two points are on the same vertical line

Examples

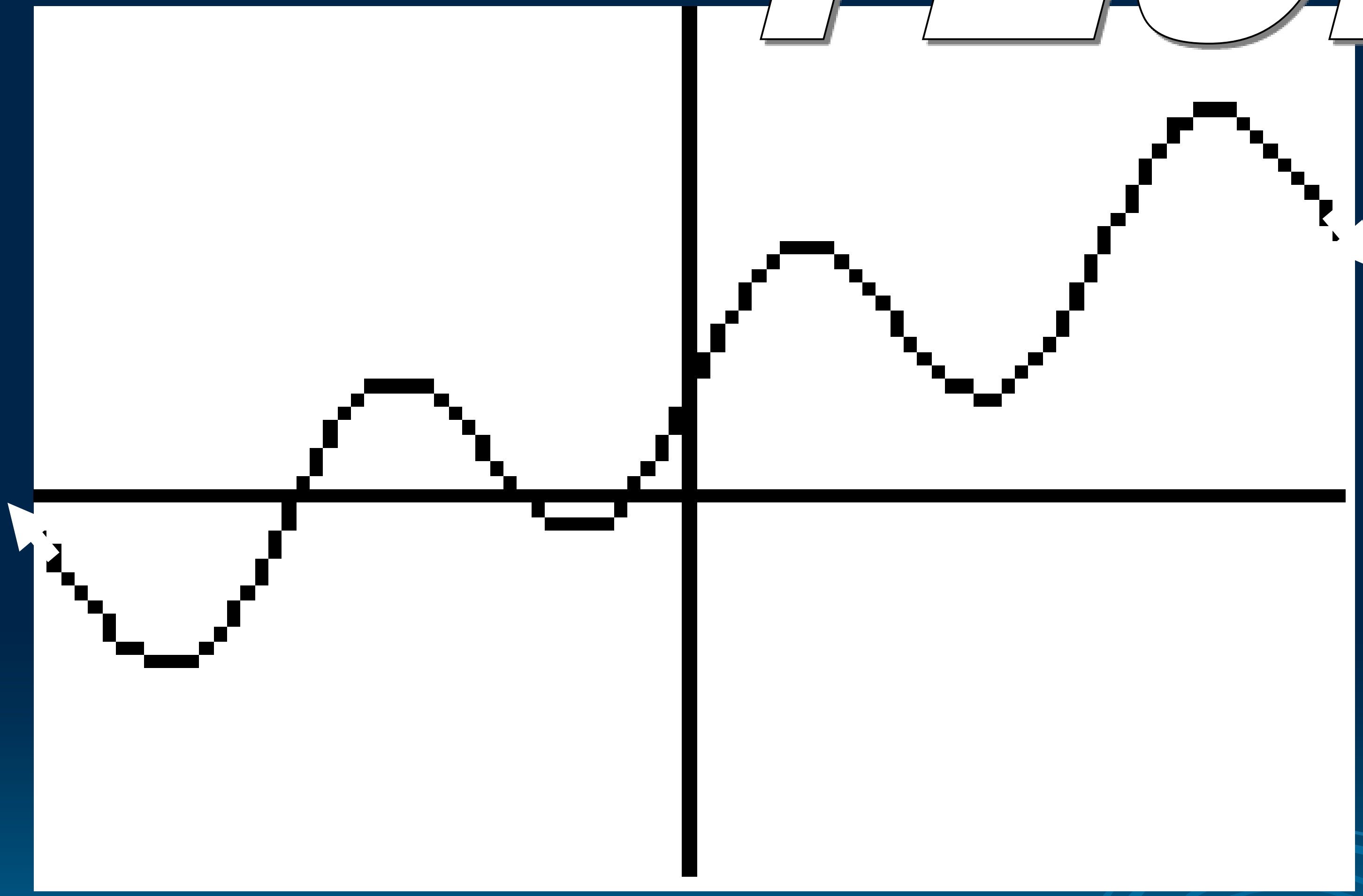
- I’m going to show you a series of graphs. **don’t write ☺
- Determine whether or not these graphs are functions.
- You do not need to draw the graphs in your notes. **or write this note

#1 Function? YES!



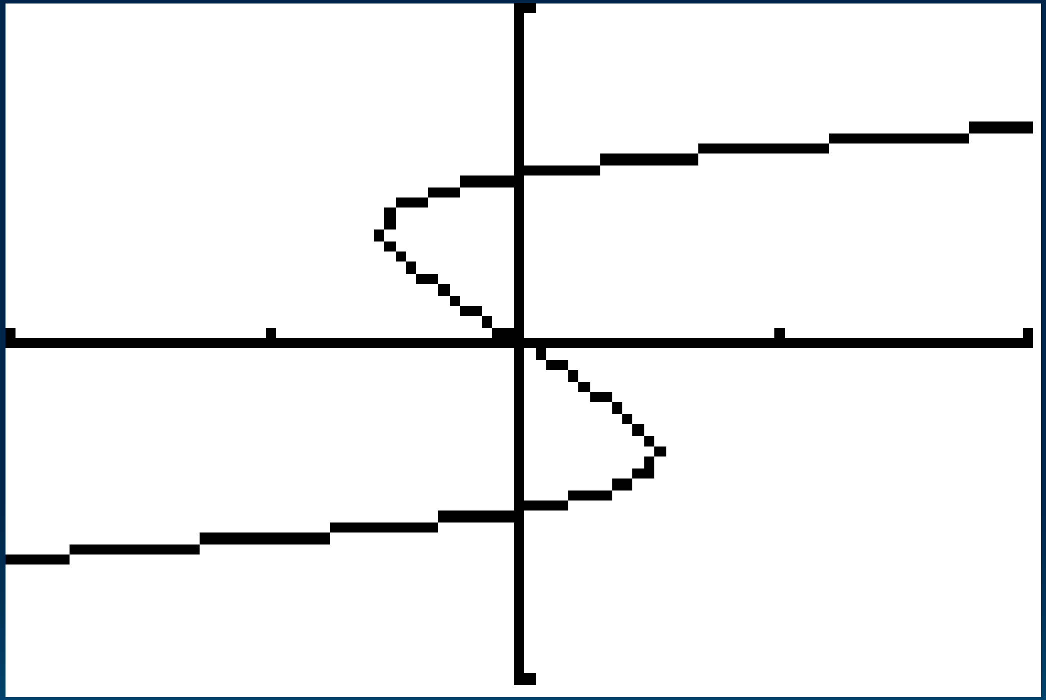
#2 Function?

YES!



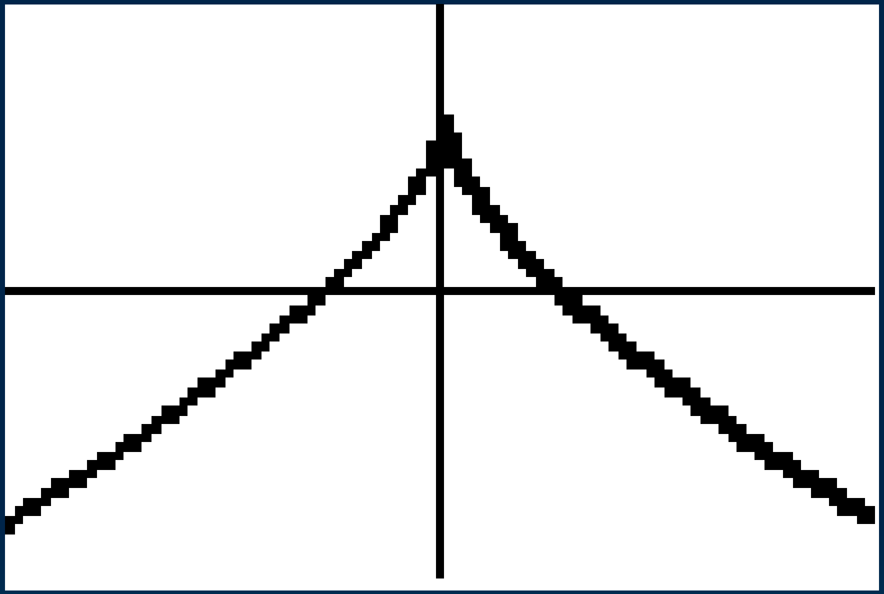
#3 Function?

NO!



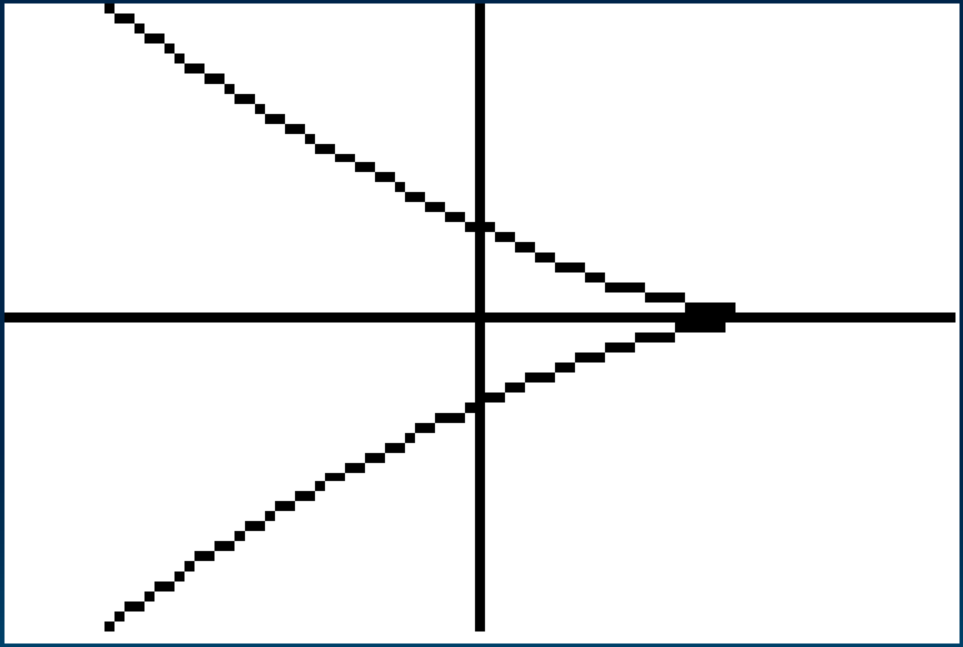
#4 Function?

YES!

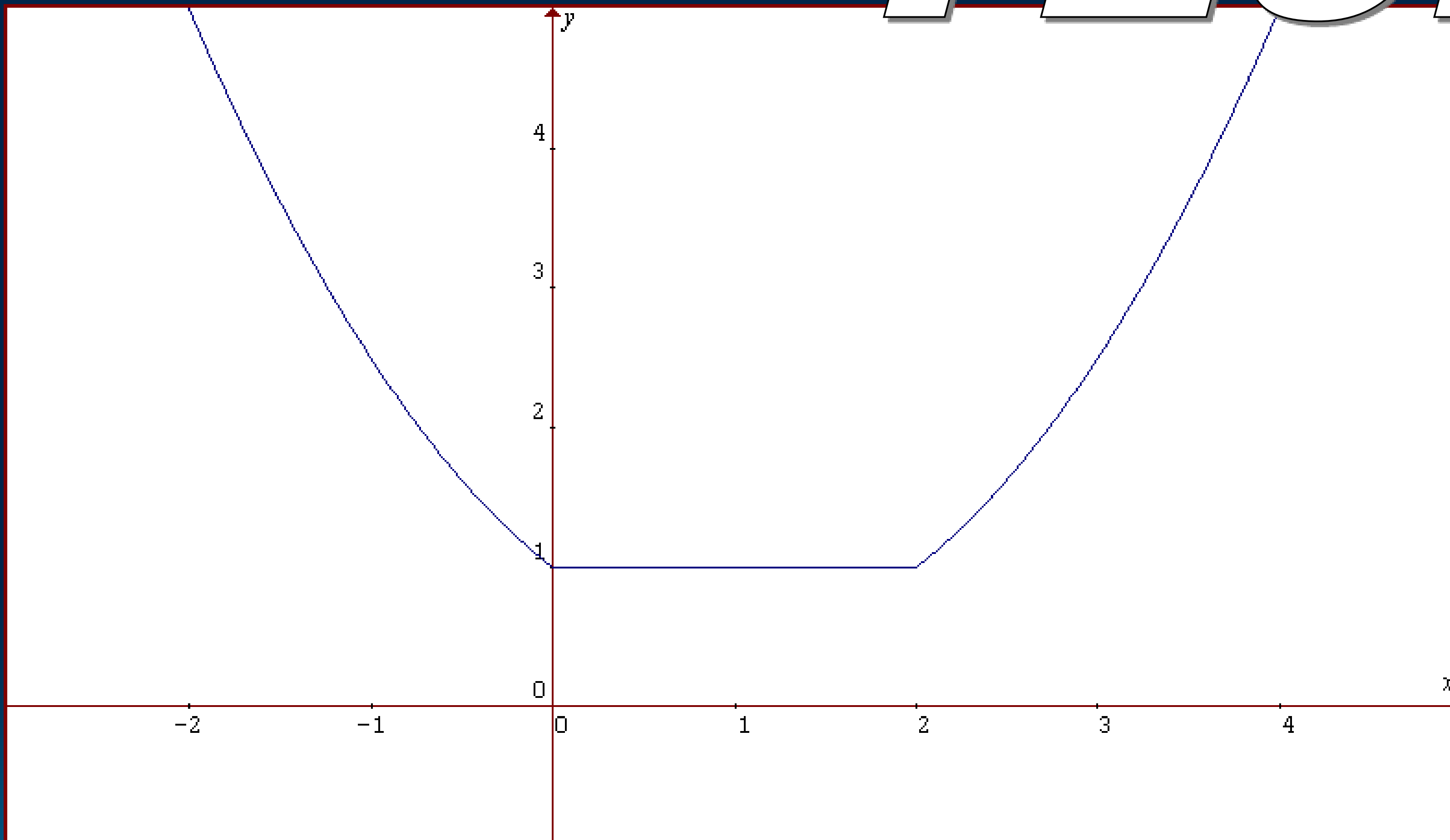


#5 Function?

NO!



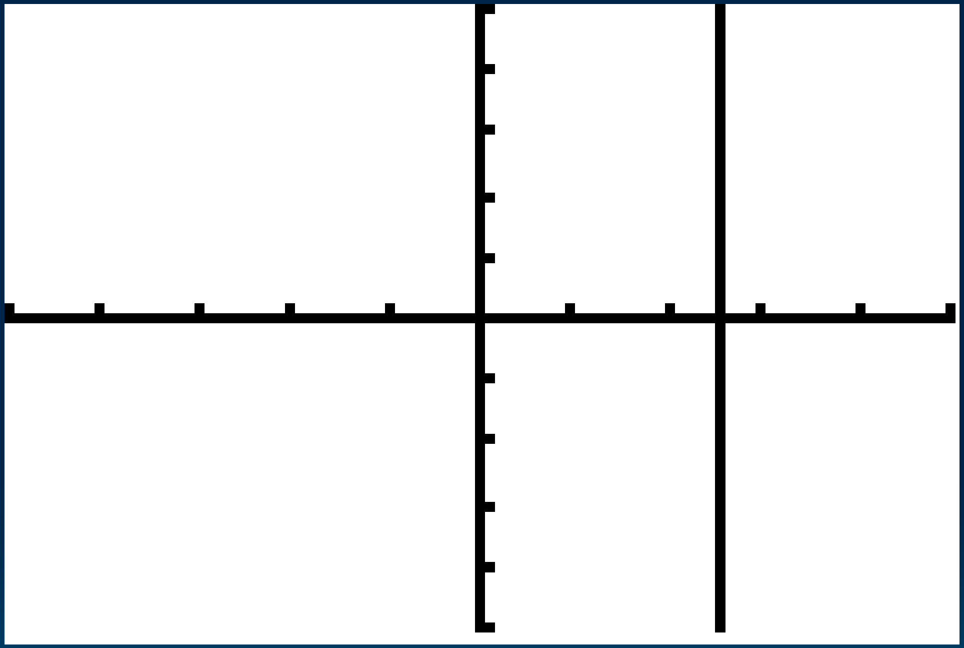
#6 Function?



YES!

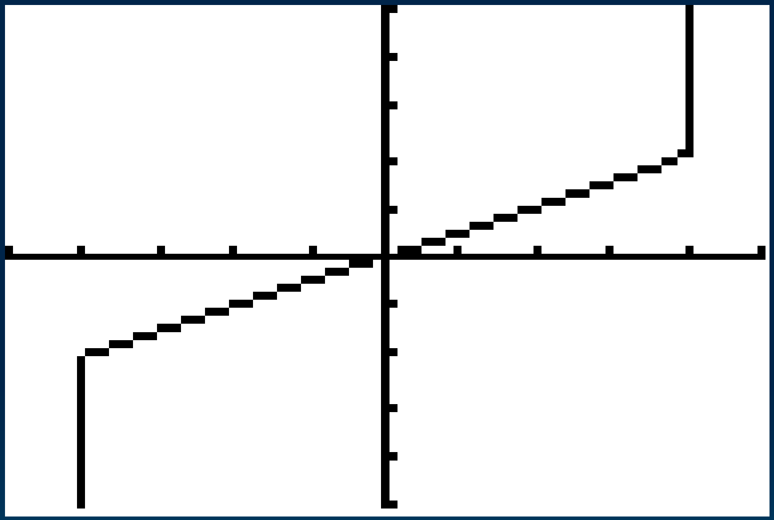
#7 Function?

NO!



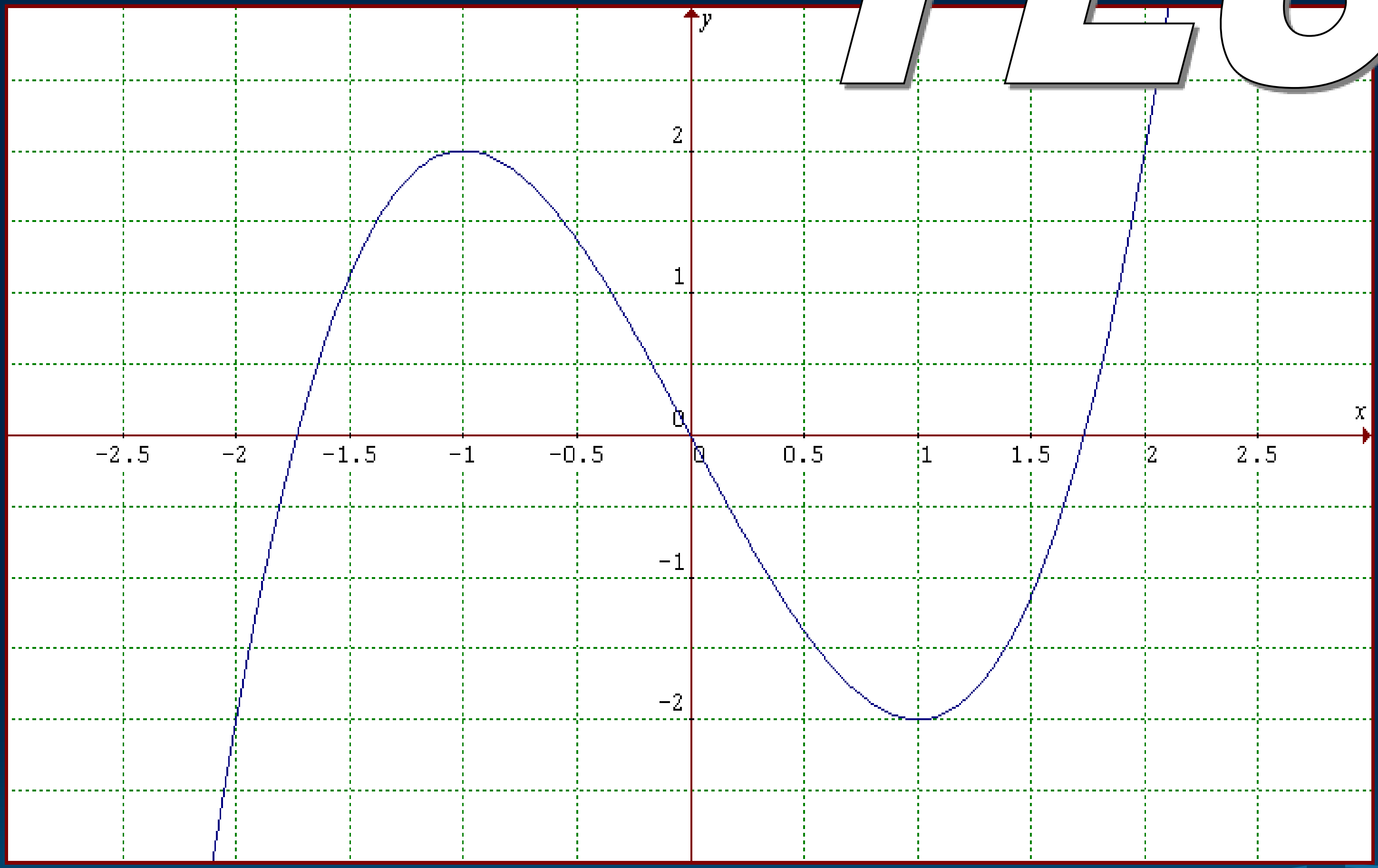
#8 Function?

NO!



#9 Function?

YES!



Function Notation

$$f(x)$$

"*f* of x"

Input = x

Output = f(x) = y

Before…

$y = 6 - 3x$

x	y
-2	12
-1	9
0	6
1	3
2	0

(x, y)

Now…

$f(x) = 6 - 3x$

x	f(x)
-2	12
-1	9
0	6
1	3
2	0

(x, f(x))

(input, output)

Example.

$$f(x) = 2x^2 - 3$$

Find f(0), f(-3), f(5).

Finding the Domain of a Function

- When a function is defined by an equation and the domain of the function is not stated, we assume that the domain is

<u>All Real Numbers</u>

- There will be certain cases where specific numbers cannot be included in the domain or a set of numbers cannot be included in the domain

Examples…

- $f(x) = 2x - 5$

**there would be no restrictions on this, so the domain is All Real Numbers*

- $g(x) = \dfrac{1}{x - 2}$

**a denominator cannot equal 0, so $x \neq 2$. The domain is $\{x \mid x \neq 2\}$*

- $h(x) = \sqrt{x + 6}$

**you cannot take the square root of a negative number, so x must be ≥ -6. The domain is $\{x \mid x \geq -6\}$*

Your Turn…Find the domain of each function

- $f(x) = x^2 + 2$
- $g(x) = \sqrt{x - 1}$
- $h(x) = \dfrac{1}{x + 5}$