Functions
Vertical Line Test

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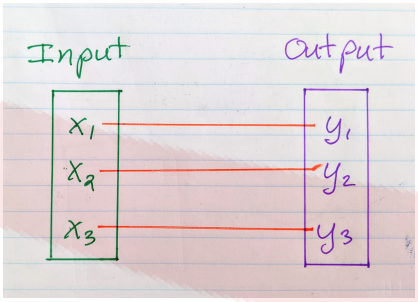
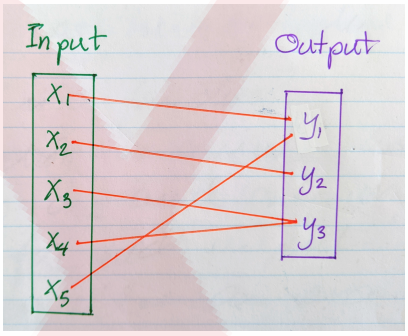
What is a function?

Mappings

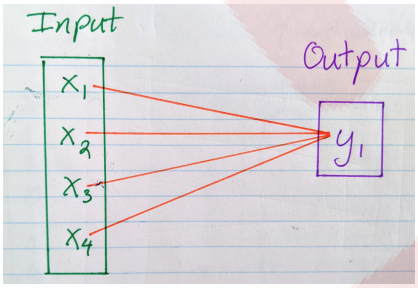
A function is a rule or mapping that assigns one and onle one value for each iput. Let's consider the diagram below.



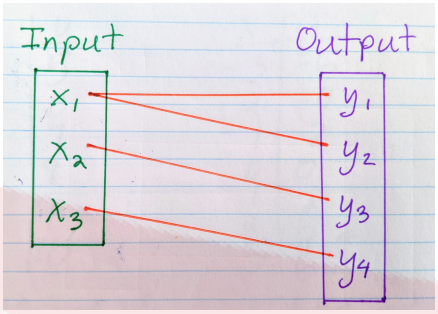
In this diagram above, we see that each x value corresponds to a single distint y value. Let's consider the diagram below.



In this diagram, notice that x_3 and x_4 both map to y_3. While the y value is not distinct, each x value maps to only one y value. So the y values that the x values are mapped to can be repeated. The diagram below shows the extreme case where all the x values map to a single y value.



All the three diagrams of *mappings* above represent *functions*. What does a mapping that is not a function look like? Let's take a look at the diagram below.



Notice in the mapping above that x_1 maps to two y values, y_1 and y_2. This mapping is NOT a function.

Tables

Another way to see whether a mapping is a function is through a table of values.

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

x	y
0	1
1	1
2	1
3	1
4	1
4	1

x	y
-1	5
0	6
1	7
2	8
3	9
4	10

x	y
-3	-6
-2	-4
-1	-2
0	0
1	2
2	4
3	6

All of the tables of values above represent mappings from x values to y values. In all the tables above, there is no x values that maps to 2 or more distinct y values. This means, that each table presenting a mapping that is a *function*. What does a table of values looks like when it DOES NOT represent a function? let's hav ea look.

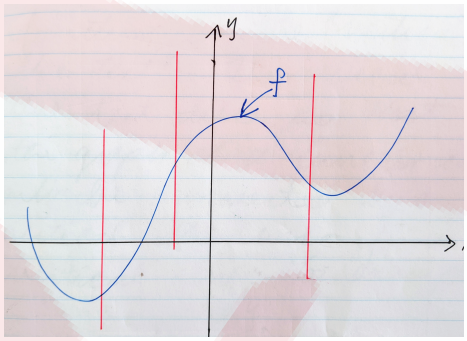
x	y
25	5
25	-5
16	4
16	-4
9	3
9	-3
4	2
4	-2
1	1
1	-1
0	0

x	y
6	-3
6	-2
6	-1
6	0
6	1
6	2
6	3
6	4

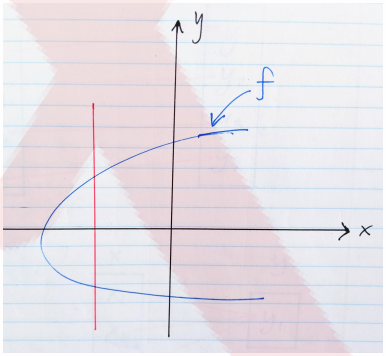
Notice that in each of the two tables avoer there is at least one x value that corresponds to moe than one y value. Another "test" to determine if a given mapping is a function is the *vertical line test*.

Vertical Line Test

The vertical line test tells us that the graph of a function can onle be intersected by a vertical ine once for any vertical line drawn. For example,



The graph of f is the blue curve above, represents a function because any vertical line that is drawn intersects the graph of f only once. Let's take a look a the graph below,

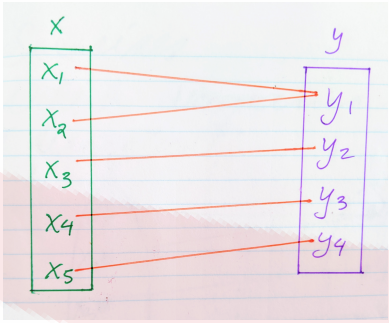


The graph of f above is NOT a graph of a function because there is a vertifal line that intersects the graph more than once.

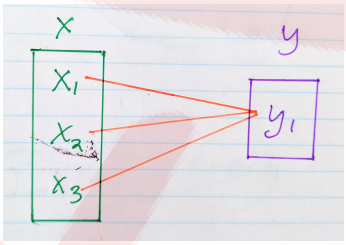
Exercises

1. Which mappings below represent functions?

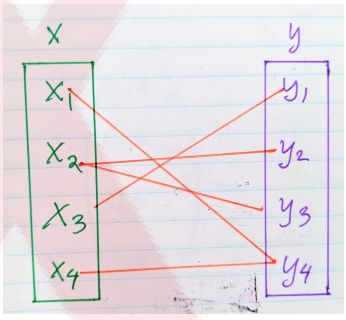
a)



b)



c)



2. Which tables of values represent functions?

a)

x	y
-3	-27
-2	-8
-1	-1
0	0
1	1
2	8
3	27

b)

x	y
-2	0
-1	1
-1	-1
0	2
0	-2
1	3
1	-3
2	4
2	-4

c)

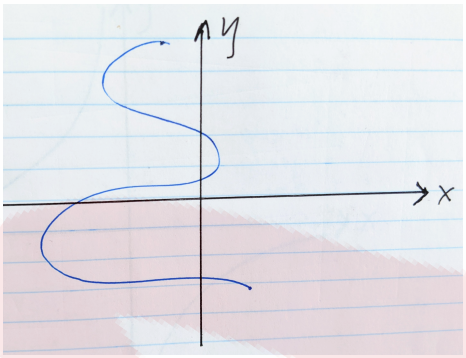
x	y
1	1
2	1/2
3	1/3
4	1/4
-1	-1
-2	-1/2
-3	- 1/3
4	-1/4

d)

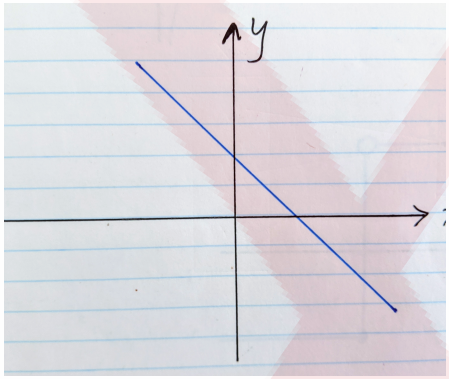
x	y
-2	4
-1	3
0	2
1	1
1	-1
2	0
3	1

3. Which of the graphs below represent functions? (Use the vertical line test.)

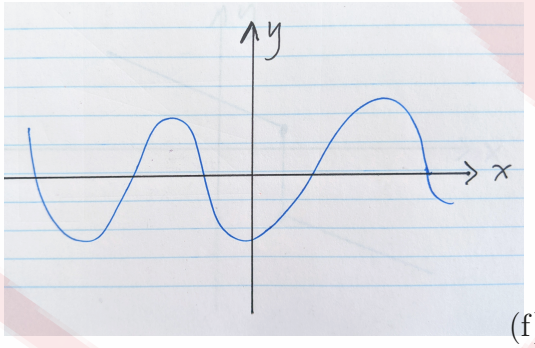
(a)



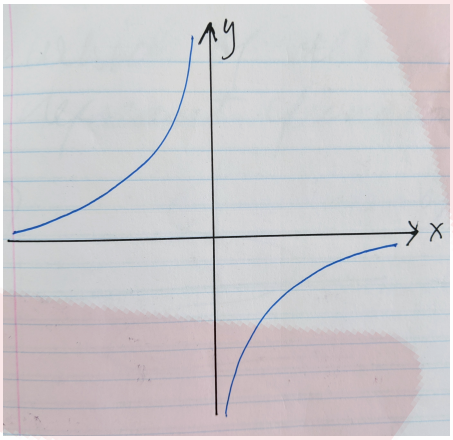
(b)



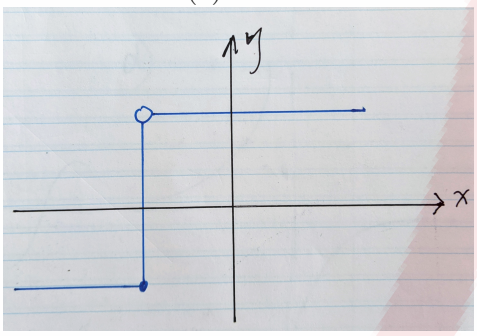
(c)



(d)



(e)



(f)