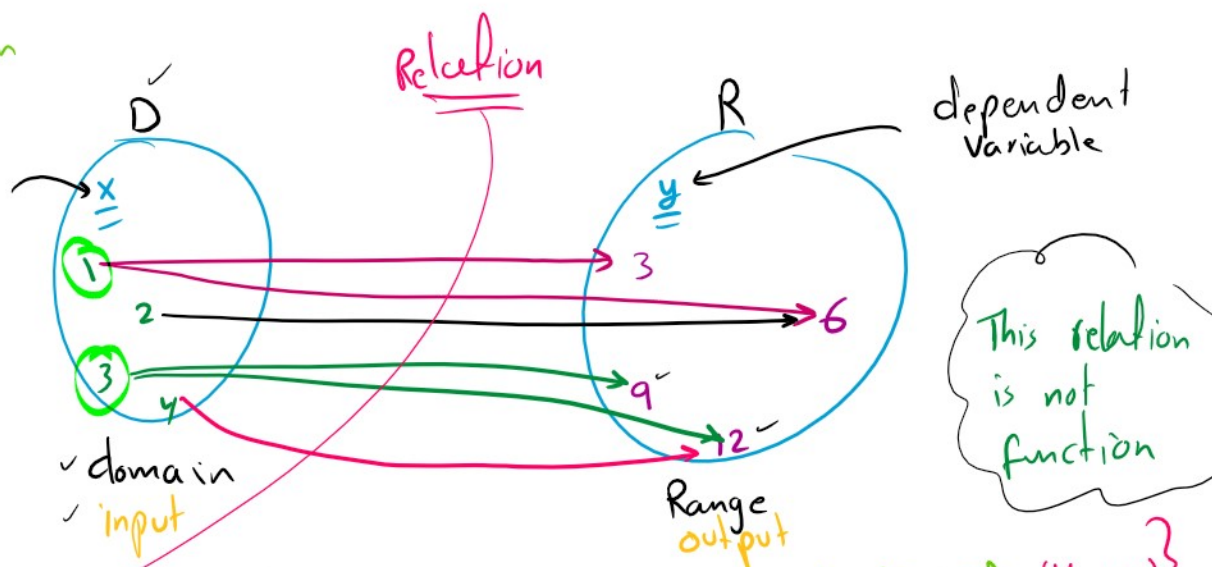


Functions ✓

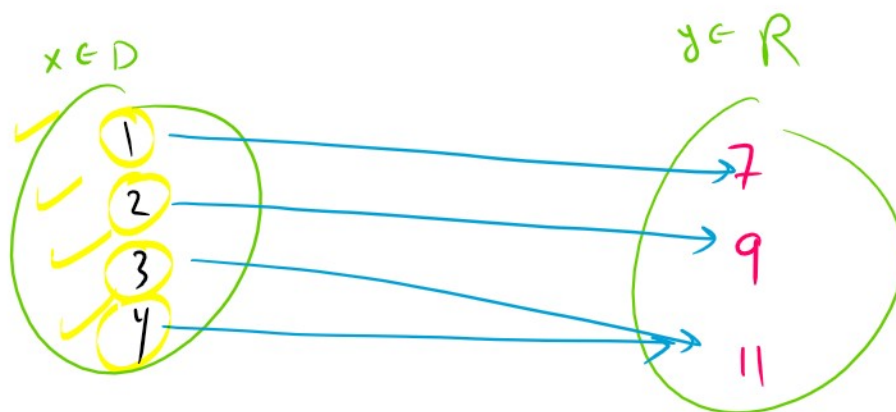
✓ 1) Relation

independent variable



Relation is set of pairs $\{(\underline{1}, \underline{3}), (\underline{1}, \underline{6}), (2, 6), (\underline{3}, \underline{9}), (\underline{3}, \underline{12}), (\underline{4}, \underline{12})\}$

✓



Relation = $\{(1, 7), (2, 9), (3, 11), (4, 11)\}$

Is this relation represent function? Yes this relation is function

Q. How can we represent relations?

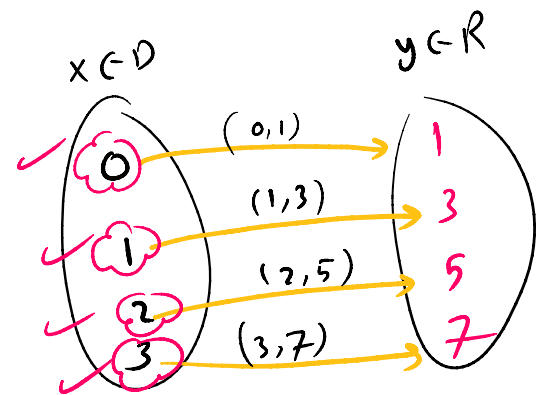
Q. How can we represent relations?

graphs, table, equation, inequality
✓ ✓ ✓ ✓

Ex The equation $y = 2x + 1$ represents relation between x and y
indep. Var. dep. Var.

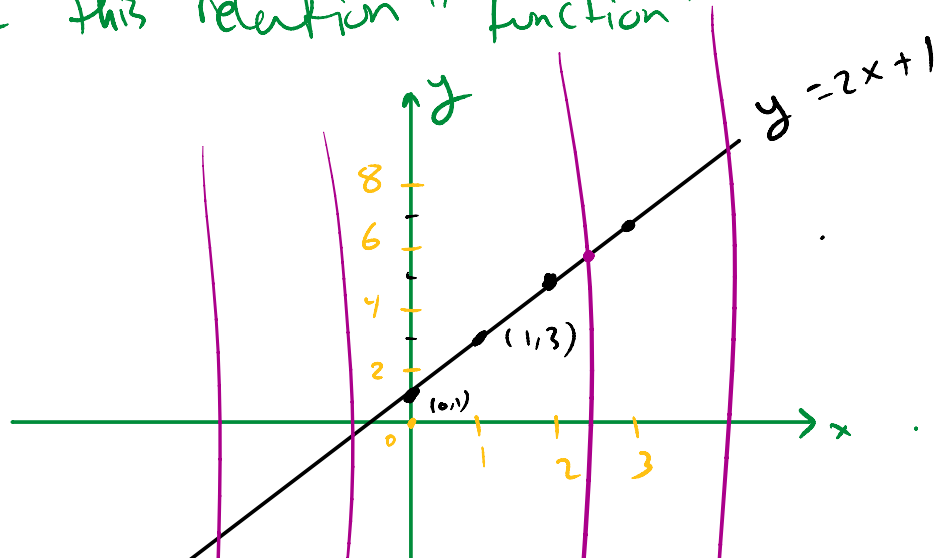
① Find the images $x = 0, 1, 2, 3$

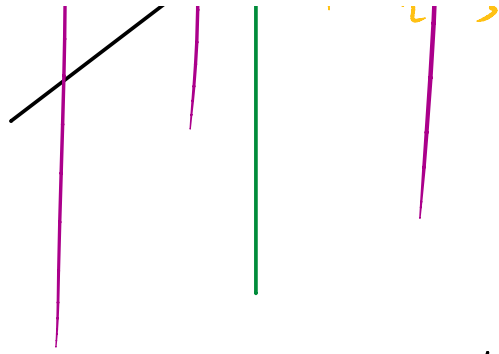
x	y
0	$2(0) + 1 = 0 + 1 = 1$
1	$2(1) + 1 = 2 + 1 = 3$
2	$2(2) + 1 = 4 + 1 = 5$
3	$2(3) + 1 = 6 + 1 = 7$



This relation is function

② Sketch this relation "function"





VLT: Vertical Line Test

كل دالة هي علاقة ولكن ليس كل علاقة هي دالة

Every function is relation but not every relation is function

Def

A **function** is **relation** between two sets such that each element $x \in D$ has one only image $y \in R$

Q.

How to test the relation if its function or not by graph?!

A.

We use VLT "Vertical Line Test"

If any VLT intersects the graph at most once, then this graph is function

عن VLT
 ← يقطع مرة واحدة فقط
 ← ولا مرة يقطع

دالة

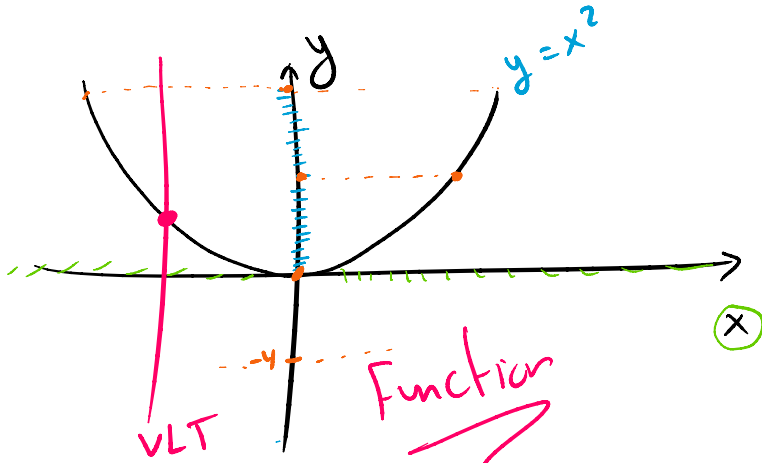
Exp

Which graph represents function

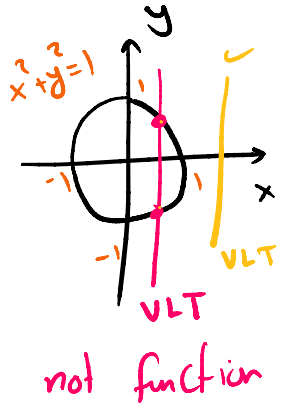
(1)

$$D = (-\infty, \infty)$$

$$R = [0, \infty)$$



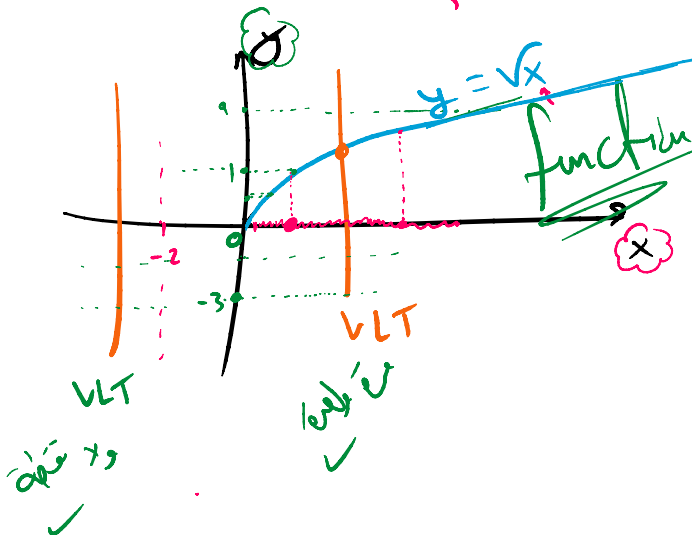
(2)



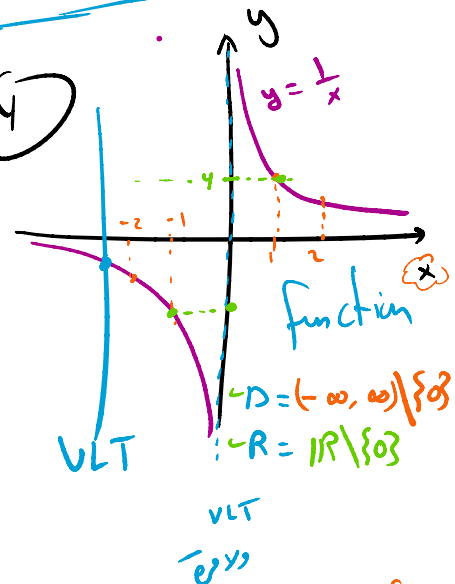
(3)

$$D = [0, \infty)$$

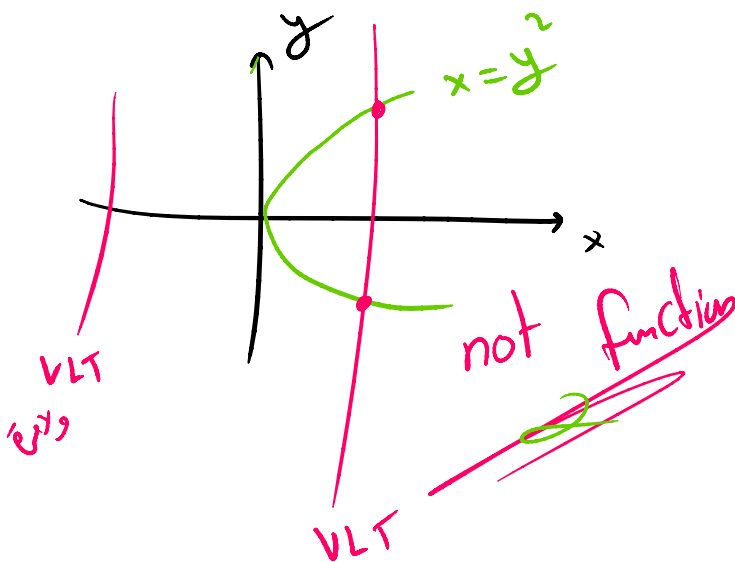
$$R = [0, \infty)$$



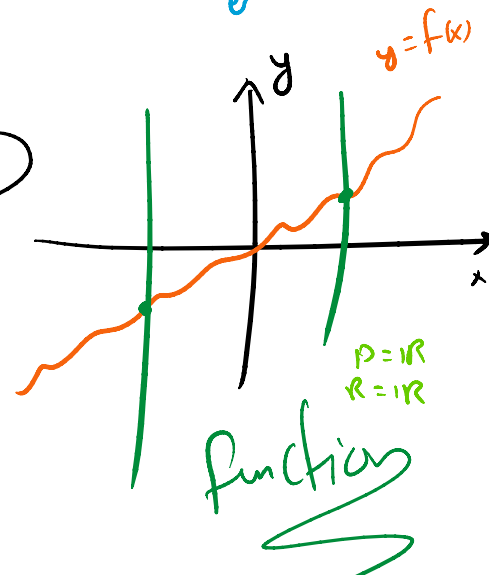
(4)

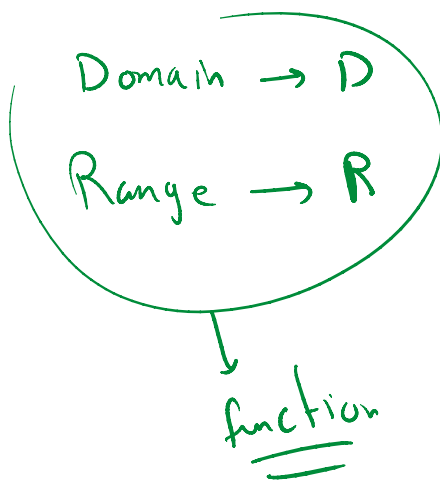
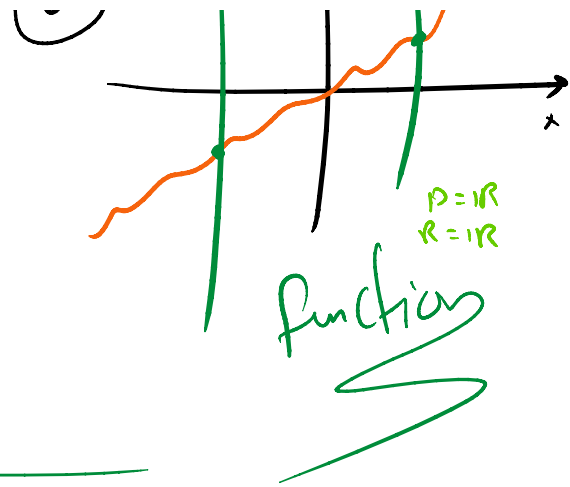
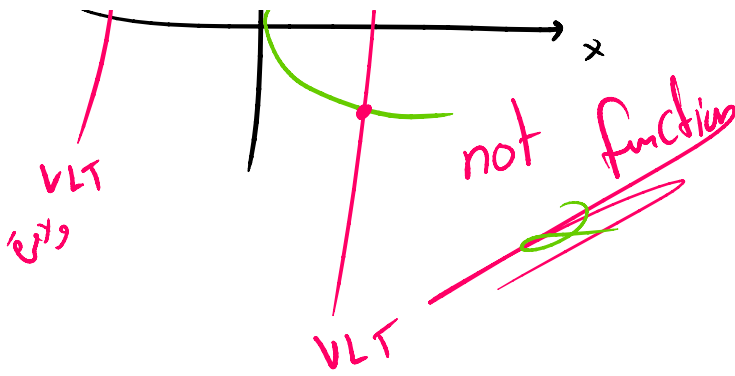


(5)



(6)





مجموعة x المدونة
مجموعة y الناتجة
عن تعيين x في x

الصور : images

Exp Find D, R only for function in Exp above

Exp Find domain of the following functions

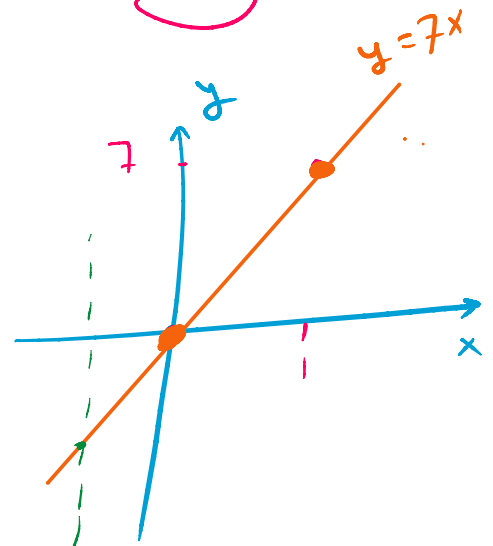
(1)

$$y = 7x$$

مجموعة x المدونة

$\Rightarrow D = \mathbb{R} = (-\infty, \infty)$

$(0, 0), (1, 7)$



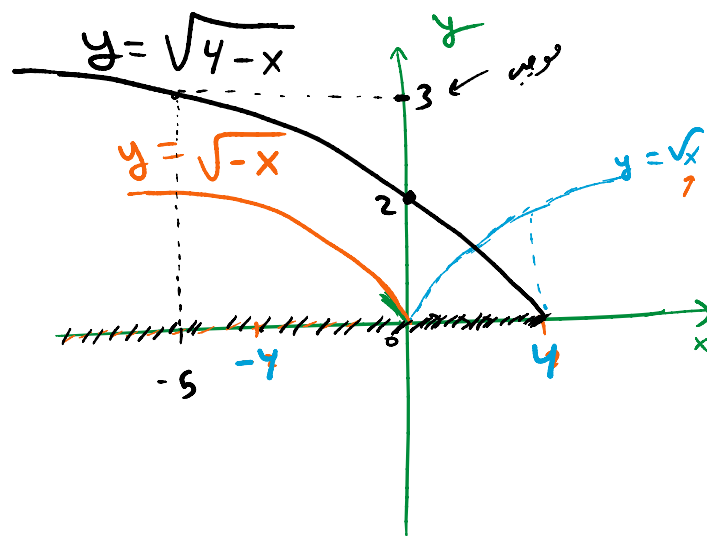
② $y = \sqrt{4-x}$

$$4-x \geq 0$$

$$-x \geq -4$$

$x \leq 4$

$D = (-\infty, 4]$



$$x = -5 \Rightarrow y = \sqrt{4 - (-5)}$$

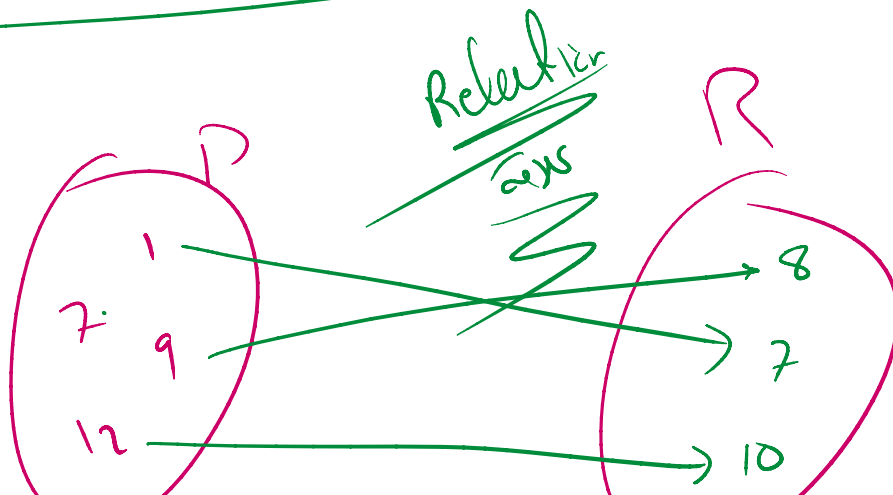
$$= \sqrt{4+5}$$

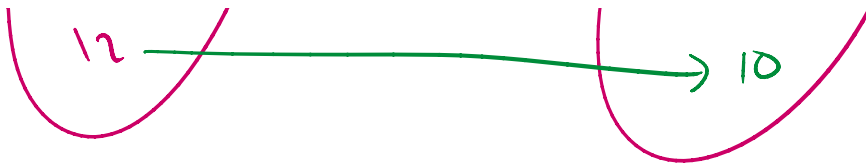
$$= \sqrt{9}$$

$$= 3$$

③ $y = 1 + \frac{1}{x-2}$

$D = \mathbb{R} \setminus \{x=2\}$





$$y = \sqrt{x}$$

لازم نكن موجب

$$\Rightarrow \begin{array}{l} \sqrt{4} = 2 \\ \sqrt{9} = 3 \\ \sqrt{1} = 1 \end{array}$$

x

y

$$y = \sqrt{-x}$$

لازم نكن سالب

$$\Rightarrow \begin{array}{l} \sqrt{4} \text{ unde } \\ \sqrt{9} \text{ unde } \\ \sqrt{1} \text{ unde } \end{array}$$

X

$$x = -4 \Rightarrow \sqrt{-(-4)} = \sqrt{4} = 2$$

$$x = -9 \Rightarrow \sqrt{-(-9)} = \sqrt{9} = 3$$

$$x = -1 \Rightarrow \sqrt{-(-1)} = \sqrt{1} = 1$$

$$y = \sqrt{4-x} \Rightarrow 4-x \geq 0$$

$$4 \geq x$$

$$x = 5 \Rightarrow y = \sqrt{4-5} = \sqrt{-1} \text{ unde}$$

$$x = -5 \Rightarrow y = \sqrt{4-(-5)} = \sqrt{9} = 3$$

$(-\infty, 4]$

