

def Relation is set of ordered pairs
العلاقة هي مجموعة الأزواج المرتبة

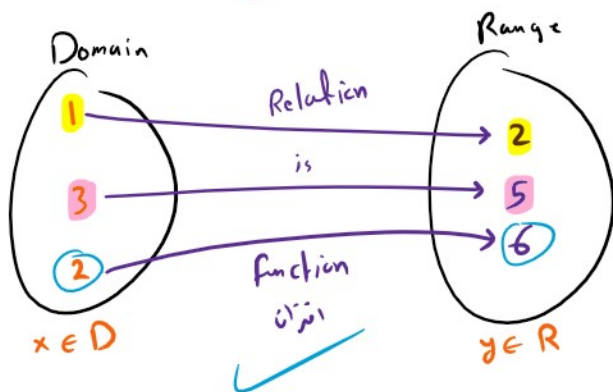
Exp $R_1 = \{ (1, 2), (3, 5), (2, 6) \}$ relation

$R_2 = \{ (a, 4), (b, 8) \}$

$R_3 = \{ (2, 3), (4, 8), (2, 5), (3, 7) \}$

Any Relation can be represented through $R_3 = \{ (2, 3), (4, 8), (2, 5), (3, 7) \}$
table, graph, equation, inequality
جدول، رسم بياني، معادلة، متباينة

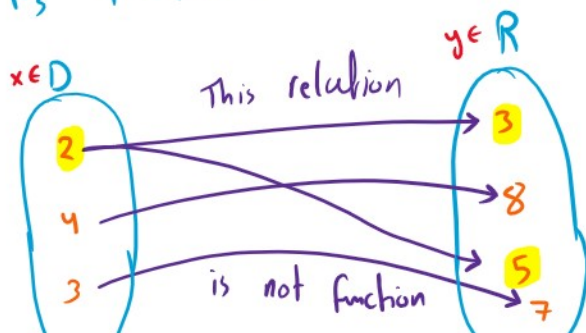
$R_1 = \{ (1, 2), (3, 5), (2, 6) \}$

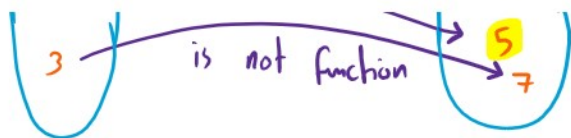


العلاقة:
كل عنصر في المجال
له صورة واحدة
فقط في المدى

$R_3 = \{ (2, 3), (4, 8), (2, 5), (3, 7) \}$

Q. Is R_3 function?





Remark : Not every Relation is function

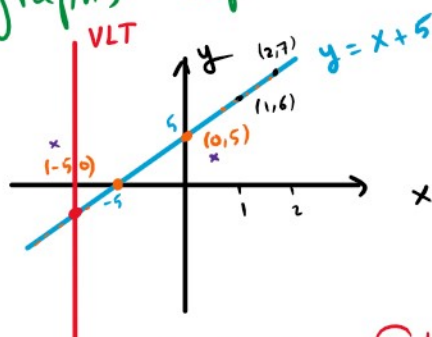
The relation R_1 is function but
 " " R_3 is not function.



Any function is relation ✓

Exp Check if the following graphs represent function or not

①



$y = x + 5$ → This relation
 $\Downarrow$
 function ✓
 by VLT

VLT: Vertical line Test

If any VLT crosses the graph in

one point or does not cross

$\Downarrow$
 function

crosses at
 most once

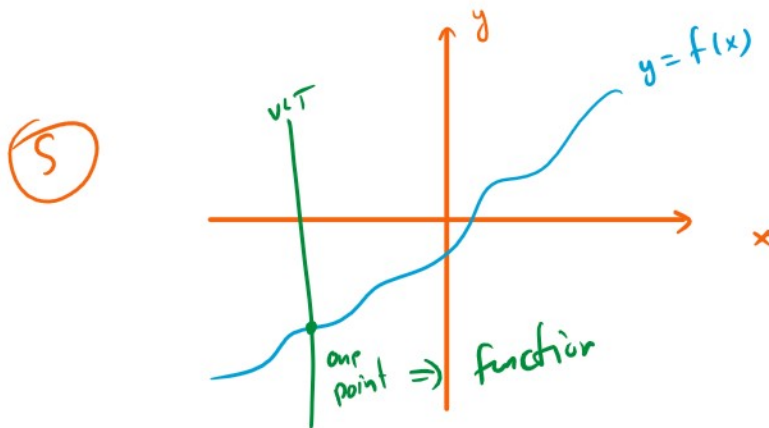
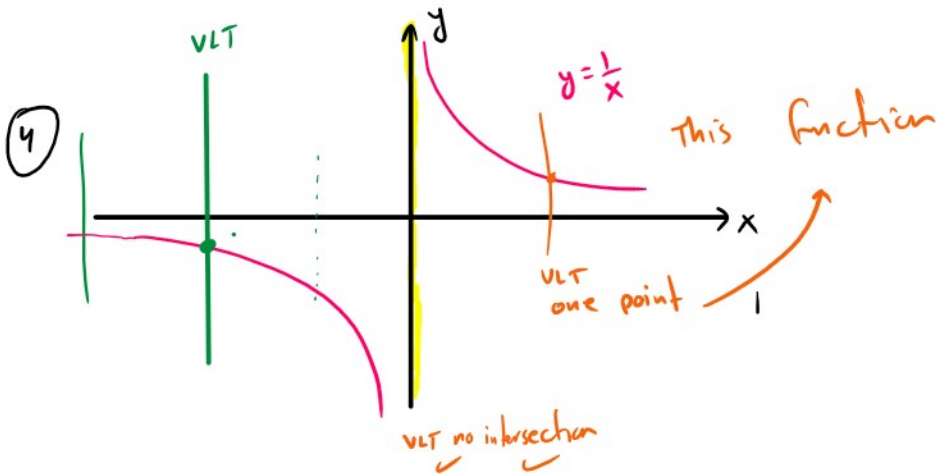
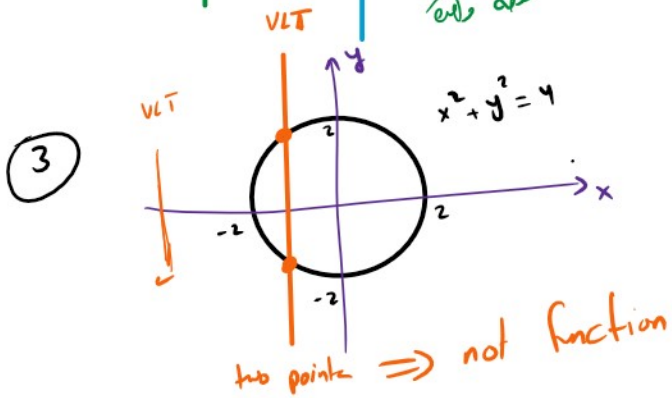
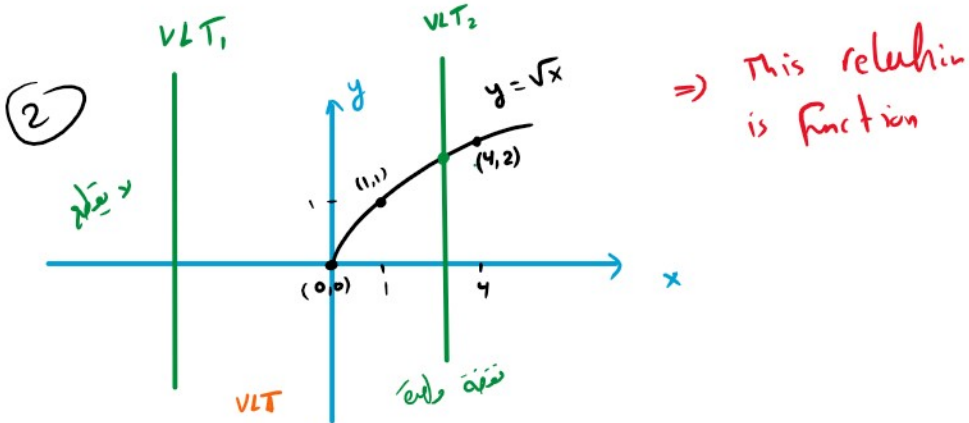
VLT₁

VLT₂

4

$y = \sqrt{x}$

⇒ This relation



Exp Fin 2 Domain of x

Exp Find Domain of

① $y = x^2$

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

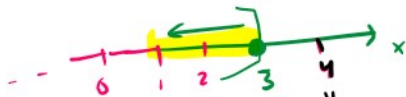
مجال x
تعريف في الاقتران

② $y = \sqrt{3-x}$

$D = (-\infty, 3]$

$3-x \geq 0$

$3 \geq x$



$y(4) = \sqrt{3-4}$
 $= \sqrt{-1}$

③ $y = 5 - \frac{1}{2x-6}$

$D = \mathbb{R} \setminus \{3\}$

$2x-6 \neq 0$

$+6 \quad +6$

$2x \neq 6$

$x \neq 3$

④ $y = \frac{x^2-1}{x^2-4}$

$D = \mathbb{R} \setminus \{-2, 2\}$

$x^2-4 \neq 0$

$\sqrt{x^2} \neq \sqrt{4}$

$|x| \neq 2$

$x \neq 2, x \neq -2$

⑤ $y = \sqrt{3x-12}$

$D = [4, \infty)$

$3x-12 \geq 0$

$3x \geq 12$

$x \geq 4$



f, g functions

① $(f \pm g)(x) = f(x) \pm g(x)$

$$① (f \pm g)(x) = f(x) \pm g(x)$$

$$② (f \cdot g)(x) = f(x) \cdot g(x)$$

$$③ \left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, \quad g(x) \neq 0$$

$$④ (f \circ g)(x) = f(g(x))$$

$$⑤ (g \circ f)(x) = g(f(x))$$

الامتزان المركب
Composit
function

Exp $f(x) = 1 - 2x$, $g(x) = 3x^2$

$$① f(2) = 1 - 2 \cdot 2 = -1 \cdot 2 = -2$$

$$= 1 - 4 = -3$$

$$② g(-1) = 3(-1)^2 = 3(1) = 3$$

$$③ (f - g)(x) = f(x) - g(x) = 1 - 2x - 3x^2 \checkmark$$

$$④ (f - g)(1) = 1 - 2(1) - 3(1)^2 = 1 - 2 - 3 = -4$$

$$⑤ (f \cdot g)(2) = f(2) \cdot g(2) = -3 \cdot 3(2)^2 = -9(4) = -36$$

$$⑥ \left(\frac{g}{f}\right)(1) = \frac{g(1)}{f(1)} = \frac{3(1)^2}{1 - 2(1)} = \frac{3}{-1} = -3$$

$f(x) = 1 - 2x$, $g(x) = 3x^2$

$$⑦ (f \circ g)(x) = f(g(x)) = f(3x^2) = 1 - 2(3x^2) = 1 - 6x^2$$

$$(8) \quad (g \circ f)(x) = g(f(x)) = g(1-2x) = 3(1-2x)^2$$

$$(f \circ g)(x) \neq (g \circ f)(x)$$

$$(9) \quad (g \circ f)(2) = 3(1-2(2))^2 = 3(1-4)^2 = 3(-3)^2 = 3(9) = 27$$

$$g(x) = 2x - x^2$$

$$g(1) = 2(1) - (1)^2 = \dots$$

$$g(-1) = 2(-1) - (-1)^2 = \dots$$

$$g(x^2) = 2(x^2) - (x^2)^2 = \dots$$

$$g(f(x)) = 2(f(x)) - (f(x))^2 = \dots$$

$$f = 1-2x$$

$$g(x) = 3x^2$$

$$g(5) = 3(5)^2 = \dots$$

$$g(10) = 3(10)^2 = \dots$$

$$g(f) = 3(f)^2 = \dots$$

$$g(1-2x) = 3(1-2x)^2 = \dots$$