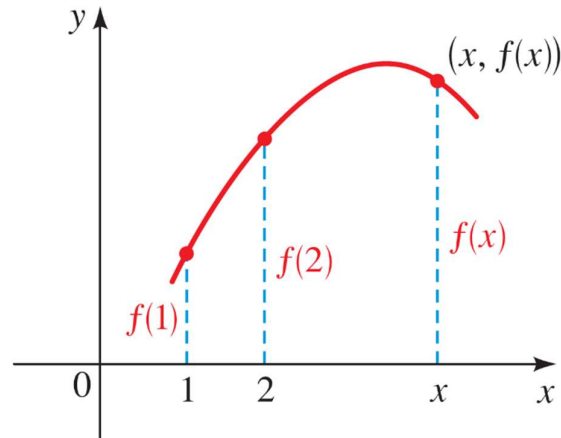


## Section 2.2 – Graphs of Functions

- The **function** الدالة can be visualized through a graph by plotting all the point pairs  $(f, f(x))$  in the  $xy$ -plane

نقدر نرسم الدالة كعلاقة بين  $x$  و  $f(x)$  على المحاور  $x$  و  $y$



### Example 1

Sketch graphs of the following functions.

(a)  $g(x) = 3x + 2$

(b)  $h(x) = x^2$

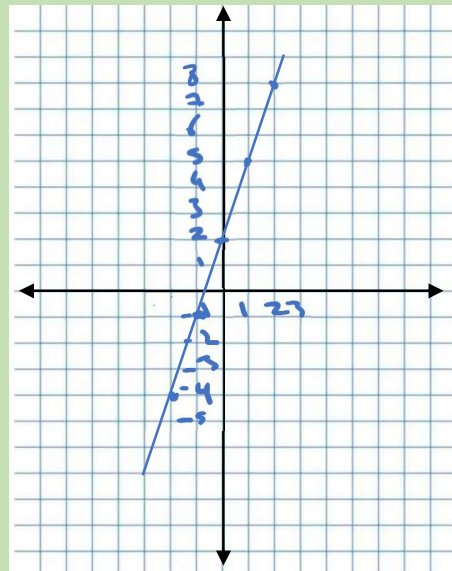
(c)  $r(x) = x^3$

(d)  $l(x) = \sqrt{x}$

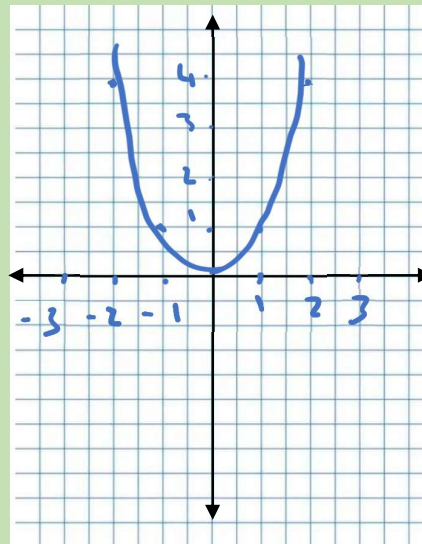
### Solution

(a)

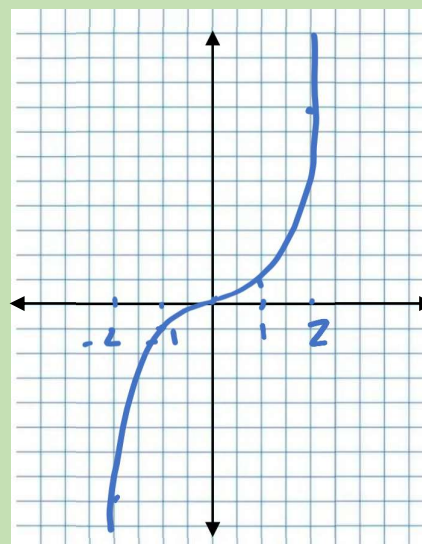
| $x$ | $g(x)$              |
|-----|---------------------|
| -2  | $3(-2) + 2 = -4$    |
| -1  | $3(-1) + 2 = -1$    |
| 0   | $3(0) + 2 = 2$      |
| 1   | $3 \cdot 1 + 2 = 5$ |
| 2   | $3 \cdot 2 + 2 = 8$ |



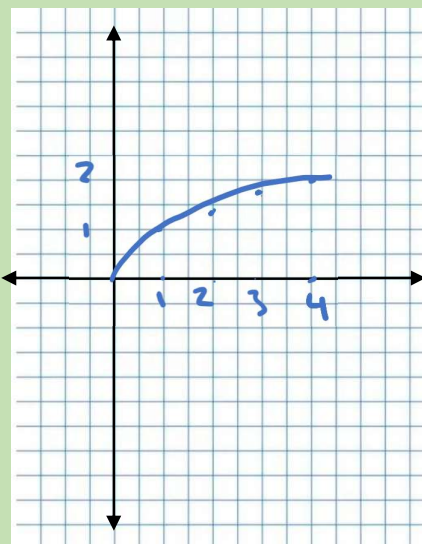
| $x$ | $h(x)$       |
|-----|--------------|
| -2  | $(-2)^2 = 4$ |
| -1  | $(-1)^2 = 1$ |
| 0   | 0            |
| 1   | 1            |
| 2   | 4            |



| $x$ | $r(x)$ |
|-----|--------|
| -2  | -8     |
| -1  | -1     |
| 0   | 0      |
| 1   | 1      |
| 2   | 8      |

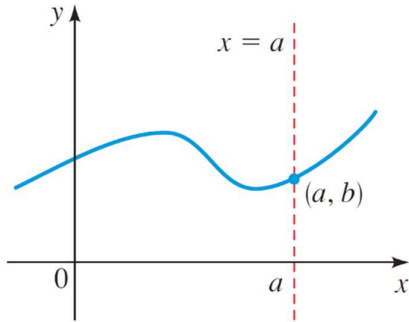


| $x$ | $l(x)$         |
|-----|----------------|
| 0   | $\sqrt{0} = 0$ |
| 1   | 1              |
| 2   | 1.414...       |
| 3   | 1.732...       |
| 4   | 2              |



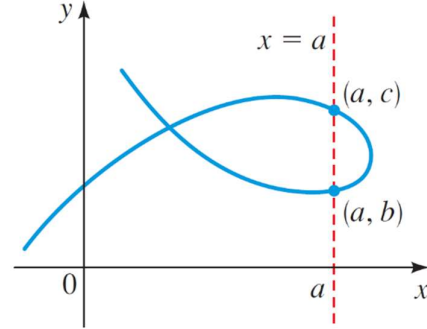
- Not every graph in the  $xy$ -plane represents a function. To verify whether a graph does, we try to plot a vertical line that intersects the curve more than once

للتعرف على الدالة من الرسم نتأكد من عدم إمكانية رسم خط عمودي يمر بالمنحنى أكثر من مرة واحدة فقط



Graph of a function

**دالة** لأن أي خط عمودي نقوم برسمه سيمر بالمنحنى الدالة مرة واحدة فقط.

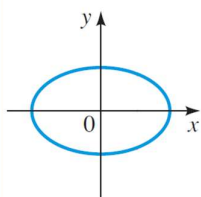


Not a graph of a function

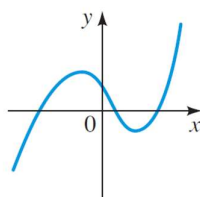
**ليست دالة** لأن يمكن رسم خطوط عمودية تقطع منحنى بالدالة أكثر من مرة.

### Example 2

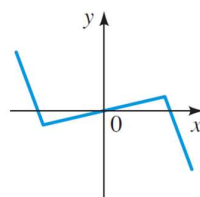
Using the Vertical Line Test, determine which of the graphs represent a function and which ones don't



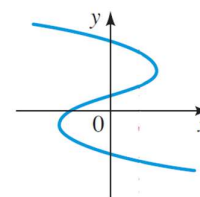
(a)



(b)



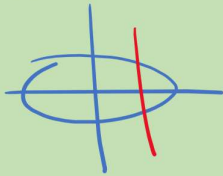
(c)



(d)

### Solution

(a)

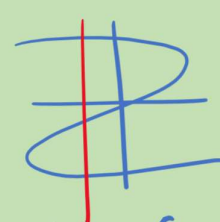


Not a function

(b) Function

(c) Function

(d)



Not a function

- Not every equation represents a function. A function must have one and only one value of  $y$  for any value of  $x$

لا تكون المعادلة دالة إلا إذا كانت أي قيمة ل  $x$  تعطي قيمة واحدة فقط ل  $y$  طبقا لتعريف المعادلة

### Example 3

Does the equation define  $y$  as a function of  $x$ ?

(a)  $y - x^2 = 2$

(b)  $x^2 + y^2 = 4$

#### Solution

$$(a) \quad y - x^2 = 2$$

$$y = x^2 + 2$$

Function: any value of  $x$  gives only one value of  $y$

$$(b) \quad x^2 + y^2 = 4$$

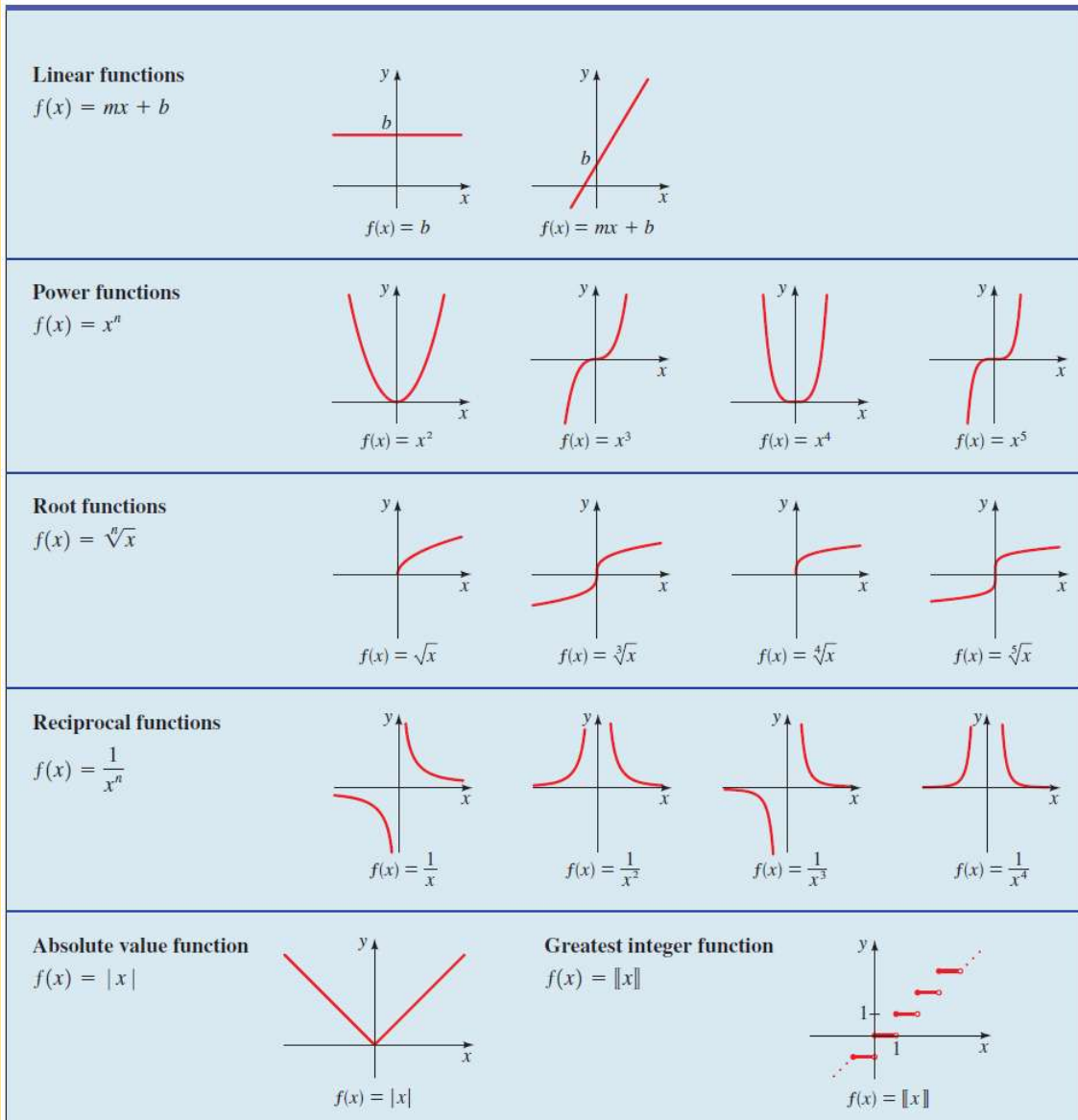
$$y^2 = 4 - x^2$$

$$y = \pm \sqrt{4 - x^2}$$

Not a function: any value of  $x$  gives 2 (positive and negative) values of  $y$

## لاحظ

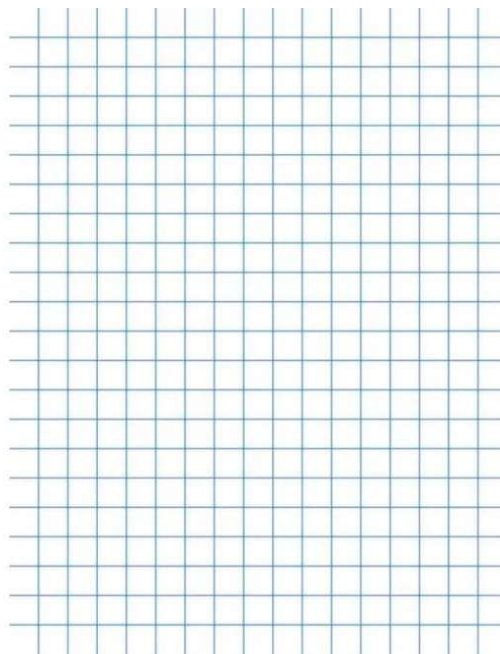
بعض المعادلات المهمة و طريقة رسمها



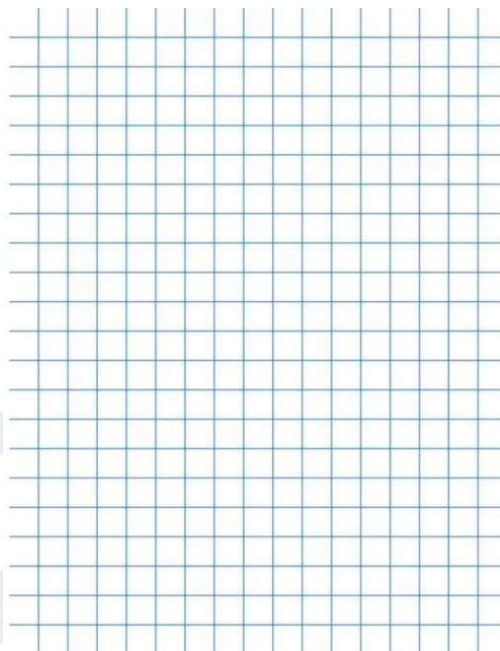
**Problems**

- Sketch a graph of the function by first making a table of values:

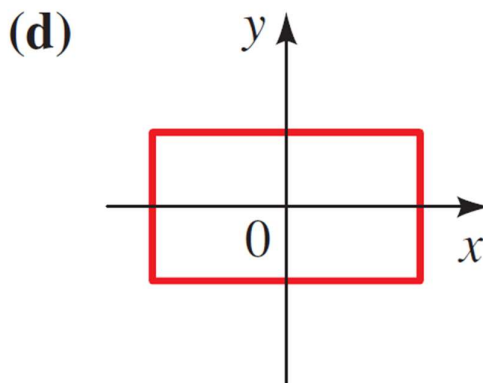
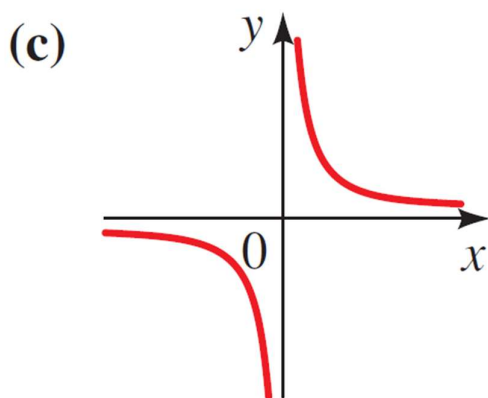
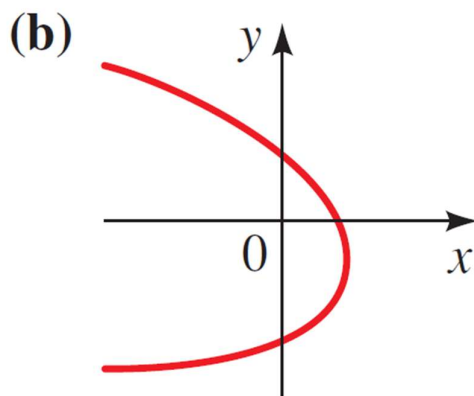
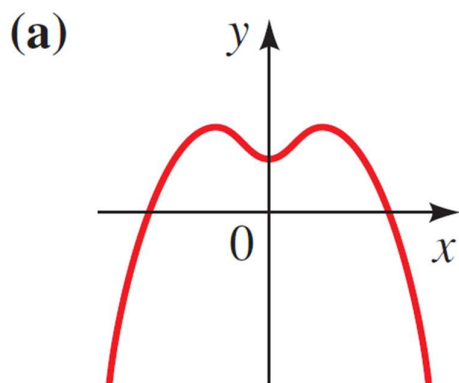
$$f(x) = -x^2$$



$$f(x) = 1 + \sqrt{x}$$



- Use the Vertical Line Test to determine whether the curve is a graph of a function of  $x$ .



- Determine whether the equation defines  $y$  as a function of  $x$ .

$$3x - 5y = 7$$

$$2x - 4y^2 = 3$$