



## رسم الدوال (Graph of Functions (Graph of Curves)

To graph the curve of a function, we can follow the following steps:

1. Find the domain and range of the function.
2. Check the symmetry of the function
3. Find (if any found) points of intersection with  $x$ -axis and  $y$ -axis.
4. Choose some another points on the curve.
5. Draw a smooth line through the above points.

**Example 3:** Sketch the graph of the curve  $y = f(x) = x^2 - 1$

**Sol.:**

**Step 1:** Find Df, Rf of the function?

$$Df = (-\infty, \infty);$$

To find Rf : we must convert the function from  $y = f(x)$  into  $x = f(y)$ .

$$y = x^2 - 1$$

$$y = x^2 - 1 \rightarrow x^2 = y + 1$$

$$x = \pm\sqrt{y + 1}$$

$$\text{So } y + 1 \geq 0 \Rightarrow y \geq -1 \Rightarrow Rf = (-1, \infty)$$

**Step 2:** Find  $x$  and  $y$  intercept:

$$\text{To find } x\text{-intercept put } y=0 \rightarrow x^2 - 1 = 0 \rightarrow X = \pm 1$$

So  $x$ -intercept are  $(-1, 0)$  and  $(+1, 0)$ .

$$\text{To find } y\text{-intercept put } x=0 \rightarrow y = 0 - 1 \rightarrow y = -1$$

So  $y$ -intercept is  $(0, -1)$ .

**Step 3:** check the symmetry:

$$x^2 - y - 1 = 0$$

$$f(x, -y) = x^2 + y - 1 \neq f(x, y)$$

## Lecture (4)



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$f(-x, y) = x^2 - y - 1 = f(x, y)$  so that the function is symmetry about  $y$ .

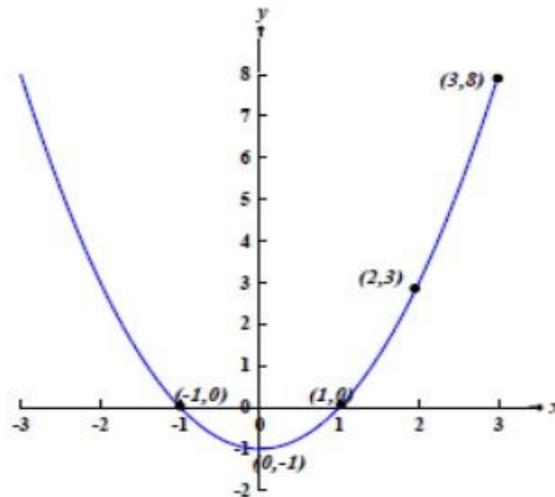
$f(-x, -y) = x^2 + y - 1 \neq f(x, y)$

**Step 4:** Choose some another point on the curve.

x	y
2	3
3	8

(2,3), (3,8)

**Step 5:** Draw smooth line through the above points



**H.W**

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

2-  $y^2 = 4x - 1$

## Lecture (4)



## DERIVATIVES المشتقة

the definition of derivative of the function  $f(x)$  and this denoted by  $y'$  or  $\frac{dy}{dx}$  or  $\frac{d}{dx}f(x)$  or  $D_x f(x)$  or  $f'(x)$  and given by the formula

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

**Example1:** Find the derivative of the function  $f(x) = x^2$  using the definition of derivative.

Sol:  $f(x) = x^2$

$$f(x + \Delta x) = (x + \Delta x)^2$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{(x + \Delta x)^2 - x^2}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{(x^2 + 2x\Delta x + \Delta x^2) - x^2}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{(2x\Delta x + \Delta x^2)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{\Delta x(2x + \Delta x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} (2x + \Delta x) = 2x + 0 = 2x$$

## Lecture (4)



**Example2:** Find the derivative of the function  $f(x) = 3x$  using the definition of derivative.

Sol:  $f(x) = 3x$

$$f(x + \Delta x) = 3(x + \Delta x)$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{3(x + \Delta x) - 3x}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{3x + 3\Delta x - 3x}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{3\Delta x}{\Delta x} = 3$$