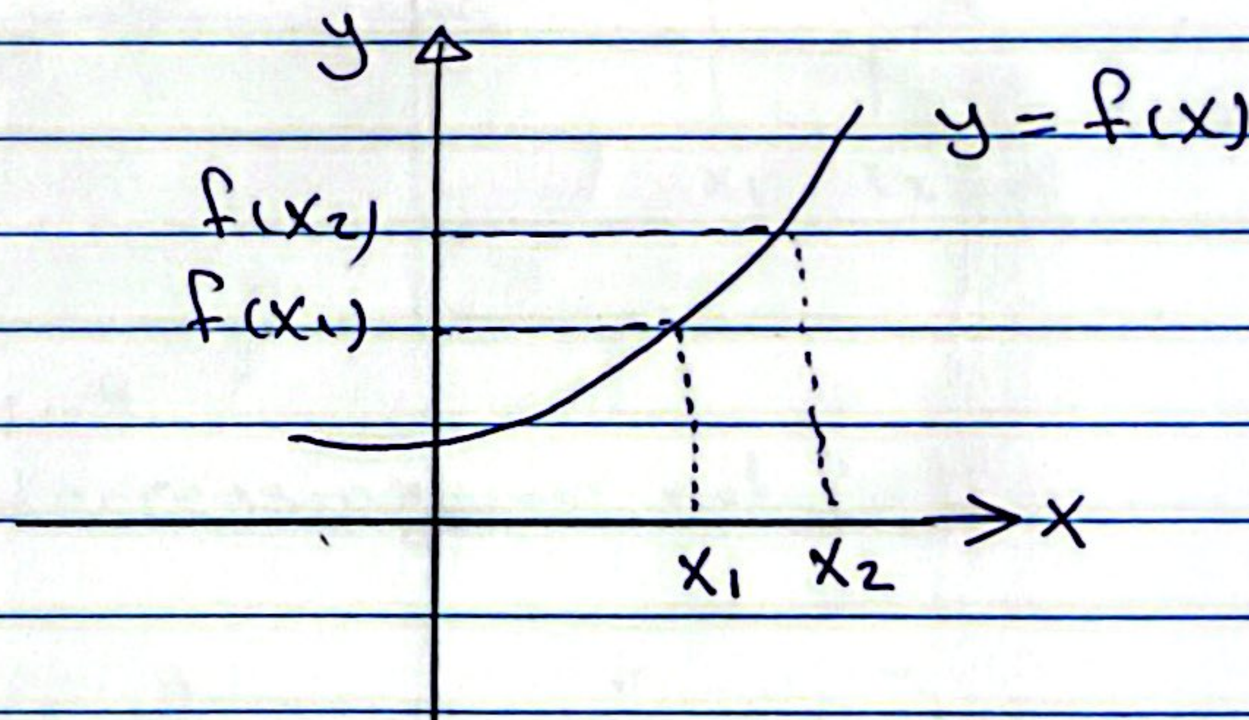
Applications on the derivative

- Increasing and Decreasing Functions:-

Def.: we say that $f(x)$ is increasing function iff satisfy :-

$f(x_1) \leq f(x_2)$ to all values of x_1 and x_2 such that $x_1 \leq x_2$



Ex let the function $y = 2 + x$

is y Increasing or not ?

Soly

x	y	x	y
1	3	0	2
2	4	-1	1
3	5	-2	0
4	6	-3	-1

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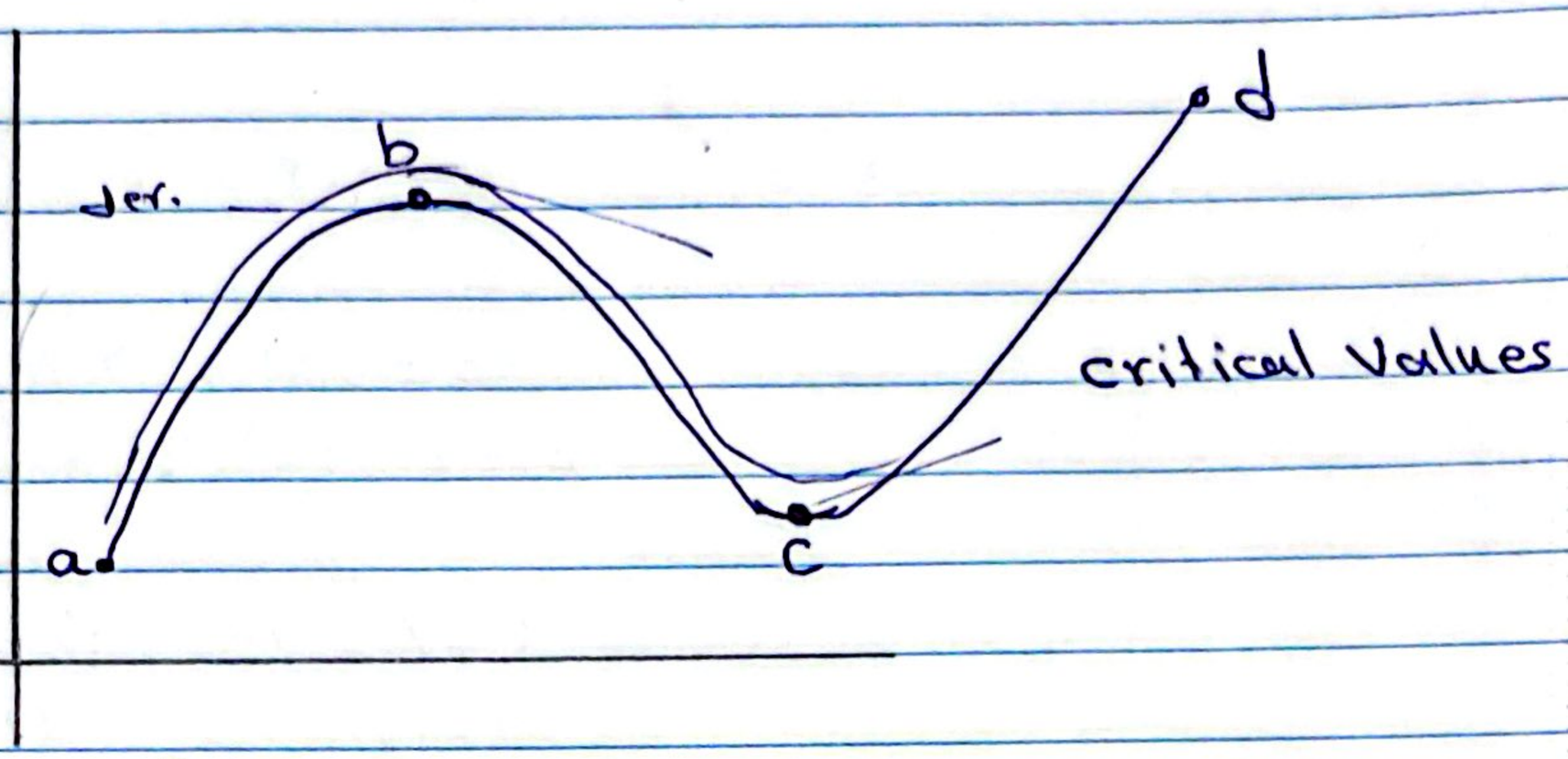
كلما زادت x زادت y كلما قلت x قلت y

$\therefore$ y is Increasing

Def.: we say that $f(x)$ is increasing iff $f'(x)$ is positive for all values of x

and $f(x)$ is decreasing iff $f'(x)$ is negative for all values of x



Ex1. If $f(x) = 2x^3 - 6x$ is increasing or not ? and identify the poinst of decreasing and increasing in the functi.

Soly $f'(x) = 6x^2 - 6$

$= 6(x^2 - 1) > 0$ positive

$f'(x) = 0 \Rightarrow 6(x^2 - 1) = 0$

$6 = 0$

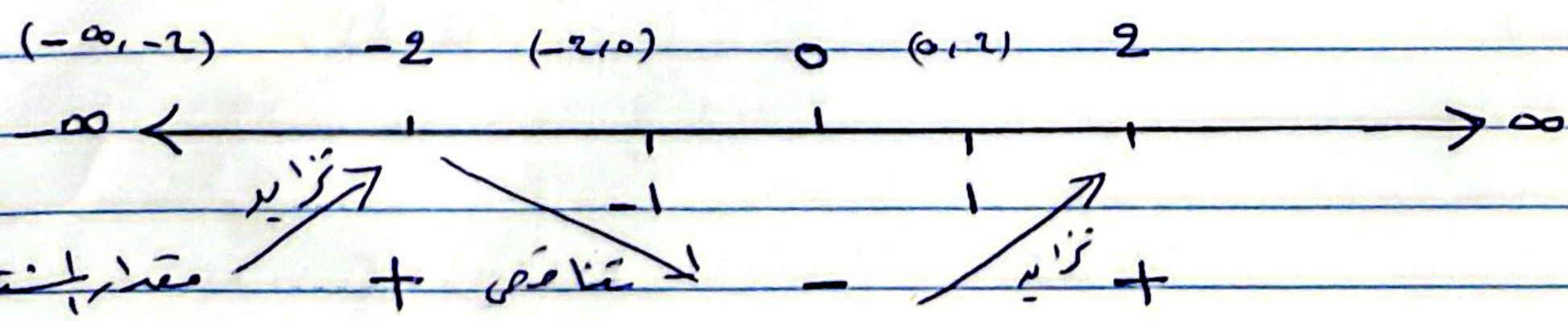
$x^2 - 1 = 0 \Rightarrow x = \mp 1$

∴ the Critical Values are $(-1, +1)$

$(-\infty, -1)$, $(-1, 1)$, $(1, \infty)$

لتحديد التزايد والتناقص في الدالة نأخذ قيم بين النقاط الحرجة وهي $(-1, 1)$ وهو 0 ويعوض في المشتقة للحصول على قيمة المشتقة بالسالب ثم قيم اقل من -1 واكبر من 1 للحصول على وضع المشتقة .

∴ y is increasing



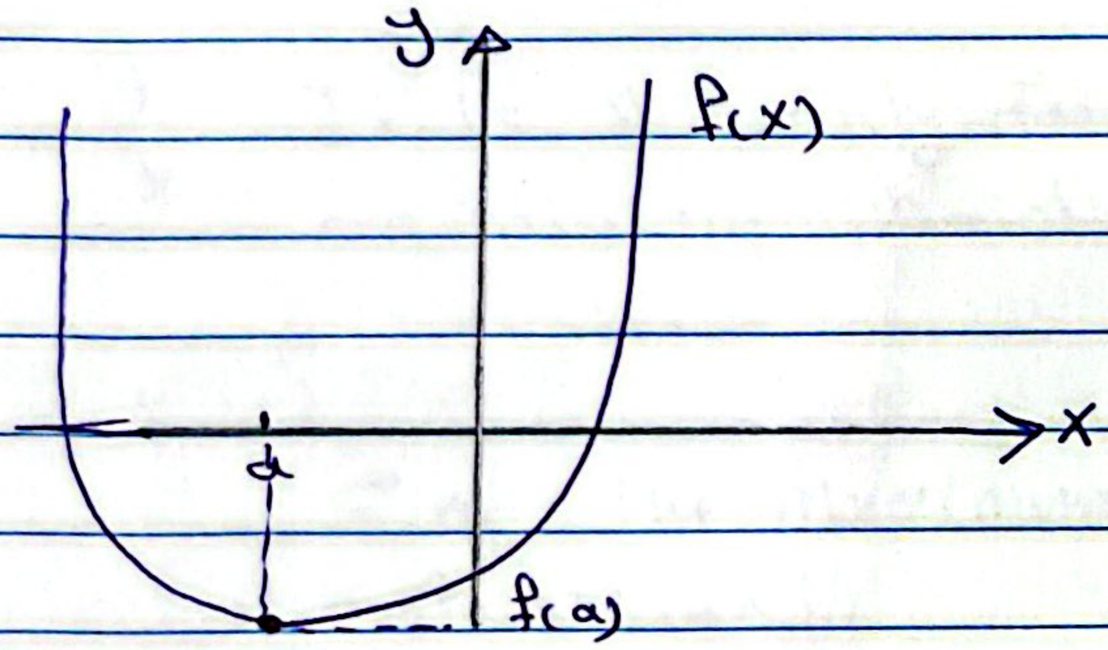
Maximum and Minimum Values:-

Def.: we say that $f(x)$ has relative maximum value at $x=a$ iff:

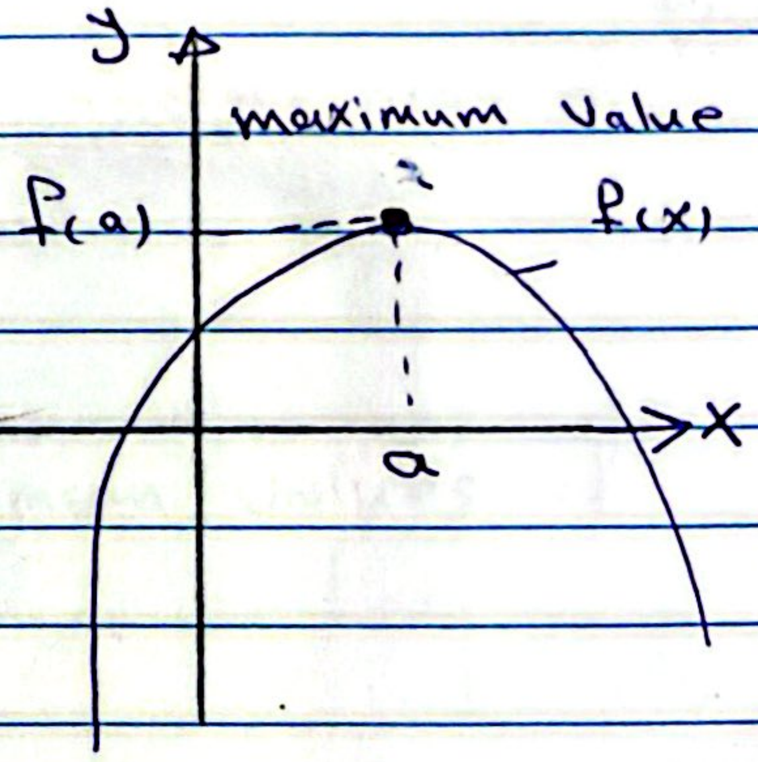
$$f(a) \geq f(x) \qquad \forall\, x \in D_f \quad (D_f: \text{Domain})$$

Def. we say that $f(x)$ has relative minimum value at $x=a$ iff:

$$f(a) < f(x) \qquad \forall\, x \in D_f$$



minimum value



Ex

1. $f(x) = x^2 - 9 \quad ; a \in (-\infty, \infty) \quad ; [-3, 3]$

Find the maximum (or minimum) value of $f(x)$ in interval $[-3,3]$

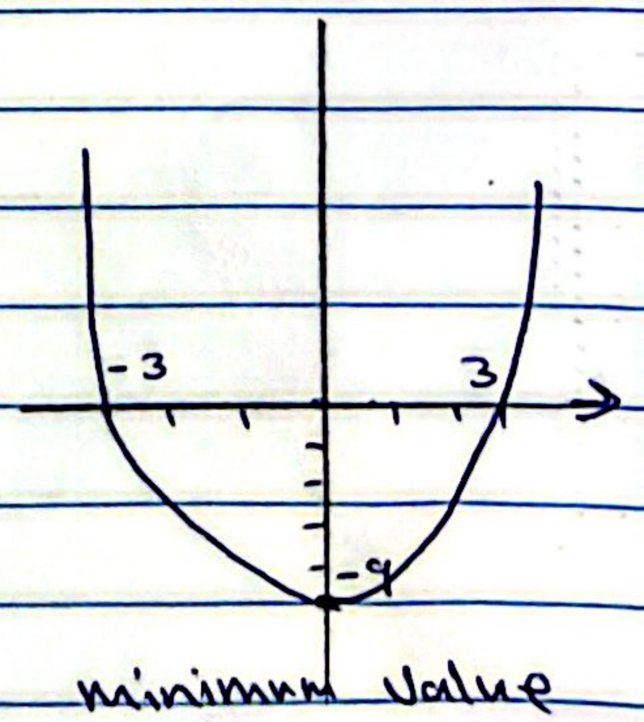
Solu

$f(x) = x^2 - 9$

$f'(x) = 2x \qquad > 0$

$f'(x) = 0 \Rightarrow 2x = 0 \Rightarrow x = 0$

from $f(x) \Rightarrow x = 0 \Rightarrow y = -9 \qquad (0, -9)$



minimum value