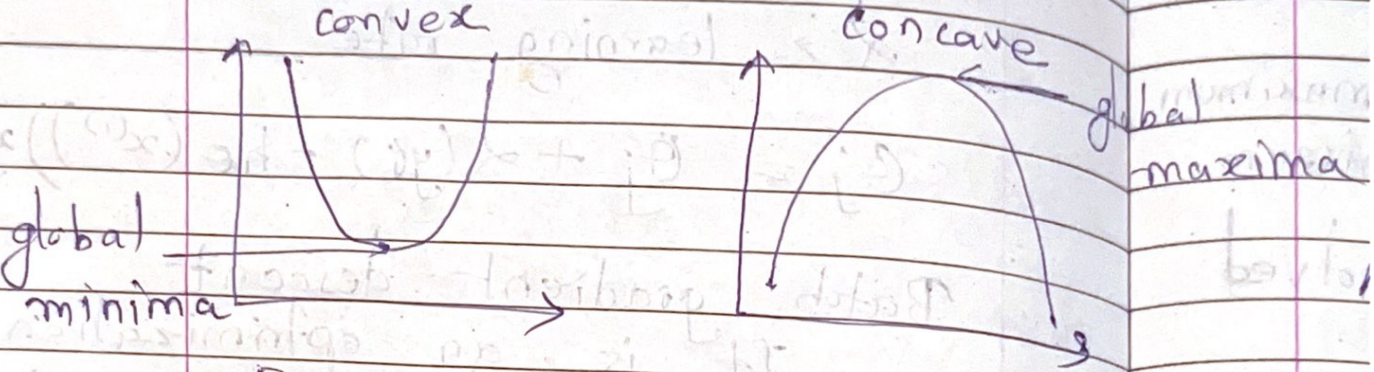
Global minima & Global maxima.



Eg:-

$$f(x) = x^3 - 3x^2 + 2x$$

1) First derivative

$$f'(x) = \frac{\partial}{\partial x}(x^3 - 3x^2 + 2x)$$

$$f'(x) = 3x^2 - 6x + 2$$

2) Equate it to 0

$$3x^2 - 6x + 2 = 0$$

$\therefore x = 1$ & $x = \frac{-1}{3}$

3) Put $x = 1$ in $f''(x)$

$$f''(x) = 6x - 6$$

$$= 6(1) - 6$$

$$= 0$$

$$f''(x) = 6x - 6$$
$$= 6\left(\frac{-1}{3}\right) - 6$$

al maxima

$$= -2 - 6 = -8$$

As $f''(x) < 0$ thus it has ~~global~~ local maximum since $x = \frac{-1}{3}$ critical point corresponds to local maxima as second derivative < 0 negative

Compare the function values at the critical points ~~&~~ end behaviour

$$f(1) = 1^3 - 3(1)^2 + 2(1) = 1 - 3 + 2$$
$$= 0$$

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

$$= \frac{-2}{27} - \frac{1}{3} - \frac{2}{3} = \frac{-7}{9}$$

As $f(1)$ & $f''(1) = 0$ it has global minimum &

as $f\left(\frac{-1}{3}\right)$ & $f''\left(\frac{-1}{3}\right) < 0$ it has

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global maxima

$f''(x) < 0$ local maximum
$f''(x) > 0$ local minimum

Linear Regression solved example

Sepal length X_1	Sepal width X_2	Petal length X_3	Petal Width Y
5.1	3.5	1.4	0.2
4.9	3.0	1.4	0.2
4.7	3.2	1.3	0.2
4.6	3.1	1.5	0.2
5.0	3.6	1.4	0.2

Linear regression eqn.

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3$$

1) Means of X_1, X_2, X_3

$$\text{Mean}(X_1) = \frac{5.1 + 4.9 + 4.7 + 4.6 + 5.0}{5}$$

$$= 4.86$$