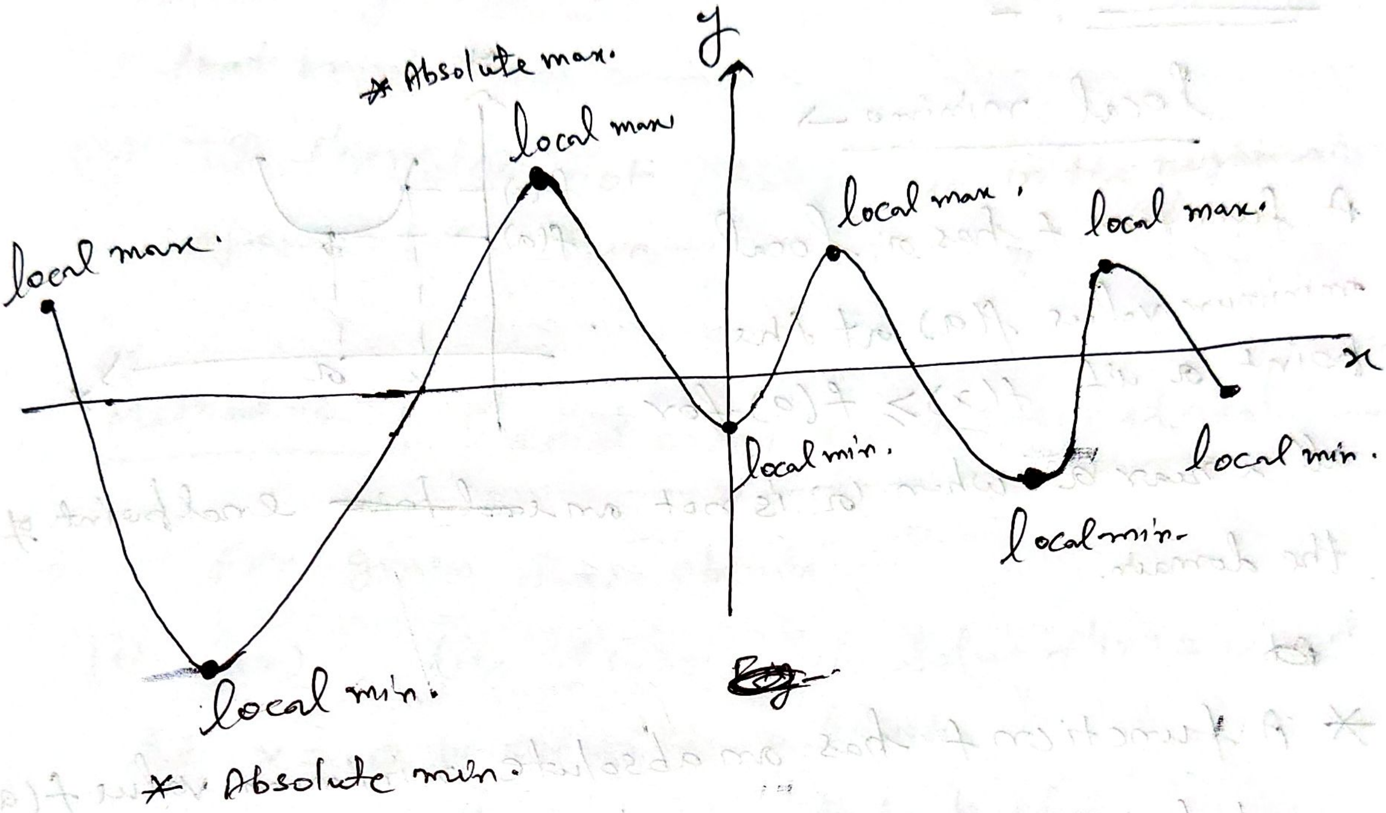
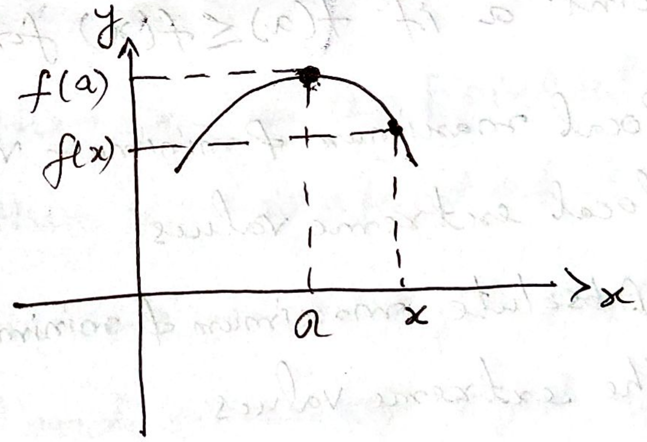
Maxima and minima of a function :





Maxima

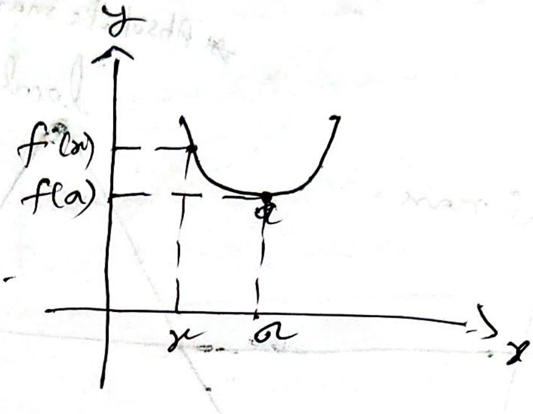
Local maximum value $\rightarrow$ A function f has a local maximum value $f(a)$ at point a if

$f(x) \leq f(a)$ for all x in the domain near a, i.e; for all $x \in (a-\epsilon, a+\epsilon)$ for a sufficiently small $\epsilon > 0$, when a is not an end point of the domain

* A function f has an absolute maximum value f(a) at point a if $f(a) \geq f(x)$ for ~~all~~ all x in domain.

Minima :-

local minima →



A function f has a local minimum value f(a) at the point a if $f(x) \geq f(a)$ for all x near 'a' when 'a' is not an ~~end poin~~ endpoint of the domain.

* A function f has an absolute minimum value f(a) at point a if $f(a) \leq f(x)$ for all x in domain.

Note: → local maximum & minimum values are called local extreme values

→ Absolute maximum & minimum values are called the extreme values.

Method of finding Maxima or Minima :-

Method-1

For a given f(x) obtain

(i) $f'(x)$

(ii) Take $f'(x) = 0$ and find stationary points

(iii) If $f'(x)$ changes sign from +ve to -ve in the neighbourhood of stationary point then $f(x)$ has maximum values at that point and if $f'(x)$ changes sign from $-ve$ to $+ve$ in the neighbourhood of stationary point then $f'(x)$ has minimum value at that point.

(iv) If $f'(x)$ does not change sign in the neighbourhood of a point then it is a point of inflexion.

Method-2 : Second order derivative method :—

For given $f(x)$ obtain

(i) $f'(x)$ (ii) $f'(x)=0$ (iii) Solve $f'(x)=0$ and

Let $x=a$ be one of its real roots.

(iv) Obtain $f''(x)$, and check if

$f''(a)<0$, then $x=a$ is a point of local max.

$f''(a)>0$, then $x=a$ is a point of local minima

$f''(a)=0$ then we use the sign of $f'(x)$ on the left of 'a' and on the right of 'a' to arrive the result.

H.W. (1) Find the local minima/maxima of the following functions:

(a) $f(x)=2x^3-8x^2-12x+8$

(b) $f(x)=\sin x+\cos x, \quad 0<x<\frac{\pi}{2}$.