

# Summary

(I) How to tell where  $f(x)$  is  $\uparrow$  or  $\downarrow$ :

Look at sign of first derivative,  $f'(x)$ .

If  $f' \begin{cases} > 0, \text{ then } f \text{ is } \uparrow \\ < 0, \text{ then } f \text{ is } \downarrow \\ = 0, \text{ then } f \text{ is neither} \end{cases}$

(II) How to tell concavity:

\* Method 1: Look at sign of  $f''(x)$ .

If  $f'' \begin{cases} > 0, \text{ then } f \text{ is } \cup \text{ (concave up)} \\ < 0, \text{ then } f \text{ is } \cap \text{ (concave down)} \\ = 0, \text{ then } f \text{ is neither} \end{cases}$

Inflection point = any point where  $f''$  changes from  $+$  to  $-$

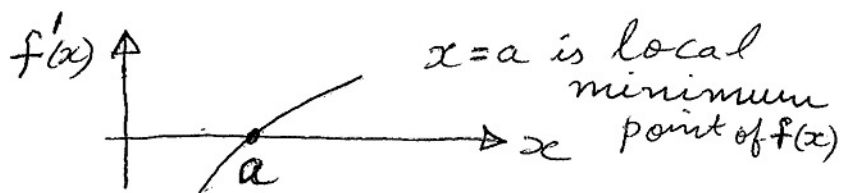
\* Method 2: Look at graph of  $f'(x)$

If  $f' \begin{cases} \uparrow, \text{ then } f \text{ is } \cup \\ \downarrow, \text{ then } f \text{ is } \cap \\ 0, \text{ then } f \text{ is neither } \cup \text{ nor } \cap \end{cases}$

(III) How to locate local minimum & maximum points

Look for  $f' = 0$  and observe the sign changes

\* Minimum:  $f'$  changes from  $-$  to  $+$



\* Maximum:  $f'$  changes from  $+$  to  $-$

