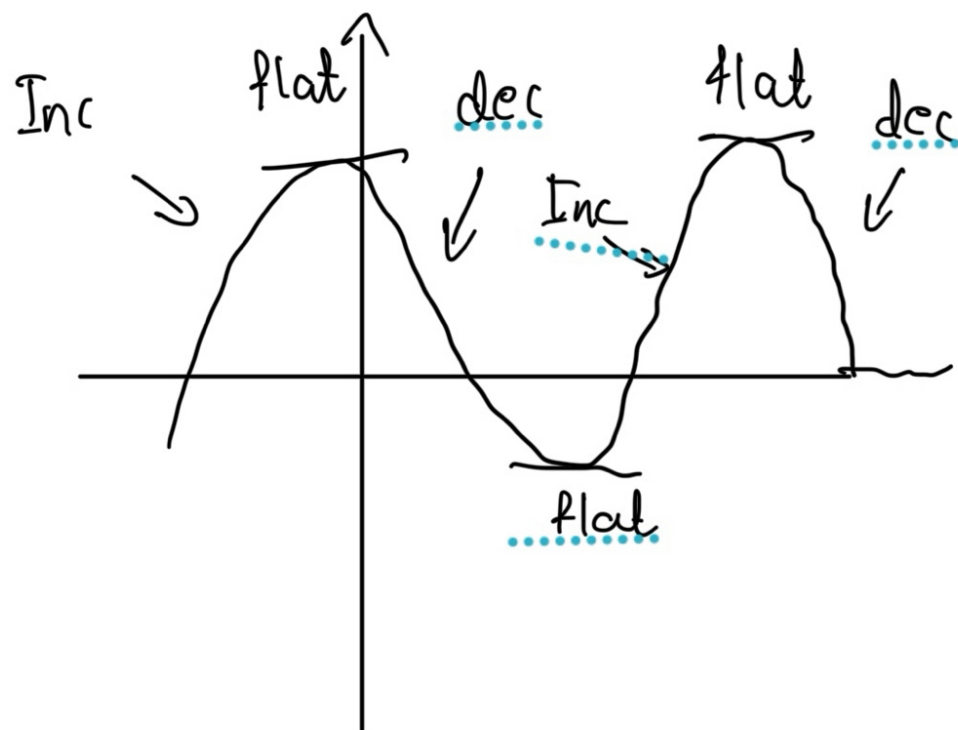


Increasing & decreasing Intervals

With Graph:



Must analyze left-right >

Without Graph:

If $f'(x) > 0 \rightarrow f(x)$ is increasing

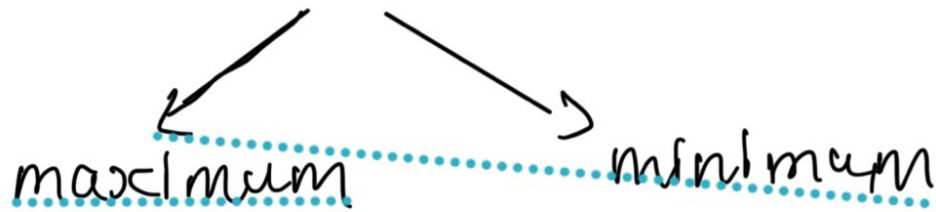
If $f'(x) < 0 \rightarrow f(x)$ is decreasing

If $f'(x) = 0 \rightarrow f(x)$ is flat

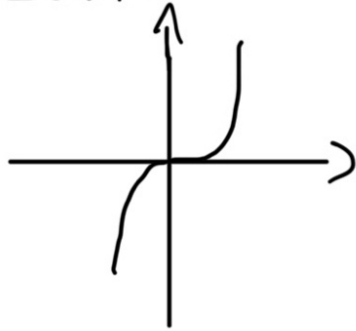
Flat Region

If a function is flat, it could be because:

① Turning Point



② Horizontal tangent



Finding Intervals

Example Question:

Find the intervals of increase and decrease for the function defined by $f(x) = x^3 - 6x^2 + 9x + 2$.

Step 1 $\rightarrow$ Find $f'(x)$

$$f'(x) = 3x^2 - 12x + 9$$

Step 2 $\rightarrow$ Equate $f'(x)$ to 0 and solve for x .

$$3x^2 - 12x + 9 = 0$$

$$(x-3)(x-1) = 0$$

$$x_1 = 3 \quad x_2 = 1$$

Step ③ → Make a T-table to test the values

Any x -values
within this range

x	$(-\infty, 1)$	$x = 1$	$(1, 3)$	$x = 3$	$(3, \infty)$
$f'(x)$	$x = 0$ $f'(0) = 9(+)$	0	$x = 2$ $f'(2) = -3(-)$	0	$x = 4$ $f'(4) = 9(+)$
$f(x)$	Increasing	Flat	Decreasing	Flat	Increasing

Step ④ → Write the intervals

$f(x)$ is increasing over the interval
 $(-\infty, 1) \cup (3, \infty)$

$f(x)$ is decreasing over the interval
 $(1, 3)$

' $\cup$ ' union is used
to combine two
increasing intervals

Example

To find max and min,

plug the x -values where $f'(x)$ is
0 into $f(x)$

→ $f(1) = 6$ (1, 6) Max
 $f(3) = 2$ (1, 2) Min