(iii) If (x) is increasing function on (a , b), then tangent at every point on the curve y = f(x) makes an acute angle θ with the positive direction of x-axis.

$$\tan\theta > 0 \Rightarrow \frac{dy}{dx} > 0 \text{ or } f'(x) > 0 \text{ for all } x \in (a, b).$$
∴

(iv) Let f be a differentiable real function defined on an open interval (a, b).

- If f ‘ (x) > 0 for all x ∈ (a, b), then f (x) is increasing on (a, b).
- If f ‘ (x) < 0 for all x ∈ (a , b), then f (x) is decreasing on (a, b).

(v) Let f be a function defined on (a, b).

- If f ‘(x) > 0 for all x ∈ (a, b) except for a finite number of points, where f ‘ (x) = 0, then f(x) is increasing on (a, b).
- If f ‘(x) < 0 for all x ∈ (a , b) except for a finite number of points, where f ‘(x) = 0, then f(x) is decreasing on (a , b).

Properties of Monotonic Functions

1. If f(x)is strictly increasing function on an interval [a, b], then f^{-1} exist and also a strictly increasing function.
2. If f(x) is strictly increasing function on [a, b], such that it is continuous, then f^{-1} is continuous on [f(a), f(b)].
3. If f(x) and g(x) are strictly increasing (or decreasing) function on [a, b], then gof(x) is strictly increasing (or decreasing) function on [a, b].
4. If one of the two functions f(x) and g(x) is strictly increasing and other a strictly decreasing, then gof(x) is strictly decreasing on [a, b].
5. If f(x) is continuous on [a, b], such that f’ (c) ≥ 0 (f ‘ (c) > 0) for each c ∈ (a, b) is strictly increasing function on [a, b].
6. If f(x) is continuous on [a, b] such that f ‘(c) ≤ (f ‘ (c) < 0) for each c ∈ (a, b), then f(x) is strictly decreasing function on [a, b].

Maxima and Minima of Functions

1. A function y = f(x) is said to have a local maximum at a point x = a. If f(x) ≤ f(a) for all x ∈ (a – h, a + h), where h is somewhat small but positive quantity.

In order to find the global maximum and minimum of f(x) in [a, b], find out all critical points of f(x) in [a, b] (i.e., all points at which f '(x)= 0) and let $f(c_1)$, $f(c_2)$,…, $f(_n)$ be the values of the function at these points.

Then, M_1 → Global maxima or greatest value.
and M_1 → Global minima or least value.
where M_1 = max { f(a), $f(c_1)$, $f(c_1)$,…, $f(c_n)$, f(b)}
and M_1 = min { f(a), $f(c_1)$, $f(c_2)$,…, $f(c_n)$, f(b)}

Then, M_1 is the greatest value or global maxima in [a, b] and M_1 is the least value or global minima in [a, b].