- Tangent is the limiting case of chord.

* Prime Condition

- If a function is not Continuous, it won't be differentiable.
- If a function is continuous, then it may or may not be differentiable.
- * If a function is differentiable, it is definitly continuous.

CONDITION:

① LHD = RHD = $f'(a)$ or $f'(a^-) = f'(a^+) = f'(a)$ OR

② $$\lim_{x\to a^-} \frac{f(x)-f(a)}{x-a} = \lim_{x\to a^+} \frac{f(x)-f(a)}{x-a} = f'(a)$$

* This prime condition check is called Standard method/ Fundamental method

Methods to check differentiablity.

- Fundamental method {Discussed above ② marked}
- * Graphing {Self Knowledge (functions)}
- * Method of direct differentiation {Conditional: Only applicabe if fxn is Continuous}

* MODD

S₁] Check Continuity of given function at doubtful points.
→ If discontinuity exists → fxn is not differentiable, don't proceed further.
→ If fxn is Continuous, goto: S₂.

S₂] $f(x) \longrightarrow f'(x)$, equate RHD $\xrightarrow{①}$ LHD, if it is equal then differentiable else not differentiable.

Reasons for non-differentiablity. {useful for MTCD - Graphing}

1) Discontinuity
2) Corner [Ex. $Y = |x|$ at $x=0$]
3) Vertical Tangent [Ex. $Y = x^{1/3}$ at $x=0$]
4) Cusp → Photo :  $Y = x^{2/3}$ → CUSP ⇒ If one of LHD/RHD = $+\infty$ & other is $-\infty$, then we call it cusp.

* Theorems

$f(x)$	$g(x)$	$f(x) \pm g(x)$	$f(x)\cdot g(x)$	$f(x)/g(x)$
D	D	D	D	D
D	ND	ND	** D/ND	D/ND
ND	ND	D/ND	D/ND	D/ND

* For ***

- Let $f(x)$ is diff. at $x=a$ & $g(x)$ is cont but not diff at $x=a$, then
  1) if $f(a)=0$, then $f(x)g(x)$ is diffrentiable at $x=a$
  2) if $f(a)\neq 0$, then $f(x)g(x)$ is non differentiable at $x=a$