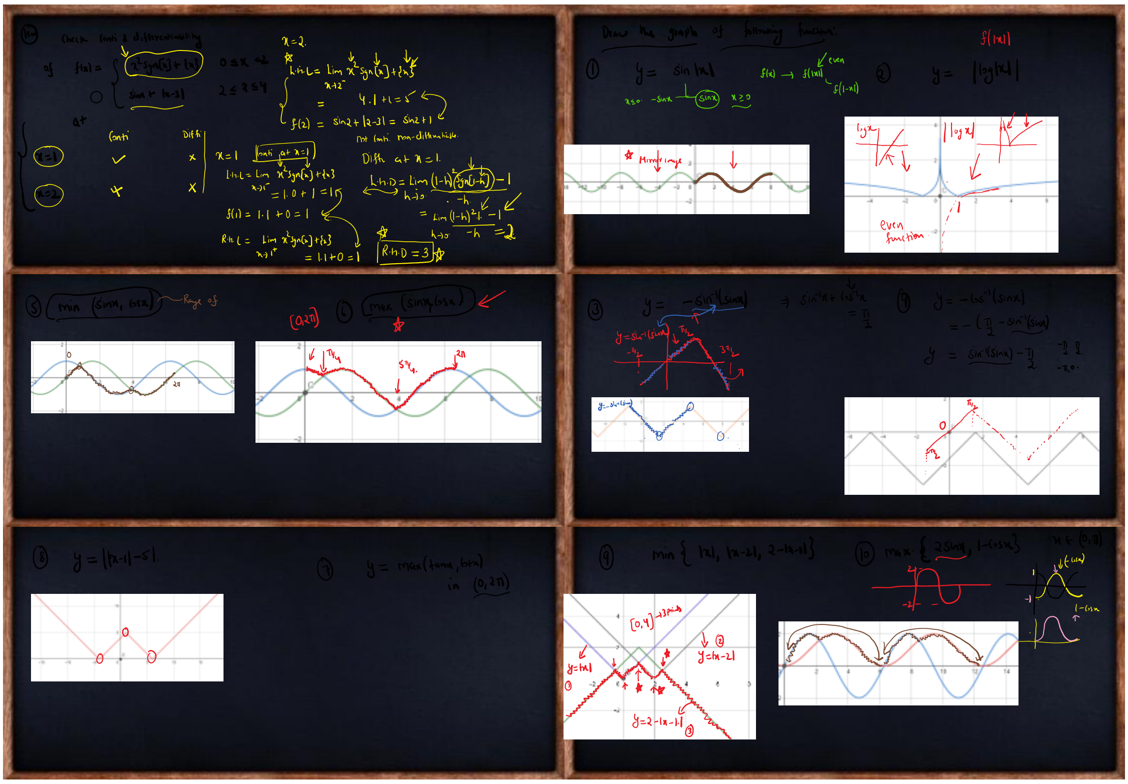

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Theorems on Differentiability:

① If $f(x)$ and $g(x)$ are differentiable at $x=a$ then $f(x) \pm g(x)$, $f(x) \cdot g(x)$, $\frac{f(x)}{g(x)}$ $(g(a) \neq 0)$ will also be differentiable at $x=a$.

e.g $f(x) = \sin x + x$ at $x=0$ ☆

$f(x) = \ln x + e^x$ at $x=4$.

② If $f(x)$ is not differentiable at $x=a$ and $g(x)$ is differentiable at $x=a$ then

☆ (i) $f(x) \pm g(x)$ will be not differentiable.

(ii) $f(x) \cdot g(x)$ & $\frac{f(x)}{g(x)}$ $(g(a) \neq 0)$ may or may not be differentiable.

☆ ③ If both $f(x)$ and $g(x)$ are not differentiable at $x=a$ then $f(x) \pm g(x)$, $f(x) \cdot g(x)$ and $\frac{f(x)}{g(x)}$ may or may not be differentiable.

Differentiability in an interval:

(a,b) $\quad$ $[a,b)$: R.H.D, Bhad me $\quad$ $[a,b]$: R.H.D, L.H.D $\quad$ $(a,b]$: Bhad me, R.H.D

(i) A function $f(x)$ defined on an (a,b) is said to be differentiable or derivable in open interval (a,b) if its differentiable in each & every point in (a,b).

(ii) A function is said to be differentiable in $[a,b]$ if it is differentiable in (a,b) and R.H.D at a $\lim\limits_{h \to 0} \frac{f(a+h)-a}{h}$, L.H.D at b $\lim\limits_{h \to 0} \frac{f(a-h)-a}{-h}$ both exists.

Note: $|x|$

① All polynomial, exponent, logarithm & trigonometric (inverse trigo not included) functions are differentiable in their domain.

② Derivability should be checked at following points for

(i) All the points where continuity needs to be checked.

(ii) All critical points of the functions modulus, inverse trigo, G.I.F, $\{x\}$, $\operatorname{sgn} x$ etc.

$|x|$, $|\sin x|$, $|\ln x|$ $\qquad$ $x=0$

H.W

① Find no. of points of non-differentiability in $(1,3)$ for $f(x) = [x]$

$f(x) = [x^2]$

$f(x) = [x^3]$

② $f(x) = |x-1| + |x+1|$

Discuss the conti and diff of $f(x)$