Limit and Continuity: Types of discontinuity

Removable Discontinuity :-

$$\lim_{x \to a} f(x) \text{ exist (finite)}$$

$$\lim_{x \to a} f(x) \neq f(a)$$

Exp

$$\frac{x^2 - 4}{x - 2} \qquad x = 2$$

$$f(2) = \frac{4 - 4}{2 - 2} = \frac{0}{0}$$

$$\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x+2)}{(x-2)} = 4.$$

$$\lim_{x \to 2} f(x) = 4. \quad \text{exist (finite)}$$

Discontinuity of first kind.

$$\lim_{x \to a^-} f(x) \neq \lim_{x \to a^+} f(x) \quad \text{But} \quad \lim_{x \to a^-} f(x) \, \&$$

$$\lim_{x \to a^+} f(x)$$

both exist

$$f(x) = \begin{cases} 1 & x > 0 \\ -1 & x < 0 \end{cases}$$

Discontinuity of Second Kind.

$\lim\limits_{x \to a^-} f(x)$ and $\lim\limits_{x \to a^+} f(x)$ doesn't exist

L.H.L & R.H.L does not exist