Name of College - S.S. College J-Bad

Dept - Mathematics

Teacher's Name - Dr. Shree Nath Sharma (Associate prof.)

Topic - Continuity and Differentiability

Time - 12 P.M to 1.30 PM

Date - 12-04-2021 Class - B.Sc II (HONS)

Study Material → Concept of Continuity From Geometrical Considoration we derive the Concept of Continuity.

If the Graph of a function $y = f(x)$ is Continuous curve, then the function $y = f(x)$ is said to be continuous function. It means a small change in the value of x should produce a small change in the value of y and so the Graph of function $y = f(x)$ should be a continuous curve without any break in it.

But the analytical definition of Continuity is quite distinct from the geometrical concept.

Continuity of f(x) at a point :→ A Function $f(x)$ is said to be continuous at $x = a$ if

$$\lim_{h \to 0} f(a-h) = \lim_{h \to 0} f(a+h) = f(a)$$

Continuity of f(x) in the Given internal $[a, b)$ → if

(i) $\lim_{h \to 0} f(a+h) = f(a)$ (ii) $\lim_{h \to 0} f(b-h) = f(b)$

(iii) $\lim_{h \to 0} f(c-h) = \lim_{h \to 0} f(c+h) = f(c)$ where ...

Discontinuity :→ If $f(x)$ is not continuous at $x = a$ then it is said $f(x)$ is Discontinuous at $x = a$

Types of Discontinuities of function at a point →

① **Discontinuity of the First kind** :→

A Function $f(x)$ is said to have a Discontinuity of the First kind at $x=a$ if $\lim_{h \to 0} f(a-h)$ and $\lim_{h \to 0} f(a+h)$ does Exist but Not equal.

② **Discontinuity of 2nd kind** :→

If $\lim_{h \to 0} f(a-h)$ and $\lim_{h \to 0} f(a+h)$ does not Exist then $f(x)$ is said to have Discontinuity of 2nd kind

Mixed Discontinuity → A Function $f(x)$ is said to have a Mixed Discontinuity at $x=a$ if one of limit

$\lim_{h \to 0} f(a-h)$ and $\lim_{h \to 0} f(a+h)$ exists and other does not.

~~Removable~~ Removal Discontinuity →

A Function $f(x)$ is said to have a removal discontinuity at $x = a$

if $\lim_{h \to 0} f(a+h) = \lim_{h \to 0} f(a-h) \neq f(a)$

Jump Discontinuity →

A function $f(x)$ at $x = a$ is said to have a Jump discontinuity

if $\lim_{h \to 0} f(a-h) \neq \lim_{h \to 0} f(a+h)$ and

$f(x)$ may be equal to Neither of the above limits.

Infinite Discontinuity :→ A Function $f(x)$ is said to have an infinite Discontinuity at $x = a$ if one or more of the Four Functional limits

$f(a+h)$, $f(a+h)$, $f(a-h)$ and $f(a-h)$

is Indefinitely Large.