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Function of several variable:

Definition of n-tuples: The Euclidean n-space R^n is the set of all n-tuples $(x_1, x_2, ..., x_n)$ of real numbers on which the two operation of vector addition and scalar multiplication are defined as follow :

(i) Vector addition of two n-tuples:

Let $(x_1, x_2, ..., x_n)$ & $(y_1, y_2, ..., y_n)$ are two vectors then

$(x_1, x_2, ..., x_n) + (y_1, y_2, ..., y_n) = (x_1 + y_1, x_2 + y_2, ... + x_n + y_n)$

(ii) Scalar multiplication:

Let $(x_1, x_2, ..., x_n) \in R^n$ & $\alpha \in R$, then

$\alpha(x_1, x_2, ..., x_n) = (\alpha x_1, \alpha x_2, ..., \alpha x_n)$

Real valued function on n-variables:

Let $S \subseteq R^n$, then a map $f : S \to R$ is called real valued function on n variables.

Limit of function of two variable:

Let $f : R^2 \to R$ be a function & $(a, b) \in R^2$, $l \in R$, then we usually denote limit by $\lim_{(x,y)\to(a,b)} f(x, y) = l$.

Important method :

Path method :

If f(x, y) gives same values 'l' along all paths $y = \phi(x)$ passing through (a, b),

Then $\lim_{(x,y)\to(a,b)} f(x, y) = l$.

Convert function from cartisian form to polar form :

Let f(x, y) is a function of two variable in cartisian form, then put $x = r\cos\theta$ & $y = r\sin\theta$

Then f(x, y) convert into $f(r, \theta)$ which is called in polar form.

Bounded function:

A function of two variables $f(x, y)$ is said to be bounded iff $\exists$ $M > 0$ s.t. $|f(x, y)| \leq M$; for all (x, y)

Results : If a function $f(x, y)$ is bounded then limit of this function need not be exist.

Results : If limit of function exist then function need not be bounded.

Function from R^n to R^m :

Let $f : R^n \to R^m$

s.t. $f(x_1, x_2, ..., x_n) = (\phi_1, \phi_2, ..., \phi_m)$, where $\phi_i : R^n \to R$

Limit of a function from $R^n \to R^m$:

Let $f : R^n \to R^m$

s.t. $f(x_1, ..., x_n) = (\phi_1, ..., \phi_m)$

f has a limit at point (a, b) iff all ϕ_i have limit at (a, b).

Q.1. Let $L = \lim_{(x,y)\to(2,-2)} \frac{\sqrt{x-y}-2}{(x-y)-4}$, then L is

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(a) 1/2 (b) 1/4

(c) 1/8 (d) 1

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Q.3. Let $l = \lim_{(x,y)\to(0,0)} \frac{x^2y^2}{x^2+y^2}$ and consider the set $A = \{x \in R \mid e^x = l\}$. Then

(a) $A = \phi$ (b) A is singleton

(c) A is countably infinite

(d) A is uncountable

Q.3. Let $L = \lim_{(x,y)\to(0,0)} \frac{x^2 y}{x^4 + y^2}$, then L is

(a) 0

(b) 1

(c) 1/2

(d) does not exist

Q.4. For $t \in R$, let $[t]$ denote the greatest integer less than or equal to t. Define function

$h : R^2 \to R$ and $g : R \to R$ by

$$h(x,y)=\begin{cases}\dfrac{-1}{x^2-y} & if \quad x^2 \neq y \\ 0 & if \quad x^2 = y\end{cases}$$

and $g(x,y)=\begin{cases}\dfrac{\sin x}{x} & if \quad x \neq 0 \\ 0 & if \quad x = 0\end{cases}$ then which of the following is false **IIT JAM 2022**

(a) $\lim\limits_{(x,y)\to(\sqrt{2},\pi)} \cos\left(\dfrac{x^2y}{x^2+1}\right)=\dfrac{-1}{2}$

(b) $\lim\limits_{(x,y)\to(\sqrt{2},2)} e^{h(x,y)}=0$

(c) $\lim\limits_{(x,y)\to(e,e)} \log\left(x^{y-[y]}\right)=e-2$

(d) $\lim\limits_{(x,y)\to(0,0)} e^{2y}g(x)=1$

Q.5. Let S be the set of $(\alpha, \beta) \in R^2$ s.t. $\frac{x^\alpha y^\beta}{\sqrt{x^2+y^2}} \to 0$ as $(x, y) \to (0, 0)$,then S is

(a) $\{(\alpha, \beta) ; \alpha > 0, \beta > 0\}$

(b) $\{(\alpha, \beta) ; \alpha > 2, \beta > 2\}$

(c) $\{(\alpha, \beta); \alpha + \beta > 1\}$

(d) $\{(\alpha, \beta) ; \alpha + 4\beta > 1\}$

Q.6. Statement – 1 : $\lim_{(x,y)\to(0,0)} \frac{x^2y^2}{(x^2+y^2)^2}$ exists.

Statement – 2 : $\lim_{(x,y)\to(0,0)} \frac{x^3y^3}{(x^2+y^2)^{3/2}}$ exists.

Then

(a) Statement – 1 is true but statement – 2 is not

(b) Statement – 2 is true but statement – 1 is not

(c) Both statements are true

(d) Both statements are false

Q.7. For what value of α & β, $f(x, y) \to 0$ as $(x, y) \to (0, 0)$. Where $f(x,y) = \dfrac{x^3 + y^3}{x^\alpha - y^\beta}$.

(a) for $\alpha = 1, \beta = 1$

(b) for $\alpha = 2, \beta = 2$

(c) for $\alpha = 3, \beta = 3$

(d) None of these

Q.8. Let $f(x,y)=\dfrac{x.y^2}{x^2+y^4}$. Then $\lim\limits_{(x,y)\to(0,0)} f(x,y)$.

(a) is equal to 1/2 (b) is equal to 2/5

(c) is equal to 3/5 (d) none of the above

Q.9. Let $R^2 \rightarrow R$ be defined by

$$f(x,y)=\begin{cases}\dfrac{x^2-y^2}{x^2+y^2}, & (x,y)\neq(0,0)\\ 0, & (x,y)=(0,0)\end{cases}$$

. Then is equal to

(a) 1/3

(b) 2/3

(c) 4/3

(d) None of the above

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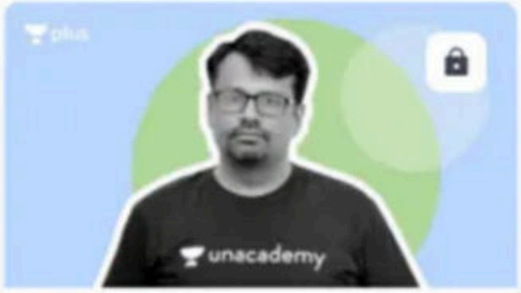

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Educator highlights

- Works at **Pacific Science College**
- Studied at **M.Sc., NET, PhD(Algebra), MBA(Finance), BEd**
- PhD, NET | Plus Educator For CSIR NET | Youtuber (260K+Subs.) | Director Pacific Science College |
- Lives in **Udaipur, Rajasthan, India**
- Unacademy Educator since

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