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Mathematics (Theory)

કુલ સમય :– ૬૦ મીનીટ કુલ પ્રશ્નો : ૫૦ વિદ્યાર્થીએ ટીક કરવાના પ્રશ્નો : ૩૫

નોંધ : વિદ્યાર્થીએ માત્ર ૩૫ પ્રશ્નો જ ટીક કરવાના રહેશે. જો વધારે ટીક કરેલ હશે તો પ્રથમ ૩૫ પ્રશ્નો જ ગણતરીમાં લેવામાં આવશે.

1. If $\lim_{(x,y)\to(3,2)} xy = 6$ then $0 < |x-3| < \delta, 0 < |y-2| < \delta \Rightarrow$ $|xy-6| <$.....
   (a) 2δ (b) 3δ (c) 4δ (d) 5δ
2. If function $\emptyset(x)$ is continuous at point $(a, \emptyset(a)) = (a,b)$ and $\lim_{(x,y)\to(a,b)} f(x,y)$ exists which is $l \in R$ then
   (a) $\lim_{x\to a} f(a, \emptyset(x))$ does not exists (b) $\lim_{x\to a} f(a, \emptyset(x)) = l$ (c) $\lim_{x\to a} f(a, \emptyset(x)) \neq l$ (d) None of them
3. Spherical δ nbhd ..... Rectangular δ nbhd
   (a) $\subset$ (b) $\supset$ (c) $\subseteq$ (d) $\supseteq$
4. If $z = xy^2 + x^2y, x = at^2, y = 2at$ then $\frac{dz}{dt}$ =.....
   (a) $16a^3t^3 + 10a^3t^4$ (b) $16a^3t^2 + 10a^3t^4$ (c) $16t^3 + 10a^3t^4$ (d) $16a^3t^3 + 10a^2$
5. $\lim_{(x,y)\to(0,0)} f(x,y)$ =.....
   where $f(x,y) = \frac{x^3-y^3}{x^2+y^2}, (x,y) \neq (0,0)$
   $= 2, \quad (x,y) = (0,0)$
   (a) 2 (b) 1 (c) 0 (d) 5
6. A real valued function $f(x,y)$ is said to be continuous at point (a,b) if
   (a) $\lim_{(x,y)\to(a,b)} f(x,y) \neq f(a,b)$ (b) $\lim_{(x,y)\to(a,b)} f(x,y) = f(a,b)$
   (c) $\lim_{(x,y)\to(a,b)} f(x,y) = (a,b)$ (d) None of them
7. A function $f: E \subset R^n \to R$ is continuous on set E and
   if $a_1, a_2 \in E \ni f(a_1) \cdot f(a_2) < 0$ then $\exists\, a \in E \ni f(a)$ =.....
   (a) 0 (b) 1 (c) E (d) None of them
8. $f: E \to R$ is a function ; for $(x,y), (x+h,y) \in E, h \neq 0$; $\lim_{h\to 0} \frac{f(x+h,y)-f(x,y)}{h}$ exists then its limit is denoted by
   (a) $\frac{\partial f}{\partial y}$ (b) $\frac{\partial f}{\partial h}$ (c) $\frac{\partial f}{\partial x}$ (d) None of them
9. If $u = \sqrt{x^2+y^2+z^2}$ then u_z =.....
   (a) $\frac{x}{u}$ (b) $\frac{y}{u}$ (c) $\frac{2z}{u}$ (d) $\frac{z}{u}$
10. If $f(x,y) = 0$ is Implicit Function then $\frac{dy}{dx}$ =....., $f_y \neq 0$
    (a) $\frac{f_y}{f_x}$ (b) $-\frac{f_y}{f_x}$ (c) $\frac{f_x}{f_y}$ (d) $-\frac{f_x}{f_y}$
11. If $f(x,y) = \frac{x-y}{x+y}$, $x \neq 0, y \neq 0$ then $\lim_{x\to 0}\{\lim_{y\to 0} f(x,y)\}$ =.....
    (a) 0 (b) 1 (c) -1 (d) Does not exit
12. ..... is not a Implicit Function.
    (a) $x^2 + y^2 = 0$ (b) $x^2 + y^2 = 1$ (c) $2x^2 + y^2 = 1$ (d) None of them
13. If $z = f(x,y)$ is a real valued function defined on non-empty set $E \subset R^2$ which is differentiable at point $(x,y) \in E$ then $f_x\delta_x + f_y\delta_y$ is called
    (a) total differential of z (b) partial differential of z (c)differential of z (d) none of the above
14. If function $z = f(x,y)$ defined on $E \subset R^2$ is differentiable at point $(a,b) \in E$ then
    (a) f is not continuous at (a,b) (b) f is continuous at (a,b)
    (c) f is continuous at every point of E (d) None of them
15. Suppose $x = f(x,y)$ is define on a non-empty set $E \subset R^2$, ... and continuous at (x,y) then f is differentiable at point $(x,y) \in E$
    (a) f_{xx}, f_y exist (b) f_x, f_{yy} exist (c) f_{xy}, f_{yx} exist (d) f_x, f_y exist
16. If function $z = f(x,y)$ defined on $E \subset R^2$ is continuous at point $(a,b) \in E$ then
    (a) f is continuous at every point of E (b) f is differentiable at (a,b)
    (c)f is not differentiable at (a,b) (d) f is differentiable at every point of E
17. If $f: E \subset R^2 \to R$ is said to be differentiable at point $(a,b) \in E$ then
    (a) $f(a+h,b+k) = f(a,b) + Ah + Bk + \epsilon\rho$ where $\rho \to 0 \Rightarrow \epsilon \to 0$
    (b) $f(a+h,b+k) = f(a,b) + Ah + Bk + \epsilon\rho$ but $\rho \to 0 \not\Rightarrow \epsilon \to 0$
    (c) $f(a+h,b+k) = f(a,b)$
    (d)None of them
18. $\lim_{k\to 0} \frac{f(x,y+k)-f(x,y)}{k}$ =.....
    (a) $\frac{\partial f}{\partial x}$ (b) $\frac{\partial f}{\partial y}$ (c) $\frac{dy}{dx}$ (d) None of them
19. $\lim_{h\to 0} \frac{f_x(x+h,y)-f_x(x,y)}{h}$ =
    (a) f_{yx} (b) f_{xy} (c) f_{yy} (d) f_{xx}
20. If $f(x,y) = 0$, $g(y,z) = 0$ then $f_y \cdot g_z \cdot \frac{dz}{dx}$ =.....
    (a) $f_x \cdot g_x$ (b) $f_z \cdot g_x$ (c) $f_z \cdot g_y$ (d) $f_x \cdot g_y$
21. A function $f: E \subset R^n \to R$ is said to be homogeneous function of degree m then
    (a) $f(tx) = t^m f(x)$ (b) $f(t^m x) = t^m f(x)$ (c) $f(tx) = x^m t(x)$ (d) $f(tx^m) = tf(x^m)$
22. If $f(x,y) = xy\tan^{-1}\left(\frac{y}{x}\right); x \neq 0$ is homogeneous function then degree of f is .....
    (a) 3 (b) 2 (c) 0 (d) 4
23. Suppose $f(x,y)$ is defined on $E \subset R^2$ and $S \subset E$. If
    $(x,y) \in S \Longrightarrow f(a,b) \leq f(x,y)$ then $f(a,b)$ is said to be ..... of f at (a,b).
    (a) Absolute maximum (b) Absolute minimum (c)Both (a) and (b) (d) None of them

24. If f is differential homogeneous function of degree m in variables x and y then
(a) $xf_x + yf_y = 0$ (b) $xf_x + yf_y = mf(x,y)$ (c) $xf_x + yf_y = m$ (d) $xf_y + yf_x = mf(x,y)$

25. If $u = \cos^{-1}\left(\frac{x^2-y^2}{x+y}\right); x + y \neq 0$ then $xu_x + yu_y =$.....
(a) $\cot u$ (b) $\tan u$ (c) $-\sec^2 u$ (d) $-\cot u$

26. If f is a real valued function defined on an open domain $\subset R^2$. If N is the nbhd of point $(a,b) \in E$ and $(a+h, b+k) \in N \cap E$ then $f(a,b)$ is said to be the local maximum value of $f(x,y)$ at (a,b) if
(a) $f(a,b) \geq f\ (a+h, b+k)$ (b) $f(a,b) = f\ (a+h, b+k)$
(c) $f(a,b) \leq f\ (a+h, b+k)$ (d) None of them

27. A function f possess continuous second order partial derivatives at point (a,b) in open domain $E \subset R^2$ and $f_x(a,b) = f_y(a,b) = 0$. If $f_{xx}(a,b) = r, f_{xy}(a,b) = s$ and $f_{yy}(a,b) = t$ then if $rt - s^2 > 0$ and $r < 0$ then
(a) f has a minimum value at point (a,b) (b) f has a maximum value at point (a,b)
(c) f has neither maximum nor minimum value at point (a,b) (d)None of them

28. If a function f possess continuous second order partial derivatives at point (a,b) in open domain $E \subset R^2$ and $f_x(a,b) = f_y(a,b) = 0$ If $f_{xx}(a,b) = r, f_{xy}(a,b) = s$ and $f_{yy}(a,b) = t$ then if $rt - s^2 < 0$ then
(a) f has a minimum value at point (a,b) (b) f has a maximum value at point (a,b)
(c) f has neither maximum nor minimum value at point (a,b) (d) None of them

29. If a function f possess continuous second order partial derivatives at point (a,b) in open domain $E \subset R^2$ and $f_x(a,b) = f_y(a,b) = 0$ If $f_{xx}(a,b) = r, f_{xy}(a,b) = s$ and $f_{yy}(a,b) = t$ then if $rt - s^2 = 0$ then
(a) f has a minimum value at point (a,b) (b) f has a maximum value at point (a,b)
(c) f has neither maximum nor minimum value at point (a,b) (d) Test is not applicable

30. A function f possess continuous second order partial derivatives at point (a,b) in open domain $E \subset R^2$ and $f_x(a,b) = f_y(a,b) = 0$. If $f_{xx}(a,b) = r, f_{xy}(a,b) = s$ and $f_{yy}(a,b) = t$ then if $rt - s^2 > 0$ and $r > 0$ then
(a) f has a minimum value at point (a,b) (b) f has a maximum value at point (a,b)
(c) f has neither maximum nor minimum value at point (a,b) (d) None of them

31. The necessary condition that $f(x,y)$ has an extreme value at (a,b) are
(a) $f_x(a,b) = 0$ (b) $f_y(a,b) = 0$ (c) $f_x(a,b) = 0,\ f_y(a,b) = 0$ (d) None of them

32. If for point $(a,b),\ f_x = f_y = 0$ but f is not maximum or minimum at (a,b) then (a,b) is said to be..... of f.
(a) Extreme value (b) Saddle point (c) Both (a) and (b) (d) None of them

33. Suppose $f(x,y)$ is defined on $E \subset R^2$ and $S \subset E$. If $(x,y) \in S \Longrightarrow f(a,b) \geq f\ (x,y)$ then $f(a,b)$ is said to be ..... of f at (a,b).
(a) Absolute maximum (b) Absolute minimum (c) Both (a) and (b) (d) None of them

34. Let $f(x,y,z) = c$ be surface. Equation of tangent plane to the surface $f(x,y,z) = c$ at point (a,b,c) is
(a) $(x-a)\frac{\partial f}{\partial x} + (y-b)\frac{\partial f}{\partial x} + (z-c)\frac{\partial f}{\partial x} = 0$ (b) $(x-a)\frac{\partial f}{\partial x} + (y-b)\frac{\partial f}{\partial y} + (z-c)\frac{\partial f}{\partial x} = 0$
(c) $(x-a)\frac{\partial f}{\partial x} + (y-b)\frac{\partial f}{\partial y} + (z-c)\frac{\partial f}{\partial z} = 0$ (d) None of them

35. If $z = f(x,y)$ is surface in R^3 then the vectors ..... and (dx, dy, dz) are perpendicular.
(a) $\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, -1\right)$ (b) $\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, 1\right)$ (c) $\left(\frac{\partial z}{\partial y}, \frac{\partial z}{\partial x}, -1\right)$ (d) $\left(-\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, -1\right)$

36. A vector space two binary operations which are
(a) Scalar multiplication and composition (b)Vector addition and scalar multiplication
(c) Vector addition and vector multiplication (d)None of them

37. Which of the following statement is true? For S is a subspace of a vector space V
(a) $[S]$ is the smallest subspace of V containing S (b) $[S]$ is not the subspace of V
(c) $[S]$ is the smallest subspace of V but not containing S (d) $[S]$ is the largest subspace of V containing S

38. If $x \in sp\{x_1, x_2, \ldots\ldots, x_n\};\ x_1, x_2, \ldots\ldots x_n \in V$ and V is a vector space then $\{x_1, x_2, \ldots\ldots, x_n\}$ is
(a) linearly dependent vector (b) linearly independent vector (c) subspace of V (d) none of them

39. Every single non-zero vector in a vector space is
(a) linearly dependent vector (b) linearly independent vector (c) scalar (d) none of them

40. A vector space V is called finite dimensional if
(a) V has an infinite generating set (b) V has no generating set
(c) V has a finite generating set (d) None of them

41. A non-empty subset B of a vector space V is called a basis of V if
(a) B is linearly independent and $[B] = V$ (b) B is linearly dependent and $[B] = V$
(c) B is linearly independent set (d)B is linearly dependent set

42. If V is a finite dimensional vector space then the number of vectors in a basis of V is called
(a) Span of V (b) Dimension of V (c) Generating set of V (d) None of them

43. If U is subspace of a finite dimensional vector space V then
(a)$\dim U < \dim V$ (b) $\dim U = \dim V$ (c) $\dim U > dim\, V$ (d) $\dim U \leq \dim V$

44. If $U_1$and U_2 are subspaces of a finite dimensional vector space V then
(a) $\dim(U_1 + U_2) = \dim U_1 - \dim(U_1 \cap U_2)$ (b)$\dim(U_1 + U_2) = \dim U_1 + \dim U_2 - \dim(U_1 \cap U_2)$
(c) $\dim(U_1 + U_2) = \dim U_1 + \dim U_2$ (d) $\dim(U_1 + U_2) = \dim U_1 + \dim U_2 + \dim(U_1 \cap U_2)$

45. For a linear transformation $T: U \to V$, set $\{T(x)/x \in U\}$ is called
(a) Kernel of T (b) Rank of T (c) Range of T (d) Nullity of T

46. For a linear transformation $T: U \to V$, set $\{x \in U/T(x) = \emptyset\}$ is known as
(a) Rank of T (b) Range of T (c) Nullity of T (d) Null space of T

47. If $T: U \to V$ is a linear transformation then null space of T is a subspace of
$(a)V$ (b) U (c) R(T) (d) None of the above

48. If $T: U \to V$ is a one-one and onto linear transformation then
(a) T is non-singular (b) T is singular (c) T is bounded (d) T is not invertible

49. If $T: R^2 \to R^2$ is linear transformation such that $T(2,1) = (2,1)$ and $T(1,2) = (4,2)$ then $T(x,y) =$.....
(a)$(y, 2y)$ (b) $(x, 2x)$ (c) $(2x, y)$ (d) $(2y, y)$

50. A linear transformation $T: R^2 \to R^3$ is defined by $T(a,b) = (a+b, a-b, b)$ then $R(T) =$..... and $N(T) =$.....
(a)$[(1,1,0)]$ and $\{\emptyset\}$ (b) $[\{(1,1,0), (1,-1,1)\}]$ and 2 (c) $[\{(1,1,0), (1,-1,1)\}]$ and $\{\emptyset\}$ (d) $[(1,-1,1)]$ and $\{\emptyset\}$