1) The value of k so that the equation $3y^2 - 8xy - 3x^2 - 29x + ky - 18 = 0$ represents a pair of straight lines, is

(A) 2
(B) 3
(C) 4
(D) none of these

2) Equation of the chord of contact of the tangents drawn from the point (x_1, y_1) to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ is

(A) $xx_1 + yy_1 + g(x + x_1) + f(y + y_1) + c = 0$
(B) $xx_1 - yy_1 + g(x + x_1) + f(y + y_1) + c = 0$
(C) $xx_1 + yy_1 - g(x + x_1) - f(y + y_1) - c = 0$
(D) none of these

3) Angle between the circles $x^2 + y^2 - 2x - 6y - 39 = 0$ and $x^2 + y^2 + 10x - 4y + 20 = 0$ is

(A) 60^o
(B) 70^o
(C) 45^o
(D) none of these

4) Latus rectum of the parabola, whose focus is $(-1,1)$ and directrix is $x + y + 1 = 0$, is

(A) $\sqrt{3}$
(B) $\sqrt{2}$
(C) $\sqrt{5}$
(D) none of these

5) The necessary and sufficient condition for a square matrix to possess the inverse is that

(A) $|A| \neq 0$
(B) $|A| = 0$
(C) $|A| = 1$
(D) none of these

6) The system of equations $2x - 5y + 9z = 6$, $x - 3y + 4z = 3$ and $3x - 8y + 11z = 11$ has solutic

(A) $x = 1,\ y = 2,\ z = 3$
(B) $x = y = z = 0$
(C) $x = y = 0,\ z = 1$
(D) No solution

7) The linear programming problem $Z = 3x_1 + 2x_2$ subject to the constraints $-2x_1 + 3x_2 \leq 9$, $x_1 - 5x_2 \leq -20$, and $x_1 - 5x_2 \leq -20$, $x_1, x_2 \geq 0$ has

(A) bounded solution
(B) unbounded solution
(C) bounded or unbounded solution
(D) none of these

8) The function defined by $f(x) = \begin{cases} 3x - 1, & for -3 \leq x \leq 1 \\ 2, & when\ x = 1 \\ 2x + 1, & when\ x \geq 1 \end{cases}$ is

(A) continuous at $x = 1$
(B) not continuous at $x = 1$
(C) differentiable at $x = 1$
(D) none of these

9) If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$, then $\frac{dy}{dx}$ is:

(A) 2
(B) $1 + x$
(C) $\frac{x^4}{4}$
(D) y

10) The two positive numbers whose sum is 15 and sum of whose squares is minimum are

(A) 2, 3 (B) $\frac{3}{5}, \frac{4}{5}$

(C) 3, 12 (D) $\frac{15}{2}, \frac{15}{2}$

11) If $u = \frac{1}{\sqrt{x^2+y^2+z^2}}$, $x^2+y^2+z^2 \neq 0$, then $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$ is

(A) 1 (B) $\frac{1}{2}$

(C) $\frac{x+y+z}{\sqrt{x^2+y^2+z^2}}$ (D) 0

12) Critical points of $f(x,y) = 2x^2 + xy + y^2 + 3y - 2x$ are

(A) $x = 0,\ y = 1$ (B) $x = 1,\ y = -2$

(C) $x = -2,\ y = 1$ (D) none of these

13) Area bounded by the curve $x^2 y = x^2 - 4$, the x-axis and the ordinates $x = 2$ and $x = 4$ is

(A) 3 square units (B) 1 square unit

(C) 2 square units (D) none of these

14) If $\left(\frac{1-i}{1+i}\right)^{100} = \alpha + i\beta$, then

(A) $\alpha = 2, \beta = -1$ (B) $\alpha = 1, \beta = 0$ (C) $\alpha = 0, \beta = 1$ (D) $\alpha = -1, \beta = 2$

15) The value of $\lim_{x\to\infty} \frac{\sin x}{x}$ is

(A) 1 (B) 0 (C) −1 (D) none of these

16) The degree of the differential equation

$$\left(\frac{d^3y}{dx^3}\right)^{2/3} + 4 - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} = 0$$

is

(A) 1 (B) 2 (C) 3 (D) none of these.

17) The sequence $\langle 1 + (-1)^n \rangle$ has

(A) Exactly one constant subsequence (B) Exactly two constant subsequences

(C) Exactly three constant subsequences (D) Exactly four constant subsequences

18) If $u_n = \sqrt{n+1} - \sqrt{n}$ and $v_n = \sqrt{n^4+1} - n^2$, then

(A) $\sum_{n=1}^{\infty} u_n$ converges but $\sum_{n=1}^{\infty} v_n$ diverges

(B) $\sum_{n=1}^{\infty} u_n$ diverges but $\sum_{n=1}^{\infty} v_n$ converges

(C) $\sum_{n=1}^{\infty} u_n$ and $\sum_{n=1}^{\infty} v_n$ both converges

(D) $\sum_{n=1}^{\infty} u_n$ and $\sum_{n=1}^{\infty} v_n$ both diverges

19) The series $\frac{1}{3^p} + \frac{1}{5^p} + \frac{1}{7^p} + \frac{1}{9^p} + \cdots$ converges, if

(A) $p < 1$ (B) $p = 1$

(C) $p > 1$ (D) none of these

20) Which of the following series is divergent?

(A) $\sum \sin \frac{1}{n}$ (B) $\sum \sin \frac{1}{n^2}$

(C) $\frac{1}{\sqrt{n}} \tan \frac{1}{n}$ (D) none of these

21) The expansion of $\tan x$ in powers of x by Maclaurin's theorems is valid in the interval

(A) $(-\infty, \infty)$ (B) $(-\frac{3\pi}{2}, \frac{3\pi}{2})$

(C) $(-\pi, \pi)$ (D) $(-\frac{\pi}{2}, \frac{\pi}{2})$

22) The value of 'c' of Lagrange's mean value theorem for $f(x) = x(x-1)$ in $[1,2]$ is given by

(A) $5/4$ (B) $3/2$

(C) $7/4$ (D) $11/6$

23) The integral $\int_0^3 [x]dx$ (where $[x]$ is greatest integer function) is

(A) 0 (B) 1 (C) 2 (D) 3

24) The series $\sum n^{-x}$ is

(A) uniformly convergent in $[1+\delta, \infty)$, $\delta \geq 0$

(B) uniformly convergent in $[1+\delta, \infty)$, $\delta > 0$

(C) uniformly convergent in $[\delta, \infty)$, $\delta \geq 0$

(D) uniformly convergent in $[\delta, \infty)$, $\delta > 0$

25) If (X, ρ) is metric space, then for all $x, y \in X$

(A) $\rho(x, y) \leq 0$ (B) $\rho(x, y) = 0$ for some $x \neq y$

(C) $\rho(x, y) = 0$ if $x = y$ (D) none of these

26) The radius of convergence of the series $\sum_{n=0}^{\infty} \frac{z^n}{n}$ is

(A) 1 (B) 0 (C) $\sqrt{3}$ (D) $\sqrt{5}$

27) If $f(z) = \bar{z}|z|^2$, then f(z) is differentiable

(A) at all points z (B) at $z - 1$

(C) only for $z = 0$ (D) at none of these points

28) The function $w = \cos z$ is

(A) unbounded and entire (B) bounded and entire

(C) bounded but nowhere analytic (D) unbounded but nowhere analytic

29) The integral $\int_{|z+i\pi|=1} \frac{z}{e^z - 1} dz$ has the value

(A) zero (B) πi (C) 2π (D) none of these

30) For $\frac{d^2y}{dx^2} + 4y = \tan 2x$ solving by variation of parameters. The value of Wronskion W is

(A) 1 (B) 2 (C) 3 (D) 4

31) Let X have the probability density function

$$f(x) = \begin{cases} 0.75(1-x^2), & x \in [-1,1] \\ 0, & otherwise \end{cases}$$

The probability distribution function $F(x)$ is given by

(A) $F(x) = 0.5 + 0.75x - 0.25x^3,\ x \in (-1,1]$

(B) $F(x) = 0.75x - 0.25x^3,\ x \in (-1,1)$

(C) $F(x) = 0.5 - 0.25x^2,\ x \in (-1,1]$

(D) $F(x) = 0.5x^2 - 0.2x^3,\ x \in (-1,1]$

32) Perimeter of the cardioide $r = a(1-\cos\theta)$ is

(A) $6a$ (B) $7a$ (C) $8a$ (D) none of these

33) If $x_r = \cos\left(\frac{\pi}{3^r}\right) + i\sin\left(\frac{\pi}{3^r}\right), r \geq 0$, then $x_1 x_2 x_3 \ldots \infty$ is

(A) 1 (B) i

(C) $-i$ (D) none of these

34) The set $[0,1]$ is

(A) countable (B) not countable

(C) finite (D) none of these

35) If a circle and the rectangular hyperbola $xy = c^2$ meet in four points t_1, t_2, t_3 and t_4, then $t_1 . t_2 . t_3 . t_4$ is equal to

(A) -1 (B) 1

(C) c (D) c^2

36) The direction cosines of a line equally inclined to the coordinate axes, are

(A) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ (B) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

(C) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ (D) All of the above

37) The tangents at the extremities of a focal chord of the parabola intersect at

(A) 45^0 (B) 60^0 (C) 90^0 (D) 180^0

38) For equally spaced tabula data for $y = f(x)$, the error in (Newton's forward) linear interpolation

(A) does not exceed $\frac{1}{8}$ times the second difference

(B) Equal to $\frac{1}{8}$ times the second difference

(C) exceeds $\frac{1}{8}$ times the second difference

(D) none of these

39) The real part of $\tan(x+iy)$ is

(A) $\frac{\cosh 2x}{\cosh 2x + \cos 2y}$ (B) $\frac{\cos 2x}{\cosh 2x + \cos 2y}$

(C) $\frac{\sinh 2x}{\cosh 2x + \cos 2y}$ (D) none of these

40) Let $\mathbb{C}$ be the set of complex numbers and let $d: \mathbb{C} \times \mathbb{C} \to \mathbb{R}$ be defined by setting

$$d(z_1, z_2) = |z_1 - z_2|, \ \forall\, z_1, z_2 \in \mathbb{C},$$

Then d is a metric on

(A) $\mathbb{R}$ (B) $\mathbb{C}$ (C) $\mathbb{C} \times \mathbb{C}$ (D) none of these

41) Let (X, d) be a metric space and let $\rho(x, y) = \min\{1, d(x, y)\}$, for all x, y in X, then ρ is a

(A) metric on X having no relation with d

(B) metric on X equivalent to d

(C) not a metric on X (D) none of these

42) Let $S = \left\{(-1)^n \frac{n}{n+1} : n \in \mathbb{N}\right\}$, then the set S

(A) has a limit point (B) has no limit point

(C) is not bounded (D) none of these

43) $\lim_{n\to\infty} \frac{1}{n}\left[1 + 2^{\frac{1}{2}} + 3^{\frac{1}{3}} + \cdots + n^{\frac{1}{n}}\right]$ is

(A) 0 (B) 1 (C) 2 (D) none of these

44) The sequence $< S_n >$ defined by $S_1 = 1,\ S_{n+1} = \frac{4+3S_n}{3+2S_n},\ n \in \mathbb{N}$

(A) converges to 2 (B) diverges to $+\infty$

(C) converges to $\sqrt{2}$ (D) none of these

45) The series $\sum \frac{(-1)^n}{\sqrt{n}}$ is

(A) conditionally convergent (B) absolutely convergent

(C) not convergent (D) none of these

46) Differentiation of $\tan^{-1}\frac{2x}{1-x^2}$ with respect to $\sin^{-1}\frac{2x}{1+x^2}$ is

(A) 1 (B) $\frac{2}{1+x^2}$ (C) $\frac{1}{1+x^2}$ (D) 2

47) If $f(x) = \tan x$, then $f^n(0) - {}^nC_2 f^{(n-2)}(0) + {}^nC_4 f^{(n-4)}(0) - \cdots$ is

(A) $\sin\frac{n\pi}{4}$ (B) $\sin\frac{n\pi}{3}$ (C) $\sin\frac{n\pi}{6}$ (D) $\sin\frac{n\pi}{2}$

48) The set $S = \left\{-1, 1, -\frac{1}{2}, \frac{1}{2}, -\frac{1}{3}, \frac{1}{3}, \dots\right\}$ is

(A) closed (B) open

(C) neither open nor closed (D) none of these

49) Solution of $(D^2 - DD' - 6D'^2)z = xy$, where $D = \frac{\partial}{\partial x}, D' = \frac{\partial}{\partial y}$ is

(A) $z = \varphi_1(y + 3x) + \varphi_2(y - 3x) + \frac{1}{6}x^3 y + \frac{x^4}{24}$

(B) $z = \varphi(y + 3x) + \frac{1}{6}x^3 y$

(C) $z = \varphi(y - 3x) + \frac{x^4}{24}$

(D) none of these

50) If the integrating factor of $(x^7y^2 + 3y)dx + (3x^8y - x)dy = 0$ is $x^m y^n$, then

(A) $m = -7, n = 1$
(B) $m = 1, n = -7$
(C) $m = n = 0$
(D) $m = n = 1$

51) The residue of $\frac{\sin z}{z^8}$ at $z = 0$ is

(A) 0
(B) $-\frac{1}{7!}$
(C) $\frac{1}{7!}$
(D) none of these

52) The Fourier series of the 2π-periodic function $f(x) = x + x^2, -\pi < x \leq \pi$ at $x = \pi$ converges to

(A) π
(B) 2π
(C) π^2
(D) $\pi + \pi^2$

53) The equation $e^x - 4x^2 = 0$ has a root between 4 and 5. Fixed point iteration with iteration function $\frac{1}{2}e^{x/2}$

(A) diverges
(B) converges
(C) oscillates
(D) converges monotonically

54) For the differential equation $t(t-2)^2y'' + ty' + y = 0$, $t = 0$ is

(A) An ordinary point
(B) A branch point
(C) an irregular point
(D) A regular singular point

55) The general solution of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ is of the form

(A) $u = f(x + iy) + g(x - iy)$
(B) $u = f(x + y) + g(x - y)$
(C) $u = cf(x - iy)$
(D) $u = g(x + iy)$

56) If $f: [a, b] \to \mathbb{R}$ is continuous and monotonic function, then

(A) f is Riemann integrable on $[a, b]$
(B) f is not Riemann integrable on $[a, b]$
(C) f is Riemann integrable on $\mathbb{R}$
(D) none of these

57) Let f and g be bounded functions defined on $[a, b]$ and let P be any partition of $[a, b]$. Then,

(A) $U(P, f + g) \leq U(P, f) + U(P, g)$
(B) $U(P, f + g) \geq U(P, f) + U(P, g)$
(C) $U(P, f + g) = U(P, f) + U(P, g)$
(D) $L(P, f + g) \leq L(P, f) + L(P, g)$

58) The point-wise limit of sequence of real-valued function

$$f_n(x) = \sin x + \frac{x}{n}, \quad \forall x \in \mathbb{R}$$

(A) $f(x) = 0, \quad \forall x \in \mathbb{R}$
(B) $f(x) = \begin{cases} 0, & x = 0 \\ 1, & else \end{cases}$
(C) $f(x) = \sin x, \quad \forall x \in \mathbb{R}$
(D) does not exists

59) If

$$f(x, y) = x^3y + e^{xy^2}.$$

Then, which one of the following is correct?

(A) $f_{xy} > f_{yx}$
(B) $f_{xy} < f_{yx}$
(C) $f_{xy} = f_{yx}$
(D) none of these

60) Solution of $(1+y^2)dx = (\tan^{-1}y - x)dy$ is
(A) $x = \tan^{-1}y - 1 + ce^{-\tan^{-1}y}$
(B) $y = \tan^{-1}x - 1 + ce^{-\tan^{-1}x}$
(C) $x = \tan^{-1}y + ce^{-\tan^{-1}y}$
(D) $y = \tan^{-1}x + ce^{-\tan^{-1}x}$

61) Consider the series $x_{n+1} = \frac{x_n}{2} + \frac{9}{8x_n}$, $x_0 = 0.5$ obtained from the Newton-Raphson method. The series converges to
(A) 1.5
(B) $\sqrt{2}$
(C) 1.6
(D) 1.4

62) Simpson's rule for integration gives exact result, when $f(x)$ is a polynomial of degree
(A) 1
(B) 2
(C) 3
(D) All of these

63) A mapping $f: \mathbb{R} \to \mathbb{R}$ which is defined as $f(x) = \cos x$, $x \in \mathbb{R}$ is
(A) one-one only
(B) onto only
(C) one-one onto
(D) neither one-one nor onto

64) Which one of the following sequence is convergent?
(A) $\{2^n\}$
(B) $\left\{\left(\frac{1}{3}\right)^n\right\}$
(C) $\{3^n\}$
(D) None of these

65) The series $1 + 3 + 5 + 7 + \cdots$ is
(A) divergent (B) convergent (C) unbounded (D) None of these

66) A finite group of order n is cyclic if and only if it has an element of order
(A) n^2 (B) n^3 (C) n (D) None of these

67) If A and B be two sets each having n elements, then number of bijections from A to B is
(A) n^2 (B) $n!$ (C) $n+1$ (D) None of these

68) Equation $x^2ax = a^{-1}$ is solvable for x in a group G if a is
(A) square of some element in G
(B) cube is and of some element in G
(C) cube of every element in G
(D) None of these

69) A semi-group S is regular if for every $y \in S$ there exists $a \in S$ such that
(A) $yay = y$
(B) $ya^2y = y^2$
(C) $y^{-1}ay = a$
(D) None of these

70) If N is a normal subgroup of a group G, then $G|N$ is abelian iff for all $x, y \in G$
(A) $xyx^{-1}y^{-1} \in N$
(B) $xy^2x^{-1}y^{-1} \in N$
(C) $x^2yx^{-1}y^{-1} \in N$
(D) None of these

In S_n the number of distinct cycles of length $r \leq n$ is

(A) $\frac{1}{r}\frac{n!}{n-r!}$
(B) $\frac{n!}{n-r!}$
(C) $\frac{(n-1)!}{n+r!}$
(D) None of these

72) If $X = \{0, 1, 2, 3, 4, 5, 6, 7\}$ be a ring under the addition and multiplication modulo 8, then this ring is

(A) Commutative and integral domain
(B) Integral domain
(C) not an integral domain
(D) None of these

73) In the ring M of 2×2 matrices over integers, consider the set $L = \left\{\begin{pmatrix} a & 0 \\ b & 0 \end{pmatrix},\ a, b \in \mathbb{Z}\right\}$, then

(A) L is not a left ideal
(B) L is a left ideal
(C) L is a right ideal
(D) None of these

74) If V is an abelian group, then $Hom(V, V)$ is

(A) a ring without unity
(B) a ring with unity
(C) not a ring
(D) None of these

75) Which one is correct

(A) Intersection of any family of subspaces of a vector space is a subspace
(B) Intersection of any family of subspaces of a vector space is not a subspace
(C) Union of any family of subspaces of a vector space is a subspace
(D) None of these

76) The set of all solution of the differential equation

$$\frac{d^2y}{dt^2} + p\frac{dy}{dt} + qy = 0$$

Where p and q are fixed functions of t,

(A) is a vector space over $\mathbb{R}$
(B) is not a vector space over $\mathbb{R}$
(C) may or may not be a vector space over $\mathbb{R}$
(D) None of these

77) Vectors (ξ_1, ξ_2) and (η_1, η_2) in $\mathbb{C}^2$ are linearly dependent iff

(A) $\xi_1\eta_2 = \xi_2\eta_1$
(B) $\xi_1^2\eta_2 = \xi_2^2\eta_1$
(C) $\xi_1\xi_2 = \eta_1\eta_2$
(D) None of these

78) Let W be the set of real valued functions $y = f(x)$ satisfying $\frac{d^2y}{dx^2} + 4y = 0$, then dimension of W over $\mathbb{R}$ is

(A) 3
(B) 0
(C) 2
(D) None of these

79) Two vectors x, y in a Euclidean space are orthogonal iff

(A) $\|x + y\|^2 = \|x\|^2 + \|y\|^2$
(B) $\|x + y\|^2 = \|x\|^2 + \|y\|^2 + 2\|x\|\|y\|$
(C) $\|x + y\|^2 = \|x\|^2 - \|y\|^2$
(D) None of these

80) A linear transformation $T: v \to v$ is a projection if

(A) $T^2 = T$
(B) $T^3 = T$
(C) $T^4 = T^3$
(D) None of these

81) If $A = (i, j)$ is an $m \times n$ matrix over a field F, then there exists non-singular matrices Q and P such that

(A) $QAP = diag\{1, 1, \ldots, 1, 0, 0, \ldots, 0\}$

(B) $QAP \neq diag\{1, 1, \ldots, 1, 0, 0, \ldots, 0\}$

(C) $QAP = \{1, 1, \ldots, 1, 0, 0, \ldots, 0\}$

(D) None of these

82) Consider the field $Q(\sqrt{2})$, then $\frac{1}{3+\sqrt{2}}$ is

(A) a polynomial in $\sqrt{2}$ over Q

(B) A polynomial in $\sqrt{3}$ over Q

(C) a polynomial in 3 over Q

(D) None of these

83) Degree of splitting field of $x^5 - 3x^3 + x^2 - 3$ over Q is

(A) 2 (B) 3 (C) 4 (D) None of these

84) $12x = 9(mod\ 15)$ has non congruence modulo 15 solution

(A) 2

(B) 3

(C) 5

(D) None of these

85) The order of convergence of Newton-Raphson method is

(A) 1

(B) 2

(C) 3

(D) none of these

86) The +ve roots of the equation $3x^3 + 5x - 40 = 0$ lies in the interval

(A) (2,3)

(B) (1,3)

(C) (2,2.5)

(D) none of these

87) The rank of the matrix

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

is

(A) 3

(B) 4

(C) 2

(D) none of these

88) Equation of the tangent at the point (x_1, y_1) to rectangular hyperbola $xy = c^2$ is

(A) $\frac{x}{x_1} + \frac{y}{y_1} = c$

(B) $\frac{x}{x_1} + \frac{y}{y_1} = -c$

(C) $\frac{x}{x_1} + \frac{y}{y_1} = 2$

(D) none of these

89) For the permutation $f = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 2 & 3 & 4 & 5 & 1 & 6 & 7 & 9 & 8 \end{pmatrix}$ cycle of 6 is

(A) (6)

(B) (8)

(C) (7)

(D) none of these

90) The general value of $\log_e(i)$ is

(A) $\frac{i\pi}{2}$

(B) $\frac{i\pi}{4}$

(C) $\frac{i\pi}{3}$

(D) none of these

91) All the eigen values of the matrix $\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ lie in the disc

(A) $|\lambda + 1| \leq 1$
(B) $|\lambda - 1| \leq 1$
(C) $|\lambda + 1| \leq 0$
(D) $|\lambda - 1| \leq 2$

92) $\iint_A xydxdy$, where A is the domain bounded by x-axis, ordinate $x = 2a$ and the curve $x^2 = 4ay$ is

(A) $\frac{a^4}{2}$
(B) $\frac{a^4}{3}$
(C) $\frac{a^3}{3}$
(D) none of these

93) The cyclic group $Z_{30} = \{0, 1, 2, \dots, 29\}$ under addition modulo 30 has

(A) 7 subgroups
(B) 8 subgroups
(C) 9 subgroups
(D) 10 subgroups

94) Let

$$f(x, y) = \frac{xy}{\sqrt{x^2+y^2}}, \quad (x, y) \neq (0, 0).$$

Then

(A) $f(x, y)$ is discontinuous at (0,0)
(B) $f(x, y)$ is continuous at (0,0)
(C) $f_x(0, 0) = 1$
(D) $f_y(0, 0) = 1$

95) The rank of the following $(n+1) \times (n+1)$ matrix where a is real number

$$\begin{bmatrix} 1 & a & a^2 & \vdots & a^n \\ 1 & a & a^2 & \vdots & a^n \\ \cdots & \cdots & \cdots & \vdots & \cdots \\ 1 & a & a^2 & \vdots & a^n \end{bmatrix}$$

is

(A) 1
(B) 2
(C) n
(D) Depends on 'a'

96) Consider the basis $S = (v_1, v_2, v_3)$ for $\mathbb{R}^3$ where $v_1 = (1, 1, 1)$, $v_2 = (1, 1, 0)$, $v_3 = (1, 0, 0)$ and let $T: \mathbb{R}^3 \to \mathbb{R}^2$ be a linear transformation such that $Tv_1 = (1, 0)$, $Tv_2 = (2, -1)$, $Tv_3 = (4, 3)$. Then, $T(2, -3, 5)$ is

(A) $(-1, 5)$
(B) $(3, 4)$
(C) $(0, 0)$
(D) $(9, 23)$

97) The solution of equation $z = pq$, is

(A) $z = \sqrt{ax} + \frac{1}{\sqrt{a}}y - b$
(B) $z = \sqrt{ax} - \frac{1}{\sqrt{a}}y + b$
(C) $z = \sqrt{ax} + \frac{1}{2\sqrt{a}}y + b$
(D) $2\sqrt{z} = \sqrt{ax} + \frac{1}{\sqrt{a}}y + b$

98) The moment of inertia of solid sphere of radius r and mass m about its diameter is

(A) $\frac{2}{5}mr^3$
(B) $\frac{2}{5}mr^2$
(C) $\frac{2}{3}mr^2$
(D) none of these

99) Consider the function

$$f(x) = \begin{cases} x - \sin x, & \text{if } x \text{ is rational} \\ 0, & \text{if } x \text{ is irrational} \end{cases}$$

(A) $f(x)$ is everywhere discontinuous (B) $f(x)$ is continuous at one point
(C) $f(x)$ is continuous more than one point but at countable points
(D) none of these

100) The function $f(x) = |x + 2|$ is not differentiable at a point
(A) $x = 2$ (B) $x = -2$
(C) $x = -1$ (D) $x = 1$