010122

Paper Code No: M33 Question Booklet No. ....

ENTRANCE EXAMINATION – 2021 - 22

SET – B

Roll No. M33[redacted]

....
Signature of Invigilator

Time: 1 Hour 30 Minutes **Total Marks: 100**

<u>Instructions to Candidates</u>

1. Do not write your name or put any other mark of identification anywhere in the OMR Response Sheet. IF ANY MARK OF IDENTIFICATIONS IS DISCOVERED ANYWHERE IN OMR RESPONSE SHEET, the OMR sheet will be cancelled, and will not be evaluated.
2. **This Question Booklet contains the cover page and a total of 100 Multiple Choice Questions of 1 mark each.**
3. Space for rough work has been provided at the beginning and end. Available space on each page may also be used for rough work.
4. There is negative marking in Multiple Choice Questions. For each wrong answer, 0.25 marks will be deducted.
5. USE/POSSESSION OF ELECTRONIC GADGETS LIKE MOBILE PHONE, iPhone, iPad, pager ETC. is strictly PROHIBITED.
6. Candidate should check the serial order of questions at the beginning of the test. If any question is found missing in the serial order, it should be immediately brought to the notice of the Invigilator. No pages should be torn out from this question booklet.
7. Answers must be marked in the OMR Response sheet which is provided separately. OMR Response sheet must be handed over to the invigilator before you leave the seat.
8. The OMR Response sheet should not be folded or wrinkled. The folded or wrinkled OMR/Response Sheet will not be evaluated.
9. Write your Roll Number in the appropriate space (above) and on the OMR Response Sheet. Any other details, if asked for, should be written only in the space provided.
10. There are four options to each question marked A, B, C and D. Select one of the most appropriate options and fill up the corresponding oval/circle in the OMR Response Sheet provided to you. The correct procedure for filling up the OMR Response Sheet is mentioned below.

CORRECT METHOD
(A) ● (C) (D)

WRONG METHODS					
(A) ☒ (C) (D)	(A) ✓ (C) (D)	(A) ◐ (C) (D)	(A) ◉ (C) (D)	(A) ● (C) ●	(A) ● (C) ●

Entrance Test - 2021
Set-B

Q. 1 If $f(x) = x \; \forall x \in [0,4]$ and $P = \{0,1,2,3,4\}$ be the partition of P, then $L(P,f)$ and $U(P,f)$ are

(A) 6, 10
(B) 3, 6
(C) 2, 4
(D) none of these.

Q. 2 Rate of convergence of Newton-Raphson method when there exist double roots is

(A) linear.
(B) quadratic.
(C) cubic.
(D) none of these.

Q. 3 Length of the arc of the curve

$$y = \log \sec x$$

from $x = 0$ to $x = \frac{\pi}{3}$ is equal to

(A) $\log(2 - \sqrt{3})$
(B) $\log(1 - \sqrt{3})$
(C) $\log(1 + \sqrt{3})$
(D) $\log(2 + \sqrt{3})$

Q. 4 Two independent random variates X and Y are both normally distributed with means 1 and 2, and standard deviations 3 and 4 respectively. The mean and variance of normal variate $Z = X - Y$ are

(A) $0, 1$
(B) $3, 7$
(C) $2, 12$
(D) $-1,\ 25$

Q. 5 Let $f: \mathbb{R} \to \mathbb{R}$ is a differentiable function and $f(2) = 4$, then the value of

$$\lim_{x \to 2} \int_4^{f(x)} \frac{2t}{x-2} dt$$

is

(A) $2f'(2)$
(B) $4f'(2)$
(C) $8f'(2)$
(D) none of these.

Q. 6 The classical fourth-order Runge-Kutta method is

$$y_1 = y_0 + \frac{1}{6}(k_1 + \alpha k_2 + 2k_3 + k_4)$$

where $k_1 = hf(x_0, y_0)$,

$k_2 = hf\left(x_0 + \frac{1}{2}h, y_0 + \frac{1}{2}k_1\right)$,

$k_3 = hf\left(x_0 + \frac{1}{2}h, y_0 + \frac{1}{2}k_2\right)$,

$k_4 = hf(x_0 + h, y_0 + \beta k_3)$

Then α and β are

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

Q. 7 If one end of the diameter of a circle $x^2 + y^2 - 4x - 6y + 11 = 0$ is (3,4) then the coordinates of the other end are

(A) $(2,3)$
(B) $(3,2)$
(C) $(2,1)$
(D) $(1,2)$

Q. 8 The coefficient of correlation between variables X and Y is 0.8. Their covariance is 4.8. Th variance of X is 16. Then the standard deviation of Y is

(A) $\frac{4.8}{0.8 \times 4}$
(B) $\frac{0.8}{4.8 \times 4}$
(C) $\frac{4}{4.8 \times 0.8}$
(D) $\frac{4.8}{0.8 \times 16}$

Q. 9 If the equation of motion of a particle executing a S. H. M. is

$$\frac{d^2x}{dt^2} + 16x = 0$$

then the frequency will be

(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{8}$
(C) $\frac{2}{\pi}$
(D) $\frac{8}{\pi}$

Q. 10 The process of determining the area of a plane geometric figure by dividing it into a collection of shapes of known area and finding the limit of the sum of these areas is called

(A) quadrature.
(B) rectification.
(C) cubature.
(D) none of these.

Q. 11 Let

$$A = \begin{bmatrix} 2 & -\frac{1}{20} \\ 0 & 5 \end{bmatrix}, \quad A^{-1} = \begin{bmatrix} \frac{1}{2} & a \\ 0 & b \end{bmatrix}$$

then $a + b =$

(A) $\frac{41}{100}$

(B) $\frac{31}{200}$

(C) $\frac{51}{100}$

(D) $\frac{41}{200}$

Q. 12 A constraint in a linear programming problem restricts

(A) value of objective function.

(B) basic solution of the problem.

(C) use of available resources.

(D) uncertainty of optimum value.

Q. 13 If $< x_n >$ is a sequence such that

$$x_n = \frac{n!}{n^n}$$

then

$$\lim_{n \to \infty} x_n =$$

(A) 0

(B) 1

(C) 2

(D) e

Q. 14 If H is any subgroup of a group G, then $HH =$

(A) H

(B) H^2

(C) $3H$

(D) none of these

Q. 15 For the game with payoff matrix,

$$\begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix}$$

the value of game is

(A) $\frac{13}{3}$

(B) $\frac{15}{3}$

(C) $\frac{17}{5}$

(D) $\frac{19}{5}$

Q. 16 Let (X, d) be a metric space and let x, y, z be any three points of X. Then

(A) $d(x,y) \geq |d(x,z) - d(z,y)|$

(B) $d(x,y) \leq |d(x,z) - d(z,y)|$

(C) $d(x,y) = |d(x,z) \times d(z,y)|$

(D) none of these

Q. 17 The divergence of $\vec{F} = i e^{-2x} \sin 2y + j\, e^{-2x} \cos 2y$ is

(A) $4e^{-2x} \sin 2y$

(B) $-4e^{-2x} \sin 2y$

(C) $4e^{-2x} \cos 2y$

(D) $-4e^{-2x} \cos 2y$

Q. 18 If A and B are two mutually exclusive events form a sample space of a random experiment, then the probability $P(\bar{A} \cup \bar{B}) =$

(A) 0

(B) 1

(C) 0.5

(D) none of these

Q. 19 Polar form of the complex number $-5 - 5i$ is

(A) $5\sqrt{2}\, e^{\frac{i\pi}{6}}$

(B) $5\sqrt{2}\, e^{\frac{i\pi}{2}}$

(C) $5\sqrt{2}\, e^{\frac{-3i\pi}{4}}$

(D) none of these

Q. 20 The vector $(m, 3, 1)$ is a linear combination of the vectors $(3,2,1)$ and $(2,1,0)$ in R^3, then th value of $m =$

(A) 3

(B) 4

(C) 5

(D) 6

Q. 21 If

$$\int_{y=0}^{a} \int_{x=0}^{y} f(x,y)\, dx\, dy = \int_{x=0}^{a} \int_{y=\alpha}^{y=\beta} f(x,y)\, dy\, dx$$

then α and β are

(A) x and a

(B) a and x

(C) a and 0

(D) none of these

Q. 22 The series

$$\frac{1}{1^m} + \frac{1}{2^m} + \frac{1}{3^m} + \cdots + \frac{1}{n^m} + \cdots$$

is

(A) convergent if $m < 1$ and divergent if $m \geq 1$.

(B) convergent if $m > 1$ and divergent if $m \leq 1$.

(C) convergent for all m.

(D) divergent for all m.

Q. 23 If W_1 and W_2 are two subspaces of a finite dimensional vector space $V(F)$, then

$$\dim(W_1 + W_2) = \dim W_1 + \dim W_2 + R$$

where R is

(A) $\dim(W_1 \cap W_2)$

(B) $-\dim(W_1 \cap W_2)$

(C) $\dim(W_1 \cup W_2)$

(D) $-\dim(W_1 \cup W_2)$

Q. 24 If $\phi(x, y, z)$ is a scalar point function, then the divergence of gradient of ϕ is

(A) curl operator

(B) double gradient operator

(C) Laplacian operator

(D) none of these

Q. 25 If O_i $(i = 1, 2, \ldots, n)$ be a set of observed (experimental) frequencies and E_i $(i = 1, 2, \ldots, n)$ is the corresponding set of expected (theoretical or hypothetical) frequencies, then (chi-square) $\chi^2 =$

(A) $\sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$

(B) $\sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i^2}$

(C) $\sum_{i=1}^{n} (O_i - E_i)^2 E_i$

(D) $\sum_{i=1}^{n} (O_i - E_i)^2 E_i^2$

Q. 26 In LU-decomposition of the matrix

$$\begin{bmatrix} 2 & 2 \\ 4 & 9 \end{bmatrix}$$

if the diagonal elements of U are both 1, then the lower diagonal entry ℓ_{22} of L is

(A) 3

(B) 5

(C) 7

(D) 9

Q. 27 The moment of a force about a point can be represented geometrically by n times the area o triangle whose base is the line completely representing the force and whose vertex in the point about which moment is to taken. The value of n is

(A) 1

(B) 2

(C) 3

(D) 4

Q. 28 If $15^{2x} = 36$ then 15^{-x} equals to

(A) $\frac{1}{15}$

(B) $\frac{1}{6}$

(C) $\frac{1}{30}$

(D) 0

Q. 29 In an Argand plane the centre of the circle $|6z - 12 + 18i| = 17$ has the affix

(A) $12 - 18i$

(B) $12 + 18i$

(C) $2 - 3i$

(D) $2 + 3i$

Q. 30 The sum of the eigenvalues of the given matrix is

$$\begin{bmatrix} 1 & 2 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

(A) 4

(B) 5

(C) 7

(D) none of these.

Q. 31 If $f(0) = 1, f(1) = 3, f(3) = 55$, then the Lagrange fundamental polynomial $l_1(x) =$

(A) $\frac{1}{2}(3x + x^2)$

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

(C) $\frac{1}{2}(3x - x^2)$

(D) $\frac{1}{2}(2x - x^2)$

Q. 32 The Serret-Frenet formulae can be written in the form $t' = w \times t,\ n' = w \times n,\ b' = w \times b$ the value of w is…………., where $t,\ n,\ b,\ \kappa,\ \tau$ are tangent, normal, bi-normal, curvature and torsion respectively.

(A) $w = \tau t + \kappa b$

(B) $w = \tau t - \kappa b$

(C) $w = \tau t$

(D) $w = -\kappa b$

Q. 33 If

$$\begin{vmatrix} 7i & -4i & 1 \\ 8 & 4i & -1 \\ 22 & 4 & i \end{vmatrix} = x + iy.$$

and $i = \sqrt{-1}$. Then values of x, y are

(A) $x = 4, y = 1$

(B) $x = 1, y = 4$

(C) $x = 0, y = 4$
(D) $x = 0, y = 0$

Q. 34 The optimum assignment schedule for the assignment problem

		Jobs		
		P	Q	R
Persons	1	5	6	10
	2	6	4	10
	3	17	16	11

is
(A) $1 \to P,\ 2 \to Q,\ 3 \to R$
(B) $1 \to Q,\ 2 \to P,\ 3 \to R$
(C) $1 \to R,\ 2 \to Q,\ 3 \to P$
(D) none of these

Q. 35 If a particle starting with a velocity u and subject to a uniform acceleration f travels for n seconds, the distance travelled by it in n^{th} second is
(A) $u + \frac{1}{2}(2n - 1)f$
(B) $u + \frac{1}{2}(n - 1)f$
(C) $u + \frac{1}{2}(2 - n)f$
(D) $u + \frac{n}{2}(2f + 1)$

Q. 36 If R is a ring, the set

$$Z(R) = \{x \in R \mid x\,r = r\,x, \forall r \in R\}$$

is called
(A) outer of a ring.
(B) inner of a ring.
(C) center of a ring.
(D) boundary of a ring.

Q. 37 Forces forming a couple are each 24 gm and its arm is 10 cm. The arm of an equivalent couple each of whose force is 30 gm is
(A) 2 cm
(B) 4 cm
(C) 6 cm
(D) 8 cm

Q. 38 If set $A = \{1, 2, 3\}$ then the relation $R = \{(1,1), (1,2)\}$ is
(A) reflexive.
(B) symmetric
(C) transitive
(D) none of these.

39 The set of integers under multiplication $(Z, \times)$ is a
(A) Monoid
(B) Group
(C) Field
(D) none of these.

40 Let F be any field and T be a linear operator on F^2 defined by

$$T(a, b) = (a + b, a),$$

then $T^{-1}(a, b) =$
(A) $(b, a - b)$
(B) $(a - b, b)$
(C) $(a, a + b)$
(D) none of these

41 The set $G = \{1,2,3,4,5,6\}$ is an abelian group under the operation
(A) addition.
(B) multiplication modulo 6.
(C) addition modulo 7.
(D) multiplication modulo 7.

42 If X is a Poisson variate and $4P(X = 4) = P(X = 3)$, then the mean of the distribution is
(A) 1
(B) 2
(C) 3
(D) 4

43 Two equal forces, P, act at a point at angle α, their resultant is
(A) $2P\cos\frac{\alpha}{2}$
(B) $4P\cos\frac{\alpha}{2}$
(C) $3P\cos\frac{\alpha}{2}$
(D) none of these

44 The value of line integral

$$\int_C (xy^2 + x^2)dx + (x^2y + y^3)dy,$$

where C is the square with vertices (0,0), (2,0), (2,2) and (0,2) is
(A) -1
(B) 0
(C) 1
(D) 2

45 The triple integral over the region bounded by the planes $2x + y + z = 4, x = 0, y = 0, z = 0$ is given by

$$\int_0^2 \int_0^{H(x)} \int_0^{G(x,y)} dzdydx$$

then the function $H(x) - G(x, y) =$
(A) $x + y$
(B) $x - y$

(C) x
(D) y

Q. 46 Three forces acting on a particle are in equilibrium. The angle between the first and the second is 90^o and that of between the second and the third is 120^o. The forces are in the ratio
(A) $1:\sqrt{2}:3$
(B) $\sqrt{3}:1:2$
(C) $2:3:\sqrt{5}$
(D) none of these

Q. 47 The Bolzano-Weierstrass theorem states that "A bounded sequence of real numbers has a
(A) empty subsequence.
(B) convergent subsequence.
(C) divergent subsequence.
(D) none of these.

Q. 48 The particular integral of the partial differential equation

$$\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$$

is
(A) $\frac{1}{18}e^{x+2y}$
(B) $\frac{1}{24}e^{x+2y}$
(C) $\frac{1}{27}e^{x+2y}$
(D) $\frac{1}{36}e^{x+2y}$

Q. 49 In case of linear programming problem, the dual of the dual is
(A) primal.
(B) dual.
(C) simplex.
(D) none of these.

Q. 50 If Beta function $B(n,2) = \frac{1}{12}$ and n is a positive integer, the value of n is
(A) 1
(B) 2
(C) 3
(D) 4

Q. 51 If the i^{th} constraint of the primal form of a linear programming problem is equality, then i^{th} variable of its dual is
(A) non-negative.
(B) unrestricted in sign.
(C) non-positive.
(D) none of these.

Q. 52 Unit normal vector to the surface $x^2 + y^2 - z = 1$ at the point $(1, 1, 1)$ is

(A) $\frac{1}{3}(i + j - 2k)$

(B) $\frac{1}{3}(2i + j - 2k)$

(C) $\frac{1}{3}(i + 2j - 2k)$

(D) $\frac{1}{3}(2i + 2j - k)$

Q. 53 The mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively. For the binomial variate X, $P(X \geq 1) =$

(A) $1 - \left(\frac{2}{3}\right)^6$

(B) $1 - \left(\frac{1}{3}\right)^6$

(C) $1 - \left(\frac{2}{5}\right)^6$

(D) none of these.

Q. 54 If W be a subspace of a finite dimensional vector space $V(F)$, where

$$V = R^3, W = \{(a, 0,0): a \in R\},$$

then the dimension of V/W is

(A) 1

(B) 2

(C) 3

(D) none of these

Q. 55 Let $f: [-1,1] \to R$ be a continuous function. Then the integral

$$\int_0^{\pi} x\, f(\sin x) dx$$

is equivalent to

(A) $\pi \int_0^{\pi} f(\sin x) dx$

(B) $\frac{\pi}{2} \int_0^{\pi} f(\sin x) dx$

(C) $\pi \int_0^{\pi} f(\cos x) dx$

(D) $\frac{\pi}{2} \int_0^{\pi} f(\cos x) dx$

Q. 56 If

$$f(x) = \frac{1}{x^2}$$

then divided difference $f[a, b]$ is

(A) $-\left(\frac{1}{a^2 b^2}\right)$

(B) $-\left(\frac{a - b}{a^2 b^2}\right)$

(C) $-\left(\frac{a^2+b^2}{a^2b^2}\right)$

(D) $-\left(\frac{a+b}{a^2b^2}\right)$

Q. 57 The least upper bound of the set $S = \left\{\frac{3}{n} + \frac{4}{m} : n, m \in N\right\}$ is

(A) 0

(B) 3

(C) 5

(D) 7

Q. 58 If $z = x + iy$ and $e^z = 1 + i$, then $x =$

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

(B) $\frac{1}{2}e^2$

(C) $\frac{1}{2}\cos 2$

(D) none of these

Q. 59 If

$$iz^2 - \bar{z} = 0$$

where z is a complex number and $\bar{z}$ is the complex conjugate of z. Then the values of $|z|$ are

(A) 0, 1

(B) 1, 2

(C) 2, 3

(D) none of these.

Q. 60 If a differentiable vector function $\vec{f}$ of the variable t has a constant length, then $\vec{f}$ and $\frac{d\vec{f}}{dt}$ are

(A) parallel, provided $\left|\frac{d\vec{f}}{dt}\right| \neq 0$.

(B) perpendicular, provided $\left|\frac{d\vec{f}}{dt}\right| \neq 0$.

(C) oscillatory, provided $\left|\frac{d\vec{f}}{dt}\right| \neq 0$.

(D) none of these.

Q. 61 The values of x and $f(x)$ are given in the table

x	1	2	3
$f(x)$	1	8	.27

Then the derivative $\frac{df}{dx}$ at $x = 1$ is

(A) 0

(B) 1

(C) 2

(D) 3

Q. 62 The eccentricity of the hyperbola

$$3x^2 - y^2 = 4$$

is

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

Q. 63 If G is a finite group and H is a normal subgroup of G, then $o(G/H) =$

(A) $o(G)$
(B) $o(H)$
(C) $\frac{o(G)}{o(H)}$
(D) none of these

Q. 64 If A and B are two non-singular square matrices of same order, then

(A) $(AB)^{-1} = AB$
(B) $(AB)^{-1} = BA$
(C) $(AB)^{-1} = B^{-1}A^{-1}$
(D) $(AB)^{-1} = A^{-1}B^{-1}$

Q. 65 In the following sequencing problem,

	Jobs						
	P	Q	R	S	T	U	V
Processing time on Machine I	3	6	4	11	7	10	13
Processing time on Machine II	5	8	9	12	9	14	8

the optimal sequence of jobs is

(A) PQRSTUV
(B) PRQTUSV
(C) PQRVSTU
(D) none of these.

Q. 66 The area of the triangle on the Argand plane formed by the complex numbers

$$-iz, z, -z + iz$$

is

(A) $\frac{1}{2}|z|^2$
(B) $|z|^2$
(C) $\frac{3}{2}|z|^2$
(D) none of these

Q. 67 The point $R(\alpha, \beta)$ is on the parabola $y = x^2$ which minimize the area of the triangle PQR, where $P(0, -10)$, $Q(2, 0)$ are two points. Then α and β are

(A) $\frac{1}{2}, \frac{1}{4}$
(B) $\frac{3}{2}, \frac{9}{4}$

(C) $\frac{5}{2}, \frac{25}{4}$

(D) $\frac{7}{2}, \frac{49}{4}$

Q. 68 The integral

$$\int_0^{\frac{\pi}{2}} \frac{\sin x + \cos x}{\sqrt{1+\sin 2x}}\, dx$$

is equal to

(A) 1

(B) 0

(C) $\frac{\pi}{2}$

(D) ∞

Q. 69 In projectile motion, if the maximum horizontal range for a particle is R, the greatest height attained is

(A) $\frac{R}{2}$

(B) $\frac{R}{3}$

(C) $\frac{R}{4}$

(D) $\frac{R}{5}$

Q. 70 Two random variables X and Y have the following joint probability density function:

$$f(x,y) = \begin{cases} 2-x-y; & 0 \le x \le 1, 0 \le y \le 1 \\ 0; & \text{otherwise} \end{cases}$$

The marginal probability density function of X is

(A) $f_X(x) = \begin{cases} \frac{1}{2} - x; & 0 < x < 1 \\ 0; & \text{otherwise} \end{cases}$

(B) $f_X(x) = \begin{cases} 1 - x; & 0 < x < 1 \\ 0; & \text{otherwise} \end{cases}$

(C) $f_X(x) = \begin{cases} \frac{3}{2} - x; & 0 < x < 1 \\ 0; & \text{otherwise} \end{cases}$

(D) none of these.

Q. 71 If $z = x + iy$ and $f(z) = u(x,y) + iv(x,y)$, then Cauchy-Riemann equations are

(A) $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}; \ \frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$

(B) $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}; \ \frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$

(C) $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}; \ \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

(D) none of these

$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$

$\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

Q. 72 The locus of the point of intersection of two perpendicular tangents to an ellipse is a circle called the

(A) director circle of the ellipse.
(B) cubic circle of the ellipse.
(C) intersecting circle of the ellipse.
(D) none of these.

Q. 73 The solution of

$$\frac{dy}{dx} = \frac{x+y-1}{x+y+1}$$

is………, where c is constant.

(A) $x + y + c = \log(x + y)$
(B) $xy + c = \log(x + y)$
(C) $x - y + c = \log(x + y)$
(D) none of these

Q. 74 If f be a function of two variables $x,\ y$ and $r = f_{xx}(a,b),\ \ s = f_{xy}(a,b),\ \ t = f_{yy}(a,b)$. Then $f(a,b)$ will be a minimum value if $rt - s^2 > 0$ and

(A) $r = 0$.
(B) $r < 0$.
(C) $r > 0$
(D) none of these.

Q. 75 The order and degree of the following differential equation

$$\frac{d^2}{dx^2}\left(\frac{d^2y}{dx^2}\right)^{-\frac{5}{2}} = 0$$

are

(A) 1, 4
(B) 4, 1
(C) 4, 4
(D) 1, 1

Q. 76 Coefficient of $(x-1)^2$ in the Taylor's series expansion of

$$x^5 - x^4 + x^3 - x^2 + x - 1$$

about the point $x = 1$ is

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

Q. 77 The locus of the tangent lines to sphere which are parallel to a given line is a cylinder known as the

(A) enveloping cylinder of the sphere.
(B) overlapping cylinder of the sphere.
(C) cubic cylinder of the sphere.
(D) none of these.

Q.78 The rate at which bacteria multiply is proportional to the instantaneous number present. If the original number triple in 2 hours, then time t at which it will be quadruple

(A) $2\log 4/\log 3$

(B) $3\log 2/\log 4$

(C) $4\log 3/\log 2$

(D) none of these

Q.79 If $p = \frac{\partial z}{\partial x}$, $q = \frac{\partial z}{\partial y}$ then the complete solution of

$$pq = p + q$$

is

(A) $z = ax + \frac{a}{a-1}y + c$, where a, c are constants.

(B) $z = ax + \frac{a^2}{a-1}y + c$, where a, c are constants.

(C) $z = ax + \frac{a^2}{a^3-1}y + c$, where a, c are constants.

(D) none of these.

Q.80 The remainder when 2^{50} is divided by 7 is

(A) 2

(B) 4

(C) 6

(D) 8

Q.81 A necessary and sufficient condition for the convergence of a sequence is that it is bounded and ....

(A) has a unique limit point.

(B) has at least two limit points.

(C) has at least three limit points.

(D) none of these.

Q.82 For $a, b, c \in R$. The differential equations $(ax^2 + bxy + y^2)dx + (2x^2 + cxy + y^2)dy = 0$ is exact, then

(A) $b = 2, c = 2a$

(B) $b = 3, c = 2$

(C) $b = 4, c = 2$

(D) $b = 6, a = 2c$

Q.83 The direction cosines of the lines equally inclined to the axes are

(A) $\left(\pm\frac{1}{\sqrt{2}}, \pm\frac{1}{\sqrt{2}}, \pm\frac{1}{\sqrt{2}}\right)$

(B) $\left(\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}\right)$

(C) $\left(\pm\frac{1}{\sqrt{5}}, \pm\frac{1}{\sqrt{5}}, \pm\frac{1}{\sqrt{5}}\right)$

(D) $\left(\pm\frac{1}{\sqrt{7}}, \pm\frac{1}{\sqrt{7}}, \pm\frac{1}{\sqrt{7}}\right)$

Q. 84 Angle between two planes $2x - y + z = 6$ and $x + y + 2z = 3$ is
(A) 30^o
(B) 45^o
(C) 60^o
(D) 90^o

Q. 85 The order of (2,3) in $Z_6 \times Z_{15}$
(A) 3
(B) 5
(C) 15
(D) 25

Q. 86 Let A be a 4×4 matrix whose determinant is 10. The determinant of the matrix $-3A$ is
(A) -810
(B) -30
(C) 30
(D) 810

Q. 87 The equation of tangent plane to the surface $z = 2x^2 + 3y^2$ at the point $(1, 2, 14)$ is
(A) $4x + 12y - z = 14$
(B) $4x + 14y - z = 16$
(C) $2x + 4y - 3z = 12$
(D) none of these.

Q. 88 $\dfrac{(n+2)! - (n+1)!}{n!} =$
(A) $(n+2)!$
(B) $(n+1)!$
(C) $(n+2)^2$
(D) $(n+1)^2$

Q. 89 The limit

$$\lim_{x \to 0} \frac{3^x - 1}{(1+x)^{\frac{1}{3}} - 1} =$$

(A) $2 \ln 2$
(B) $3 \ln 3$
(C) $3 \ln 2$
(D) $2 \ln 3$

Q. 90 The area bounded by the curve $r^2 = a^2 \cos 2\theta$ is
(A) a^2
(B) a^3
(C) $3a^4$
(D) none of these.

Q. 91 If a continuous function $f(x)$ does not have a root in the interval $[a, b]$, then which of the following statement is true?

(A) $f(a)f(b) > 0$
(B) $f(a)(b) < 0$
(C) $\dfrac{f(a)}{f(b)} \leq 0$
(D) $f(a)f(b) = 0$

Q. 92 The solution to a transportation problem with M sources and N destinations is feasible, if the number of allocations is

(A) $M + N$
(B) $M + N - 3$
(C) $M + N - 2$
(D) $M + N - 1$

Q. 93 If $x = v(1 + u)$, $y = u(1 + v)$, then

$$\frac{\partial(x,y)}{\partial(u,v)} =$$

(A) $1 + u + v$
(B) $-1 - u - v$
(C) $1 - u + v$
(D) 0

Q. 94 If $\Delta f(x) = f(x+1) - f(x)$, then $\Delta^3(-6x^3 + 11x^2 - 6x + 1) =$

(A) -24
(B) -36
(C) -48
(D) none of these.

Q. 95 The given formula

$$\int_{x_0}^{x_2} f(x)dx = \frac{h}{3}[y_0 + \alpha y_1 + y_2]$$

is known as non-composite Simpson's 1/3 rule for $y = f(x)$, then $\alpha =$

(A) 2
(B) 3
(C) 4
(D) 5

Q. 96 The coordinates of the centre of the conic

$$x^2 - 3xy + y^2 + 10x - 10y + 21 = 0$$

are

(A) $(-2, 2)$
(B) $(2, -2)$
(C) $(2, 2)$
(D) none of these

Q. 97 The integrating factor of the differential equation

$$\frac{dy}{dx} + 3x^2y = 6x^2$$

is

(A) e^{x^2}

(B) e^{x^3}

(C) e^{x^4}

(D) none of these.

Q. 98 The particular integral of the differential equation

$$(D + 2)^2 y = e^{2x} - e^{-2x}$$

where $D \equiv \frac{d}{dx}$.

(A) $\frac{1}{16}e^{2x} + \frac{x^2}{2}e^{-2x}$

(B) $\frac{1}{16}e^{-2x} + \frac{x^2}{2}e^{2x}$

(C) $\frac{1}{16}e^{-2x} - \frac{x^2}{2}e^{2x}$

(D) $\frac{1}{16}e^{2x} - \frac{x^2}{2}e^{-2x}$

Q. 99 In a linear programming problem of 2 constraints and 4 variables, the maximum number of basic solutions are

(A) 2

(B) 4

(C) 6

(D) 8

Q. 100 If a set S has n elements, then the number of all relations on S is

(A) $2n$

(B) n^2

(C) 2^n

(D) 2^{n^2}