Sample Paper

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Maths

Q.No. 1 Let $A = [a_{ij}]$ and $B = [b_{ij}]$ be two 3 x 3 real matrices such that $b_9 = (3)^{(1+j-2)a_j}$ where i,j = 1, 2, 3. If the determinant of B is 81, then the determinant of A :

(A) 1/3

(B) 3

(C) 1/81

(D) 1/9

Q.No. 2 The sum of the following series $1 + 6 + \frac{9(1^2+2^2+3^2)}{7} + \frac{12(1^2+2^2+3^2+4^2)}{9} + \frac{15(1^2+2^2+\ldots+5^2)}{11} + \cdots$ upto 15 terms is

(A) 7510

(B) 7820

(C) 7830

(D) 7520

Q.No. 3 The perpendicular distance from the origin to the plane containing the two lines, $\frac{x+2}{3} = \frac{y-2}{5} = \frac{z+5}{7}$ and $\frac{x-1}{1} = \frac{y-4}{4} = \frac{z+4}{7}$, is:

(A) 11

(B) $6\sqrt{11}$

(C) $11/\sqrt{6}$

(D) $11\sqrt{6}$

Q.No. 4 The number of ordered pairs (r, k) for which $6.{}^{35}C_r = (k^2 - 3).\ {}^{36}C_{r+1}$, where k is an integer is:

(A) 3

(B) 2

(C) 6

(D) 4

Q.No. 5 The normal to the curve y(x−2)(x−3)=x+6 at the point where the curve intersects the y-axis passes through the point :

(A) (1/2,1/2)

(B) (1/2,-1/3)

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(C) (1/2,1/3)

(D) (-1/2,-1/2)

Q.No. 6 The number of values of k, for which the system of equations (k + 1)x + 8y = 4k kx + (k + 3)y = 3k − 1 has no solution, is

(A) 1

(B) 2

(C) 3

(D) infinite

Q.No. 7 Let K be the set of all real values of x where the function $f(x) = \sin|x| - |x| + 2(x-\pi)\cos|x|$ is not differentiable. Then the set K is equal to :

(A) {π}

(B) {0, π}

(C) Φ (an empty set)

(D) {0}

Q.No. 8 Let $S = \{t \in \mathbf{R} : f(x) = |x-\pi| \cdot (e^{|x|}-1)\sin|x|$ is not differentiable at t}. Then the set S is equal to :

(A) Φ (an empty set)

(B) {0}

(C) {π}

(D) {0,π}

Q.No. 9 If the fractional part of the number $\frac{2^{403}}{15}$ is k/15, then k is equal to :

(A) 6

(B) 8

(C) 14

(D) 4

Q.No. 10 If the point $(2, \alpha, \beta)$ lies on the plane which passes through the points (3, 4, 2) and (7,0, 6) and is perpendicular to the plane 2x - 5y=15, then $2\alpha - 3\beta$ is equal to :

(A) 7

(B) 12

(C) 17

(D) 5

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Q.No. 11 In a class of 60 students, 40 opted for NCC, 30 opted for NSS and 20 opted for both NCC and NSS. If one of these students is selected at random, then the probability that the student selected has opted neither for NCC nor for NSS is :

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

(B) $\frac{5}{6}$

(C) $\frac{1}{3}$

(D) $\frac{2}{3}$

Q.No. 12 The sum of all two digit positive numbers which when divided by 7 yield 2 or 5 as remainder is:

(A) 1256

(B) 1365

(C) 1356

(D) 1465

Q.No. 13 For each xeR, let [x] be the greatest integer less than or equal to x. Then $\lim_{x\to 0^-} \frac{x([x]+|x|)\sin[x]}{|x|}$ is equal to :

(A) 0

(B) 1

(C) sin 1

(D) -sin 1

Q.No. 14 If the circles $x^2 + y^2 - 16x - 20y + 164 = r^2$ and $(x-4)^2 + (y-7)^2 = 36$ intersect at two distinct points, then:

(A) 1 < r < 11

(B) r > 11

(C) 0 < r < 1

(D) r=11

Q.No. 15 The area of the region enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line y = x is :

(A) $\frac{1}{6}(24\pi - 1)$

(B) $\frac{1}{3}(6\pi - 1)$

(C) $\frac{1}{3}(12\pi - 1)$

(D) $\frac{1}{6}(12\pi - 1)$

Q.No. 16 The area (in sq. units) of the region $\{(x,y) : x\geq 0, x+y\leq 3, x^2\leq 4y \text{ and } y\leq 1+\sqrt{x}\}$ is:

(A) 3/2

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(B) 7/3

(C) 5/2

(D) 59/12

Q.No. 17 If the system of linear equations 2x + 2ay + az =0 2x + 3by + bz =0 2x + 4cy + cz =0 Where a,b and c ∈ R are non zero and distinct: has a non zero solution, then :

(A) 1/a, 1/b, 1/c are in A.P.

(B) a,b, and c are in G.P.

(C) a+b+c = 0

(D) a,b and c are in A.P.

Q.No. 18 The product of three consecutive terms of a G.P. is 512. If 4 is added to each of the first and the second of these terms, the three terms now form an A.P. Then the sum of the original three terms of the given G.P. is:

(A) 36

(B) 24

(C) 28

(D) 32

Q.No. 19 Let the equations of two sides of a triangle be 3x - 2y+6=0 and 4x +5y-20=0. If the orthocentre of this triangle is at(1, 1), then the equation of its third side is :

(A) 26x+61y+1675= 0

(B) 122y +26x +1675=0

(C) 26x-122y-1675=0

(D) 122y-26x - 1675=0

Q.No. 20 For $(2x)^{2y} = 4e^{2x-2y}$, If x > 1, then $(1 + \log_e 2x)^2 \frac{dy}{dx}$ is equal to:

(A) $\frac{x \log_e 2x - \log_e 2}{x}$

(B) $\log_e 2x$

(C) $\frac{x \log_e 2x + \log_e 2}{x}$

(D) $x \log_e 2x$

Q.No. 21 If, for a positive integer n, the quadratic equation, $x(x+1)+(x+1)(x+2)+\ldots. + (x+\overline{n-1})\ (x+n) = 10n$ has two consecutive integral solutions, then n is equal to:

(A) 9

(B) 10

(C) 11

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(D) 12

Q.No. 22 From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged in a row on a shelf so that the dictionary is always in the middle. The number of such arrangements is :

(A) at least 1000

(B) less than 500

(C) at least 500 but less than 750

(D) at least 750 but less than 1000

Q.No. 23 A box contains 15 green and 10 yellow balls. If 10 balls are randomly drawn, one-by-one, with replacement, then the variance of the number of green balls drawn is :

(A) 6

(B) 4

(C) 6/25

(D) 12/5

Q.No. 24 If $\cos^{-1}\left(\frac{2}{3x}\right)+\cos^{-1}\left(\frac{3}{4x}\right)=\frac{\pi}{2}\left(x>\frac{3}{4}\right)$, then x is equal to:

(A) $\frac{\sqrt{145}}{12}$

(B) $\frac{\sqrt{145}}{11}$

(C) $\frac{\sqrt{145}}{10}$

(D) $\frac{\sqrt{146}}{12}$

Q.No. 25 Let f be a differentiable function such that f(1) = 2 and f'(x) = f(x) for all x ∈ r. If h(x)=f(f(x)), then h'(1) is equal to:

(A) $2e^2$

(B) 4e

(C) 2e

(D) $4e^2$

Q.No. 26 If θ^1 and θ^2 be respectively the smallest and the largest values of θ in (0, 2 π) - {π}) which satisfy the equation, $2\cot^2\theta-\frac{5}{\sin\theta}+4=0$ then $\int_0^{\theta_2}\cos^2 3\theta d\theta$ is equal to :

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

(B) $\frac{2\pi}{3}$

(C) $\frac{\pi}{3}$ + ⅙

(D) $\frac{\pi}{9}$

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Q.No. 27 Let z be the set of integers. If $A = \left\{x \in Z \quad : \quad 2^{(x+2)(x^2-5x+6)} = 1\right\}$ and $B = \{x \in Z : -3 < 2x - 1 < 9\}$, then the number of subsets of the set A x B, is :

(A) 2^{18}

(B) 2^{12}

(C) 2^{15}

(D) 2^{10}

Q.No. 28 The integral $\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \frac{dx}{1+\cos x}$ is equal to :

(A) 2

(B) 4

(C) -1

(D) -2

Q.No. 29 The value of α for which $4a\int_{-1}^{2} e^{-a|x|}dx = 5$ is :

(A) $\log_e$

(B) $\log_e(3/2)$

(C) $\log_e\sqrt{2}$

(D) $\log_e(4/3)$

Q.No. 30 'The value of c in the Lagrange's mean value theorem for the function $f(x) = x^3 + 8x + 11$, when $x \in [0, 1]$ is :

(A) $\frac{4-\sqrt{5}}{3}$

(B) $\frac{4-\sqrt{7}}{3}$

(C) 2/3

(D) $\frac{\sqrt{7}-2}{3}$

Q.No. 31 Let A, B, C and D be four non-empty sets. The contrapositive statement of " If $A \subseteq B$ and $B \subseteq D$, then $A \subseteq C$" is

(A) If $A \not\subset C$, then $A \subseteq B$ and $B \subseteq D$

(B) If $A \subseteq C$, then $A \subseteq B$ and $B \subseteq D$

(C) If $A \not\subset C$, then $A \not\subset B$ and $B \subseteq D$

(D) If $A \not\subset C$, then $A \not\subset B$ and $B \not\subset D$

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Q.No. 32 If the function f given by $f(x) = x^3 - 3(a-2)x^2 + 3ax + 7$, for some a∈R is increasing in (0, 1] and decreasing in [1, 5), then a root of the equation, $\frac{f(x)-14}{(x-1)^2} = 0 (x \neq 1)$

(A) 7

(B) -7

(C) 5

(D) 6

Q.No. 33 Let P be a Plane passing through the points (2,1,0) , (4,1,1) and (5,0,1) and R be any point (2,1,6) . Then the image of R in the Planet P is :

(A) (6,5,2)

(B) (6,5,-2)

(C) (4,3,2)

(D) (3,4-2)

Q.No. 34 If z is a complex number of unit modulus and argument θ, then arg (1+z)/(1+$\bar{z}$)

(A) π/2 - θ

(B) θ

(C) π - θ

(D) - θ

Q.No. 35 Equation of a common tangent to the circle, $x^2 + y^2 - 6x = 0$ and the parabola, $y^2 = 4x$, is :

(A) $\sqrt{3}y = 3x + 1$

(B) $2\sqrt{3}y = -x - 12$

(C) $2\sqrt{3}y = 12x + 1$

(D) $\sqrt{3}y\ x + 3$

Q.No. 36 Let $S_n = 1 + q + q^2 + \ldots + q^n$ and $T_n = 1 + \left(\frac{q+1}{2}\right) + \left(\frac{q+1}{2}\right)^2 + \ldots + \left(\frac{q+1}{2}\right)^n$ where q is a real number and q1. If ${}^{101}C_1 + {}^{101}C_2 \cdot S_1 + \ldots + {}^{101}C_{101} \cdot S_{100} = \alpha T_{100}$ then α is equal to :

(A) 2^{99}

(B) 202

(C) 200

(D) 2^{100}

Q.No. 37 Let y = y(x) be a function of x satisfying $y\sqrt{1-x^2} = k - x\sqrt{1-y^2}$ where k is a constant and $y\left(\frac{1}{2}\right) = -\frac{1}{4}$. Then dy/dx at x = 1/2 is equal to:

(A) $-\frac{\sqrt{5}}{4}$

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(B) $-\frac{\sqrt{5}}{2}$

(C) $\frac{2}{\sqrt{5}}$

(D) $\frac{\sqrt{5}}{2}$

Q.No. 38 Let $I_n = \int \tan^n x \, dx$, (n>1). If $I_4 + I_6 = a \tan^5 x + bx^5 + C$, where C is a constant of integration, then the ordered pair (a,b) is equal to:

(A) (1/5,0)

(B) (1/5,-1)

(C) (-1/5,0)

(D) (-1/5,1)

Q.No. 39 The equation of the line passing through (-4, 3, 1), parallel to the plane x+2y-z-5=0 and intersecting the line $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z-2}{-1}$ is

(A) $\frac{x+4}{-1} = \frac{y-3}{1} = \frac{z-1}{1}$

(B) $\frac{x+4}{3} = \frac{y-3}{-1} = \frac{z-1}{1}$

(C) $\frac{x-4}{3} = \frac{y-3}{-1} = \frac{z-1}{1}$

(D) $\frac{x+4}{1} = \frac{y-3}{1} = \frac{z-1}{3}$

Q.No. 40 If y = mx +4 is a tangent to both the parabolas, y^2 =4x and x^2 =2by , then b is equal to :

(A) -32

(B) -64

(C) -128

(D) 128

Answer Sheet

Q.No	Answer
Q.No. 1	(D)
Q.No. 2	(B)
Q.No. 3	(C)
Q.No. 4	(D)
Q.No. 5	(A)
Q.No. 6	(C)
Q.No. 7	(C)
Q.No. 8	(A)
Q.No. 9	(B)

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Q.No. 10	(A)
Q.No. 11	(A)
Q.No. 12	(C)
Q.No. 13	(D)
Q.No. 14	(A)
Q.No. 15	(D)
Q.No. 16	(C)
Q.No. 17	(A)
Q.No. 18	(C)
Q.No. 19	(C)
Q.No. 20	(A)
Q.No. 21	(C)
Q.No. 22	(A)
Q.No. 23	(D)
Q.No. 24	(A)
Q.No. 25	(B)
Q.No. 26	(A)
Q.No. 27	(C)
Q.No. 28	(A)
Q.No. 29	(A)
Q.No. 30	(B)
Q.No. 31	(D)
Q.No. 32	(A)
Q.No. 33	(B)
Q.No. 34	(B)
Q.No. 35	(D)
Q.No. 36	(D)
Q.No. 37	(B)
Q.No. 38	(A)
Q.No. 39	(B)
Q.No. 40	(C)

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