MASTER CADRE 2021 QUESTION PAPER

Q.1. The matrix $A=\begin{bmatrix} 3i & 4-2i \\ -4-2i & 0 \end{bmatrix}$ is

(a) symmetric (b) skew-symmetric
(c) hermition (d) skew-hermition

Q.2. If A and B are square matrices of order 3 such that |A| = -1, |B| = 3, then the determinant of 4AB is
(a) -64 (b) -12 (c) -182 (d) -192

Q.3. Determinant of a skew-symmetric matrix of odd order is
(a) zero (b) 1
(c) a non-zero perfect square (d) order of the matrix

Q.4. If A is a non-singular matrix, then A^{-1} is
(a) symmetric matrix (b) singular matrix
(c) non-singular matrix (d) skew symmetric matrix

Q.5. If $A^2 - A + I = 0$, then the inverse of the matrix A is
(a) A^{-2} (b) A + I (c) I – A (d) A – I

Q.6. If A and B are 3 × 3 matrices such that |A| = |B|, then
(a) A = B (b) A = -B
(c) A and B are both always zero matrices (d) A and B can be different matrices

Q.7. The system of equations $\begin{matrix} x+y=3 \\ 3x+3y=9 \end{matrix}$ has
(a) no solution (b) unique solution
(c) finitely many solutions (d) infinitely many solutions

Q.8. A (adjoint A) is
(a) a zero matrix (b) a scalar matrix
(c) a unit matrix (d) skew symmetric matrix

Q.9. If every minor of order r of a matrix A is zero, then rank A is always
(a) greater than r (b) equal to r
(c) less than or equal to r (d) less than r

Q.10. The eigen values of the matrix $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ 0 & a_{22} & a_{23} \\ 0 & 0 & a_{33} \end{vmatrix}$ are

(a) $a_{11}, 0, 0$ (b) $a_{12}, a_{22}, 0$ (c) a_{13}, a_{23}, a_{33} (d) a_{11}, a_{22}, a_{33}

Q.11. If A = {x : $x^2 - 5x + 6 = 0$}, B = {2, 4}, C = {4, 5}, then A × (B ∩ C) is
(a) {(2, 4), (3, 4)} (b) {(4, 2), (4, 3)}
(c) {(2, 4), (3, 4), (4, 4)} (d) {(2, 2), (3, 4), (5, 5)}

Q.12. If A = {(x, y) : $x^2 + y^2 = 25$}, B = {(x, y) : $x^2 + 9y^2 = 144$}, then A ∩ B consists of
(a) one point (b) two points (c) no point (d) four points

Q.13. For any real numbers, an operation a * b = 1 + ab is
(a) commutative but not associative (b) associative but not commutative
(c) neither commutative nor associative (d) both commutative and associative

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Q.14. Which one of the following sets is open?
(a) the set of all natural numbers
(b)]a, b[
(c) the set of all rational numbers
(d) the set of all algebraic numbers

Q.15. The set of all irrational numbers is
(a) open
(b) closed
(c) both open and closed
(d) neither open nor closed

Q.16. Which one of the following statements is true?
(a) set of rational numbers is compact
(b) set of rational numbers is uncountable
(c) if A and B are countable, then A × B is countable
(d) set of integers is an open set

Q.17. In an infinite G.P., first term is equal to twice of the sum of the remaining terms, then its common ratio is
(a) 1 (b) 1/2 (c) 1/3 (d) -1/3

Q.18. 2 + 6 + 12 + 20 + … upto n terms is equal to
(a) $\frac{n(n+1)}{2}$ (b) $\frac{n(n^2+2)}{3}$ (c) $\frac{n+1}{3}$ (d) $\frac{n(n+1)(n+2)}{3}$

Q.19. The next term in the series $\frac{3}{2}+\frac{5}{4}+\frac{9}{8}+\frac{17}{16}+...$ is
(a) $\frac{25}{32}$ (b) $\frac{29}{32}$ (c) $\frac{37}{32}$ (d) $\frac{33}{32}$

Q.20. If the lengths of sides of a right angled triangle are in A.P., then the ratio of sides is
(a) 2:3:4 (b) 3:4:5 (c) 2:3:6 (d) 4:5:6

Q.21. The series $\sum_{n=1}^{\infty}\frac{\sin nx}{n^p}$, uniformly converges for real x
(a) for p = 1 only
(b) for p < 1 only
(c) for p ≤ 1
(d) for p > 1

Q.22. The middle term in the expansion of $\left(x+\frac{1}{x}\right)^{10}$ is
(a) $^{10}C_5$ (b) $^{10}C_4(1/x)$ (c) $^{10}C_6$ (d) $^{10}C_4$

Q.23. The co-efficient of x^3 in the expansion of $\left(x^4-\frac{1}{x^3}\right)^{15}$ is
(a) $-^{15}C_3$ (b) $^{15}C_4$ (c) $-^{15}C_4$ (d) $^{15}C_3$

Q.24. If the co-efficients of 5^{th} and 6^{th} terms in the expansion of $(1 + x)^n$ are equal, then n =
(a) 8 (b) 10 (c) 9 (d) 11

Q.25. A subset of real line is compact if and only if it is closed and bounded, is
(a) Binomial theorem
(b) Bolzano-Weierstrass Theorem
(c) Nested Interval Theorem
(d) Heine-Borel Theorem

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Q.26. The function $f(x)=\begin{cases}0, & x \text{ is irrational}\\ 1, & x \text{ is rational}\end{cases}$ is

(a) continuous at x = 0
(b) continuous at x = 1
(c) discontinuous at x = 0 only
(d) discontinuous everywhere

Q.27. $\lim_{x\to 0}\left(\frac{\sin x - x}{x^3}\right)$ is equal to

(a) 1 (b) -1 (c) -1/6 (d) 1/6

Q.28. The function $f(x)=\frac{1}{x^2}, x\neq 0$ is

(a) continuous in]-∞, ∞[
(b) uniformly continuous in [0, ∞[
(c) uniformly continuous in]-∞, ∞[
(d) uniformly continuous in [1, ∞[

Q.29. The derivative of $\sin x^3$ with respect to $\cos x^3$ is equal to

(a) $-\cot x^3$ (b) $\cot x^3$ (c) $\tan x^3$ (d) $-\tan x^3$

Q.30. If $y = be^{ax} + ae^{bx}$, then $\frac{d^2y}{dx^2}$ is equal to

(a) ab (b) ab (a + b) (c) 2ab (d) a + b

Q.31. If $y^x = 2^x$, then $\frac{dy}{dx}$ is equal to

(a) y^{x-1} (b) $2^x \log 2$ (c) $\frac{y}{x}\log\left(\frac{2}{y}\right)$ (d) $\frac{x}{y}\log\left(\frac{2}{y}\right)$

Q.32. If x = a(t cost – sint), y = a(t sint + cost), then $\frac{dy}{dx} =$

(a) – tan t (b) – cot t (c) tan t (d) cot t

Q.33. If $f(x) = x^3 - 6x^2 + 9x + 7$ is a decreasing function, then x lies in

(a) (3, ∞) (b) (-1, 3) (c) (1, 3) (d) (-∞, -1)

Q.34. A stone is thrown vertically up and the height reached in time t is given by $s = 80t - 16t^2$. The stone reaches the maximum height in time t =

(a) 2 (b) 2.5 (c) 3 (d) 3.5

Q.35. If the rate of change of area of a circle is equal to the rate of change of its diameter, then its radius is

(a) $\frac{1}{\pi}$ (b) $\sqrt{2\pi}$ (c) $\frac{1}{\sqrt{2\pi}}$ (d) $\frac{1}{2}\frac{1}{\sqrt{\pi}}$

Q.36. For $f(x) = (x - 1)^{1/3}$, Lagrange's Mean Value Theorem is applicable in the interval

(a) [1, 2] (b) (1, 2) (c) (0, 2) (d) (-∞, ∞)

Q.37. The function $f(x)=\frac{x}{1+|x|}$ is

(a) strictly increasing
(b) strictly decreasing
(c) neither increasing nor decreasing
(d) not differentiable at x = 0

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Q.38. The equation of tangent to the curve $y = x + \frac{4}{x^2}$, which is parallel to X-axis is

(a) y = 3 (b) y = 2 (c) y = 0 (d) y = 4

Q.39. The function $f(x) = x^x$ has a stationary point at

(a) x = e (b) x = 1 (c) $x = \frac{1}{e}$ (d) $x = -\frac{1}{e}$

Q.40. The function $f(x) = \begin{cases} 2+x, & x \geq 0 \\ 2-x, & x < 0 \end{cases}$ is

(a) differentiable at x = 0
(b) discontinuous at x = 0
(c) non-differentiable at x = 0
(d) differentiable everywhere

Q.41. If sin(x + y) = log(x + y), then $\frac{dy}{dx}$ is equal to

(a) 1 (b) -1 (c) 2 (d) -2

Q.42. The maximum value of sinx + cosx is

(a) 1 (b) 2 (c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$

Q.43. $\int \frac{|x|}{x} dx =$

(a) x + k (b) –x + k (c) |x| + k (d) kx + |x|

where k is constant of integration.

Q.44. $\int \frac{(x+1)e^x}{\cos^2(xe^x)} dx =$

(a) tan (xe^x) + k (b) sec (xe^x) + k (c) cosec (xe^x) + k (d) cot (xe^x) + k

Q.45. $\int_0^2 (|x-2| + [x])\, dx$, where [x] denotes integral part of x, is equal to

(a) 1 (b) 2 (c) 3 (d) 4

Q.46. $\lim_{n\to\infty}\left(\frac{1}{n+1} + \frac{1}{n+2} + \ldots + \frac{1}{n+n}\right)$ is equal to

(a) log 2 (b) 0 (c) –log 2 (d) infinity

Q.47. $\int_0^{\frac{\pi}{2}} \frac{\tan x}{\tan x + \cot x} dx =$

(a) 0 (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) π

Q.48. C.G. of the arc of the curve $x = a\cos^3 t$, $y = a\sin^3 t$ lying in the first quadrant is at

(a) (0, 0) (b) (a, 0) (c) (0, a) (d) $\left(\frac{2a}{5}, \frac{2a}{5}\right)$

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Q.49. $\int_0^{\pi}\int_0^{x} \sin x\,dx\,dy =$

(a) 0 (b) π (c) $\sin\pi$ (d) $\cos\pi$

Q.50. The differential equation cosx(cosx – sina siny) dx + cosy (cosy – sina sinx)dy = 0 is

(a) with variable separable (b) homogenous

(c) Exact (d) reducible to homogenous form

Q.51. Number of arbitrary constants in singular solution of an equation of degree n are

(a) N (b) n – 1 (c) 0 (d) 1

Q.52. Solution of the differential equation $y = x\frac{dy}{dx} + \left(\frac{dy}{dx}\right)^2$ is

(a) y = cx (b) y = cx + c (c) $y = cx + \frac{1}{c}$ (d) y = cx + c

Q.53. The differential equation of the family of orthogonal trajectories of the family of curves given by $f\left(x, y, \frac{dy}{dx}\right) = 0$ is

(a) $f\left(x, -y, \frac{dy}{dx}\right) = 0$ (b) $f\left(-x, y, \frac{dy}{dx}\right) = 0$

(c) $f\left(-x, -y, \frac{dy}{dx}\right) = 0$ (d) $f\left(x, y, -\frac{dx}{dy}\right) = 0$

Q.54. Particular Integral of differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{2x}$ is

(a) e^{2x} (b) $x\,e^{2x}$ (c) $-xe^{2x}$ (d) x^2e^{2x}

Q.55. The solution of the differential equation $\frac{d^2y}{dx^2} + 4y = 0$ is

(a) y = ai cos 2x + bi sin 2x (b) y = (ai + bi) cos 2x

(c) y = (ai + bi) sin 2x (d) y = ai cos 4x + bi sin 4x

Q.56. If $P_n(x)$ denotes Legendre polynomial of order n of Legendre equation, then $\int_{-1}^{1} P_3(x)\,P_4(x)\,dx =$

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) 0 (d) $\frac{1}{12}$

Q.57. The projection of the vector $\vec{i} - 2\vec{j} + \vec{k}$ on the vector $4\vec{i} - 4\vec{j} + 7\vec{k}$ is

(a) $\frac{5}{19}$ (b) $\frac{19}{9}$ (c) $\frac{9}{19}$ (d) $\frac{1}{19}$

Q.58. A unit vector coplanar with $\vec{i} + \vec{j} + 2\vec{k}$ and $\vec{i} + 2\vec{j} + \vec{k}$ and perpendicular to $\vec{i} + \vec{j} + \vec{k}$ is

(a) $\frac{1}{2}(\vec{j} + \vec{k})$ (b) $\frac{1}{2}(\vec{j} - \vec{k})$ (c) $\pm\frac{-\vec{j} + \vec{k}}{\sqrt{2}}$ (d) $\frac{\vec{j} + \vec{k}}{\sqrt{2}}$

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Q.59. The value of $[\vec{a}-\vec{b},\vec{b}-\vec{c},\vec{c}-\vec{a}]$, where $|\vec{a}|=1,|\vec{b}|=5,|\vec{c}|=3$ is
(a) 1 (b) 2 (c) 3 (d) 0

Q.60. If $\vec{a},\vec{b},\vec{c}$ are coplanar, then $[\vec{a}+\vec{b},\vec{b}+\vec{c},\vec{c}+\vec{a}]$=
(a) $|\vec{a}|$ (b) 0 (c) $|\vec{b}|$ (d) $2[\vec{a}\,\vec{b}\,\vec{c}]$

Q.61. If $\vec{a}.\vec{b}=0$ and $\vec{a}+\vec{b}$ makes an angle of 30° with $\vec{a}$, then
(a) $|\vec{b}|=2|\vec{a}|$ (b) $|\vec{a}|=2|\vec{b}|$ (c) $|\vec{a}|=\sqrt{2}|\vec{b}|$ (d) $|\vec{a}|=\sqrt{3}|\vec{b}|$

Q.62. The dimension of the vector space C of all complex numbers over the field Q of all rational numbers is
(a) 0 (b) 1 (c) 2 (d) infinite

Q.63. The solution of $2 - 3x - 2x^2 \geq 0$ is
(a) $-1 < x < 2$ (b) $-2 \leq x \leq 1/2$ (c) $-2 < x < -1$ (d) $-1 < x < 3$

Q.64. If the pair of lines $xy - x - y + 1 = 0$ and the line $ax + 2y - 3 = 0$ are concurrent then a =
(a) 0 (b) 1 (c) -1 (d) 2

Q.65. The point (3, 2) is first translated through a distance 2 units along the positive direction of Y-axis and then rotated through an angle of 45° about the origin in the anticlockwise direction. The co-ordinates of new point are
(a) $\left(\frac{1}{\sqrt{2}},\frac{7}{\sqrt{2}}\right)$ (b) $\left(\frac{1}{2},\frac{7}{2}\right)$ (c) $\left(-\frac{1}{2},\frac{7}{2}\right)$ (d) $\left(-\frac{1}{\sqrt{2}},\frac{7}{\sqrt{2}}\right)$

Q.66. If a straight line passes through the point (α, β) and the portion of the line intercepts between the axis is divided equally at the point, then $\frac{x}{\alpha}+\frac{y}{\beta}=$
(a) 0 (b) 1 (c) 2 (d) 4

Q.67. The distance of the point (1, 2) from the line $x + y + 5 = 0$ measured along the line parallel to $3x - y = 7$ is equal to
(a) $\sqrt{10}$ (b) $\sqrt{40}$ (c) 10 (d) 40

Q.68. Two circles of equal radius r cut orthogonally. If their centres are (2, 3) and (5, 6), then r =
(a) 1 (b) 2 (c) 3 (d) 4

Q.69. The circle $x^2 + y^2 - 4x + 4y + c = 0$ touches both the axes if c =
(a) 2 (b) 4 (c) 8 (d) 16

Q.70. The equation of the directrix of the parabola $y^2 + 4y + 4x + 2 = 0$ is
(a) $2x - 3 = 0$ (b) $4x + 1 = 0$ (c) $5x + 1 = 0$ (d) $5x - 1 = 0$

Q.71. The latus rectum of the parabola $x^2 - 4x - 2y - 8 = 0$ is
(a) 2 (b) 1 (c) 4 (d) 8

Q.72. The centre of the ellipse $4x^2 + 9y^2 + 16x - 18y - 11 = 0$ is
(a) (-2, -1) (b) (-2, 1) (c) (2, -1) (d) (2, 1)

Q.74. Equations of the tangents to the hyperbola $2x^2 - 3y^2 = 6$ which are parallel to the line $y = 3x + 4$ are
(a) $y = 3x \pm 6$ (b) $y = 3x \pm 4$ (c) $y = 3x \pm 5$ (d) $y = 3x \pm 1$

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Q.75. The ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ and the hyperbola $\frac{x^2}{25}-\frac{y^2}{16}=1$ have in common
(a) centre only (b) vertices only
(c) foci only (d) centres and vertices

Q.76. The length of shortest distance between the lines
$\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ is
(a) $\frac{-1}{\sqrt{30}}$ (b) $2\sqrt{30}$ (c) $5\sqrt{30}$ (d) $3\sqrt{30}$

Q.77. The angle between the planes $\vec{r}.(3\vec{i}+\vec{j}-\vec{k})=1$ and $\vec{r}.(\vec{i}+4\vec{j}-2\vec{k})=2$ is
(a) π (b) 2π (c) $\cos^{-1}\left(\frac{9}{\sqrt{231}}\right)$ (d) $\sin^{-1}\left(\frac{9}{\sqrt{231}}\right)$

Q.78. The plane X∘Z divides the join of (1, -1, 5) and (2, 3, 4) in the ratio in the ratio λ : 1, then λ is
(a) 1 (b) 2/3 (c) 1/3 (d) 3

Q.79. The straight line $\frac{x-3}{3}=\frac{y-2}{1}=\frac{z-1}{0}$ is
(a) parallel to X-axis (b) parallel to Y-axis
(c) parallel to Z-axis (d) perpendicular to Z-axis

Q.80. Equation of the plane perpendicular to the line $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and passing through the point (2, 3, 4) is
(a) x + y + z = 9 (b) x + 2y + 3z = 20
(c) x + 2y + 3z = 9 (d) x + y + z = 6

Q.81. The square roots of complex number 6 + 8i are
(a) $\pm(\sqrt{6}+\sqrt{8}i)$ (b) $\pm(\sqrt{8}+\sqrt{2}i)$
(c) $\pm(\sqrt{6}-\sqrt{8}i)$ (d) $\pm(\sqrt{8}-\sqrt{2}i)$

Q.82. The complex numbers, 1, -1, $i\sqrt{3}$ form a triangle which is
(a) right angled (b) isosceles
(c) equilateral (d) isosceles right angled

Q.83. The modulus and amplitude of $\frac{1+2i}{1-(1-i)^2}$ are respectively
(a) $1,\frac{\pi}{3}$ (b) $\sqrt{2},\frac{\pi}{6}$ (c) 1, 0 (d) $\sqrt{3},0$

Q.84. Root of equation $3^{x-1}+3^{1-x}=2$ is
(a) 0 (b) 1 (c) -1 (d) 2

Q.85. The number of real solutions of the equation $x^2-3|x|+2=0$ is
(a) 1 (b) 2 (c) 3 (d) 4

Q.86. If one root of $ax^2+bx+c=0$ is twice the other root, then
(a) $b^2=9ac$ (b) $2b^2=9ac$ (c) $2b^2=ac$ (d) $b^2=ac$

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Q.87. The value of $\frac{\cot 54^\circ}{\tan 36^\circ} + \frac{\tan 20^\circ}{\cot 70^\circ}$ is

(a) 0 (b) 1 (c) 2 (d) 4

Q.88. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$, then $\tan^{-1}\left(\frac{1}{2}\right) + \tan^{-1}\left(\frac{1}{3}\right) =$

(a) 0 (b) π (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

Q.89. If $\sqrt{2}\cos(60° - \theta) = 1$, then θ =

(a) 30° (b) 15° (c) 60° (d) 45°

Q.90. The number of ways in which a committee of 6 members can be formed from 8 men and 4 women so that the committee contains at least 3 women is

(a) 252 (b) 272 (c) 352 (d) 372

Q.91. If $2\,{}^{n}P_3 = {}^{n+1}P_3$, then n is equal to

(a) 5 (b) 7 (c) 8 (d) 12

Q.92. The number of selections of 2 candidates for a post out of 5 equally qualified and non-qualified candidates is

(a) ${}^{3}P_2 - 2$ (b) ${}^{3}C_2 - 2$ (c) ${}^{3}C_2 + 2$ (d) 10

Q.93. If $u = x^y$, then $\frac{du}{dy} =$

(a) yx^{y-1} (b) 0 (c) $x^y \log x$ (d) $x^y \log y$

Q.94. If $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$

(a) 0 (b) 1 (c) 4 (d) 2u

Q.95. The function f(x, y) = |x| + |y| is

(a) discontinuous at origin
(b) continuous at origin
(c) differentiable at origin
(d) neither continuous nor differentiable at origin

Q.96. If f_x and f_y are both differentiable at a point (a, b) of the domain of the definition of function f(x, y), then $f_{xy}(a, b) = f_{yx}(a, b)$, is

(a) Euler's Theorem (b) Young's Theorem
(c) Schwarz's Theorem (d) Implicit Function Theorem

Q.97. The number of primitive roots of 13 are

(a) 1 (b) 2 (c) 3 (d) 4

Q.98. For the Euler ϕ function, $\phi(4)$ =

(a) 1 (b) 2 (c) 3 (d) 4

Q.99. If n objects are distributed over m places and if n > m, then some place receives at least two objects, is

(a) Fundamental Theorem of Arithmetic (b) Fundamental Theorem of Algebra
(c) Pigeonhole Principle (d) Chinese Remainder Theorem

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Q.100. The set Z of integers is a group under operation '*' defined by a * b = a + b + 1, a, b $\in$ Z. In this group, inverse of a is
(a) –a (b) a + 1 (c) -2 – a (d) 2 – a

Q.101. Which one of the following statements is correct?
(a) If G is a group of even order, then it has an element a $\neq$ e (the identity) such that $a^2 = e$
(b) If G is a group and a $\in$ G, then $a^{o(G)} = e$
(c) The group Q of all rational numbers is cyclic
(d) Every abelian group is cyclic but converse is not true

Q.102. Which one of the following statements is incorrect?
(a) Every subgroup of an abelian group is a normal subgroup
(b) Every group is isomorphic to a permutation group
(c) If o(G) = 36, then G has 1 or 4 Sylow-3-subgroups
(d) If $o(G) = p^2$, p is a prime, then G is cyclic

Q.103. If A is left and B is right ideal of a ring R, then
(a) AB is a two sided ideal of R (b) BA is a two sided ideal of R
(c) A + B is a two sided ideal of R (d) A $\cap$ B is a two sided ideal of R

Q.104. Identify the wrong statement
(a) In a division ring D, (o) is a maximal ideal
(b) In an integral domain, (o) is a prime ideal
(c) Every prime ideal is maximal
(d) Any finite non-zero ring R without zero divisors is a division ring

Q.105. Every principal ideal domain is a
(a) field (b) Euclidean domain
(c) Unique factorization domain (d) division ring

Q.106. The order of any subgroup of a finite group divides the order of the group, is
(a) Cayley's Theorem (b) Fundamental Theorem of Algebra
(c) Sylow's Theorem (d) Lagrange's Theorem

Q.107. Identify the correct statement
(a) a log x + b sin x + c = 0 is an algebraic equation
(b) Newton-Raphson method of solving the equation f(x) = 0, x $\in$ (a, b) fails if the derivative of f(x) vanishes in the neighbourhood of the desired root
(c) Bisection method of solving the equation f(x) = 0, x $\in$ [a, b] works even if f(x) is discontinuous on [a, b]
(d) The equation $x^2 – 2x – 1 = 0$ has no root in (2, 3)

Q.108. If Δ is forward difference operator, ∇ is backward difference operator and E is shifting operator, then
(a) $E = \Delta - 1$ (b) $\nabla = 1 + E^{-1}$ (c) $E = 1 + \Delta$ (d) $E = 1 - \nabla$

Q.109. Identify the wrong statement
(a) The maximum number of real roots of the equation $x^{2n}-1 = 0$ is 2
(b) In Simpson's one third rule, the curve y = f(x) is always a circle
(c) In Trapezoidal rule, the curve y = f(x) is considered as a straight line
(d) Using Bisection method, the interval in which the real root of $x^4 + 2x^3 – x – 1 = 0$ lies is (0, 1)

Q.110. Picard method is used
(a) for solving algebraic equation
(b) for numerical integration
(c) for solving ordinary differential equations
(d) for solving partial differential equations

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Q.111. If the resultant of two forces of magnitude P and $P\sqrt{3}$ acting on a particle is of magnitude P, then the angle between them is
(a) 30° (b) 60° (c) 120° (d) 150°

Q.112. A force F is resolved into two components P and Q. If P is at right angle to F and has the same magnitude so that of F, then the magnitude of Q is
(a) F (b) 2F (c) $\frac{F}{\sqrt{2}}$ (d) $F\sqrt{2}$

Q.113. Three forces keep a particle in equilibrium. One acts towards west, another towards north-east and the third towards south. If the first be 5 kg weight, then the other two are
(a) $5\sqrt{2}$ kg, $5\sqrt{2}$ kg (b) $5\sqrt{2}$ kg, 5 kg
(c) 5 kg, 5 kg (d) $\sqrt{2}$ kg, 5 kg

Q.114. The resultant of three equal like parallel forces acting at the vertices of a triangle act at its
(a) Centroid (b) Incentre (c) Circumcentre (d) Orthocentre

Q.115. A couple of (bN, bm) is equivalent to a couple (aN, cm), then a, b, c are
(a) in A.P. (b) in G.P. (c) equal (d) in H.P.

Q.116. A train is moving with a velocity of 36 km/hr and its brakes can produce a retardation of 0.5 m/sec^2. The distance from where brakes be applied so that it stops just at the station is
(a) 80 m (b) 100 m (c) 120 m (d) 90 m

Q.117. If a particle is thrown vertically upward with a velocity u meters/sec under gravity, then the time for the particle to come to the earth again is
(a) $\frac{u}{g}$ sec (b) $\frac{2}{g}$ sec (c) $\frac{2u}{g}$ sec (d) $\frac{u}{2g}$ sec

Q.118. If u and α are the velocity and angle of projection of a projectile, then the maximum height reached by projectile is
(a) $\frac{u^2}{g}$ (b) $\frac{u^2}{2g}\sin^2\alpha$ (c) $\frac{2u^2}{g}\sin\alpha$ (d) (u sin α)g

Q.119. A constant forces acting on a body of mass 20g, produces in it a velocity of 27 cm/sec in 6 seconds. If the body starts from rest, then the magnitude of the forces is
(a) 80 dynes (b) 95 dynes (c) 90 dynes (d) 100 dynes

Q.120. A point moves with simple harmonic motion whose period is 4 seconds. If it starts from rest at a distance 4 meters from the centre of the path, then the time that elapses before has described 2 meters is
(a) $\frac{2}{3}$ seconds (b) 2 seconds (c) $\frac{1}{3}$ seconds (d) 4 seconds

Q.121. Given that $(p \vee q) \wedge (\sim p \vee \sim q)$ is false, then the truth values of p and q are
(a) both false (b) both true
(c) either both true or both false (d) none of these

Q.122. The proposition defined by $p \wedge (\sim p \vee q)$ is
(a) a tautology (b) a contradiction
(c) logically equivalent to $p \wedge q$ (d) none of these

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Q.123. If p and q are two statements then the statement $p \to q$ is equivalent to
(a) $\sim p \vee q$ (b) $p \vee \sim q$ (c) $\sim p \wedge q$ (d) $p \wedge \sim q$

Q.124. The truth value of $\sim p \to (q \to p)$, then p is false and q is true is
(a) false (b) true
(c) some time false and some time true (d) none of these

Q.125. The proposition defined by $p \vee (p \to q)$ is
(a) a tautology (b) a contradiction
(c) a contingency (d) none of these

Q.126. The truth value of $(p \wedge q) \to \sim p$ is false when
(a) p is true (b) q is true
(c) both (a) and (b) (d) neither (a) nor (b)

Q.127. If the standard deviation of the observations: -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5 is $\sqrt{10}$, then the standard deviation of the observations: 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 will be
(a) $\sqrt{10}+20$ (b) $\sqrt{10}+10$ (c) $\sqrt{10}$ (d) none of these

Q.128. The sum of absolute deviation about median is
(a) greatest (b) least (c) zero (d) none of these

Q.129. The mean and variance of first n even natural numbers are respectively
(a) n + 1 and $\frac{n^2-1}{3}$ (b) $\frac{n+1}{2}$ and $\frac{n^2-1}{12}$
(c) $\frac{n-1}{2}$ and $\frac{n^2+1}{12}$ (d) $\frac{n^2+1}{12}$ and $\frac{n-1}{2}$

Q.130. For a binomial distribution, we have
(a) mean = variance (b) mean < variance
(c) mean > variance (d) None of these

Q.131. If the joint pmf of random variables X and Y is given by

$$P(X=x,Y=y)=\begin{cases}\frac{x+y}{30}\ ; x=0,1,2,3 \text{ and } y=0,1,2\\ 0\ ; \qquad \text{otherwise}\end{cases}$$

then P(X + Y = 4) is
(a) $\frac{2}{5}$ (b) $\frac{1}{6}$ (c) $\frac{4}{15}$ (d) none of these

Q.132. If $P(A\cup B)=\frac{5}{6}, P(A\cap B)=\frac{1}{3}$ and $P(\bar{A})=\frac{1}{2}$, then conditional probability $P\left(A/B\right)$ is equal to
(a) 1.00 (b) 0.25 (c) 0.75 (d) 0.50

Q.133. If $P(A\cap B)=\frac{1}{2}, P(\bar{A}\cap\bar{B})=\frac{1}{3}$, and P(A) = P(B) = p, then the value of p is
(a) $\frac{1}{2}$ (b) $\frac{7}{8}$ (c) $\frac{1}{3}$ (d) $\frac{7}{12}$

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Q.134. A symmetric die is thrown 600 times. Using Chebychev's inequality, the lower bound for the probability of getting 80 to 120 sixes is given by

(a) $\frac{29}{34}$ (b) $\frac{9}{14}$ (c) $\frac{19}{24}$ (d) None of these

Q.135. Two random variables X and Y have the following joint pdf:

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

Now the value of E(XY) is

(a) $\frac{1}{5}$ (b) $\frac{1}{6}$ (c) $\frac{1}{4}$ (d) $\frac{1}{3}$

Q.136. A Charted Accountant applies for a job in two firms X and Y. He estimates that the probability of his being selected in firm X is 0.7 and being rejected at Y is 0.5 and the probability of at least one of his application being rejected is 0.6. Now the probability that he will be selected in at least one of the firm is

(a) 0.6 (b) 0.7 (c) 0.5 (d) 0.8

Q.137. For two events A and B, the value of $P(A/B^c) + P(A^c/B^c)$ is

(a) 1 (b) $\frac{2}{3}$ (c) $\frac{1}{2}$ (d) 0

Q.138. If the events A and B are such that $(A)=\frac{1}{4}, P(A/B)=\frac{1}{2}$ and $P(B/A)=\frac{2}{3}$. Then P(B) is equal to

(a) $\frac{1}{2}$ (b) $\frac{1}{6}$ (c) $\frac{1}{3}$ (d) $\frac{2}{3}$

Q.139. A multiple choice examination has 5 questions. Each question has three alternative answers of which exactly one is correct. The probability that a student will get 4 or more correct answers, just by guessing, is

(a) $\frac{17}{3^5}$ (b) $\frac{13}{3^5}$ (c) $\frac{11}{3^5}$ (d) $\frac{10}{3^5}$

Q.140. If $(A)\frac{3}{10}, P(B)=\frac{2}{5}$ and $P(A\cup B)=\frac{3}{5}$, then P(B/A) + P(A/B) is equal to

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{5}{12}$ (d) $\frac{7}{12}$

Q.141. If A and B are two independent events of a random experiment such that $P(A\cap B)=\frac{1}{6}$ and $P(A^c\cap B^c)=\frac{1}{3}$, then P(A) is equal to

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{5}{7}$ (d) $\frac{2}{3}$

Q.142. A purse contains 4 copper coins and 3 silver coins. The second purse contains 6 copper coins and 2 silver coins. A coin is taken out from any one of these two purses selected at random. The probability that it is a copper coin, is

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(a) $\frac{4}{7}$ (b) $\frac{37}{56}$ (c) $\frac{3}{7}$ (d) $\frac{3}{4}$

Q.143. A fair die is thrown 20 times. Getting a number greater than 4 is considered as a success. Then the mean and variance of the number of successes are respectively
(a) 6.6, 4.4 (b) 6.5, 4.5 (c) 6.3, 4.3 (d) 6.2, 4.2

Q.144. A fair coin is tossed n times. If X is the number of times that head occur and P(X = 4), P(X = 5), and P(X = 6) are in arithmetic progression, then the value of n is
(a) 13 (b) 7 (c) 11 (d) 12

Q.145. A whose sale merchant wants to start the business of cereal with Rs. 24000/-. Wheat is Rs. 400 per quintal and rice is Rs. 600 per quintal. He has capacity to store 200 quintal cereal. He earns the profit Rs. 25 per quintal on wheat and Rs. 40 per quintal on rice. If he stores x quintal rice and y quintal wheat, then for maximum profit, the objective function is
(a) 25x + 40y (b) 40x + 25y (c) 400x + 600y (d) 10x + 24y

Q.146. The optimal value of the objective function is attained at the point
(a) given by intersection of inequations with axes only
(b) given by intersection of inequations with X-axes only
(c) given by corner point of the feasible region
(d) given by intersection of inequations with Y-axes only

Q.147. A furniture dealer deals in only two items namely tables and chairs. He has Rs. 5000 to invest and space to store at most 60 pieces. A table cost him Rs. 250 and a chair Rs. 60. He can sell a table at a profit of Rs. 15. Assume that he can sell all the items that he produced. For determining the number of chairs and tables to maximize his profit, the numbers of constraints in the problem are
(a) 2 (b) 3 (c) 4 (d) 5

Q.148. The linear function of the variables which is to be maximize or minimize is called
(a) Constraints (b) Objective function
(c) Decision variable (d) None of the above

Q.149. If the value of the objective function may be increased or decreased indefinitely, such solution is called
(a) Bounded solution (b) Unbounded solution
(c) Solution (d) None of the above

Q.150. The best use of linear programming is to find optimal use of
(a) Money (b) Manpower (c) Machine (d) All of these

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