MASTER CADRE QUESTIONS
Previous year paper

1. If A and B are two matrices such that AB = B and BA = A, then A^2 =
   (a) 2AB (b) 2BA
   (c) A (d) B

2. The matrix $A=\begin{bmatrix} i & 1-2i \\ -1-2i & 0 \end{bmatrix}$ is
   (a) symmetric (b) skew-symmetric
   (c) hermition (d) skew-hermition

3. If $\frac{1}{3}$ and $-\frac{1}{2}$ are the eigen-values of a non-singular matrix A and |A| = 4, then the eigen-values of adj. A are
   (a) $\frac{4}{3}, -2$ (b) $\frac{4}{3}, -1$
   (c) 12, -8 (d) 12, 8

4. If A is a square matrix, then A - A′ is a
   (a) unit matrix
   (b) zero matrix
   (c) symmetric matrix
   (d) skew-symmetric matrix, A′ denotes transpose of A

5. The value of $\begin{vmatrix} \frac{1}{a} & a^2 & bc \\ \frac{1}{b} & b^2 & ca \\ \frac{1}{c} & c^2 & ab \end{vmatrix}$ is
   (a) 1 (b) 0
   (c) -1 (d) abc

6. The equations 2x + y = 4, 3x + 2y = 2, x + y = -2 have
   (a) no solution
   (b) one solution
   (c) two solutions
   (d) infinitely many solutions

7. If A′ = -A, where A is a 3 × 3 matrix and A′ denotes transpose of A then |A| =
   (a) 1 (b) 0
   (c) -1 (d) 2

8. If A is a singular matrix then adj . A is
   (a) singular (b) non-singular
   (c) symmetric (d) null matrix

9. The rank of the matrix $A=\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ is
   (a) 1 (b) 2
   (c) 3 (d) 0

10. The value of $\begin{vmatrix} \sec x & \tan x \\ \tan x & \sec x \end{vmatrix}$ is
    (a) 0 (b) 1
    (c) sec x tan x (d) sec x – tan x

11. If A = {1, 2, 3, 4, 5}, B = {2, 3, 6, 7}, then the number of elements in (A × B) ∩ (B × A) is equal to
    (a) 4 (b) 5
    (c) 20 (d) 10

12. If A = {x : x^2 – 1 = 0}, B = {x : x^2 – 2x + 1 = 0), then
    (a) A ∩ B = A (b) A ∪ B = ϕ
    (c) A ∩ B = ϕ (d) A ∪ B = A

13. The supremum of the set $\left\{\frac{1}{n} : n \text{ is a natural number}\right\}$ is
    (a) 0 (b) 1
    (c) -1 (d) $\frac{1}{2}$

14. Which one of the following is neighbourhood of each of its points?
    (a) the set Q of rational numbers
    (b) the set Q* of irrational numbers
    (c) the set N of natural numbers
    (d) the set R of real numbers

15. Which one of the following sets is countable?
    (a) [0, 1] (b)]0, 1]
    (c)]0, 1[(d) {1, 4, 9, 16, 25, …}

16. Which one of the following set is compact?
    (a) the set N of natural numbers
    (b) the set Q of rational numbers
    (c) the set R of real numbers
    (d) [a, b]

17. If the roots of the equation x^3 - $2x^2$ + 39x - 28 = 0 are in A.P. then their common difference is
    (a) ± 1 (b) ± 2
    (c) ± 3 (d) ± 4

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18. If H is the Harmonic mean between P and Q, then $\frac{H}{P}+\frac{H}{Q}$ is

(a) 2 (b) $\frac{P+Q}{PQ}$

(c) $\frac{PQ}{P+Q}$ (d) P + Q

19. If the third term of a G.P. is 3, then the product of its first 5 terms is
(a) 15 (b) 81
(c) 243 (d) 27

20. G.M. and H.M. of two numbers are 10 and 8 respectively. The numbers are
(a) 2, 50 (b) 5, 20
(c) 4, 25 (d) 1, 100

21. If x, y, z are in A.P. then $\frac{1}{yz},\frac{1}{zx},\frac{1}{xy}$ are in
(a) A.P. (b) G.P.
(c) H.P. (d) none of these

22. Value of $1+\frac{2}{2}+\frac{3}{4}+\frac{4}{8}+\frac{5}{16}+\ldots$ is
(a) 2 (b) 3
(c) 4 (d) 6

23. The series $\sum_{n=1}^{\infty} n^2x^n$ is uniformly convergent in [-α, α]
(a) α is any real number
(b) 0 < α < 1
(c) 0 < α < 2
(d) 2 < α < 3

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

25. Which one of the following is true?
(a) $\sum n^2=\frac{n(n+1)}{2}$
(b) $\sum n=\frac{n(2n+1)}{6}$
(c) $\sum n^3=\left(\sum n\right)^2$
(d) $\sum n^3=\frac{n(n+1)(2n+1)}{6}$

26. If n is a positive integer, then the number of terms in the expansion of $(x + a)^n$ is
(a) n (b) n + 1
(c) n – 1 (d) n + 2

27. Sum of the coefficients in the expansion of $(ax + by)^n$ is
(a) $a^n + b^n$ (b) $(a + b)^n$
(c) $a^{n-1} + b^{n-1}$ (d) $(a + b)^{n-1}$

28. Constant term in the expansion of $\left(x-\frac{1}{x}\right)^{10}$ is
(a) -252 (b) 252
(c) 152 (d) -152

29. In the expansion of $(3x + 2)^4$, the coefficient of the middle term is
(a) 81 (b) 54
(c) 216 (d) 36

30. A subset of the set R of real numbers is compact if and only if it is closed and bounded, is
(a) Bolzano-Weiestrass theorem
(b) Binomial theorem
(c) Cayley- Hamilton theorem
(d) Heine-Borel theorem

31. The function $f(x)=\frac{1}{x}$ is uniformly continuous on
(a)]0, 1] (b) [0, 1]
(c) [1, ∞[(d)]-∞, ∞[

32. The function f(x) = |x| at x = 0 is
(a) continuous and differentiable
(b) continuous but not differentiable
(c) neither continuous not differentiable
(d) not continuous, but differentiable

33. $\lim_{x\to 3}\frac{|x-3|}{x-3}=$
(a) 1 (b) 0
(c) -1 (d) does not exist

34. $\lim_{\alpha\to\beta}\frac{\sin^2\alpha-\sin^2\beta}{\alpha^2-\beta^2}=$
(a) 0 (b) 1

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(c) $\frac{\sin 2\beta}{2\beta}$ (d) $\frac{\sin \beta}{\beta}$

35. If $y = \tan^{-1}\left(\frac{\sin x}{1+\cos x}\right)$ then $\frac{dy}{dx} =$

(a) 1 (b) $\frac{1}{2}$

(c) 0 (d) $-\frac{1}{2}$

36. The derivative of $e^{\log x}$ is
(a) $\log x\, e^{\log x}$ (b) $e^{\log x}$
(c) $e^{\log x - 1}$ (d) 1

37. If $y = \sin^{-1}(\cos x)$ then $\frac{dy}{dx} =$

(a) -1 (b) sin x

(c) 1 (d) $\frac{1}{1-\cos^2 x}$

38. The differential coefficient of x^6 w.r.t. x^3 is
(a) $6x^5$ (b) $3x^2$
(c) $2x^3$ (d) x^3

39. The distance s of a particle at time t is given by $s = t^3 - 6t^2 - 4t - 8$. Its acceleration vanishes at t =
(a) 1 (b) 2
(c) 3 (d) 4

40. If the rate of change of volume of a sphere is equal to the rate of change of its radius, then its radius =

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

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

41. For the curve $x = t^2 - 1$, $y = t^2 - 2t$, tangent is parallel to X-axis where

(a) t = 0 (b) $t = \frac{1}{2}$

(c) t = 1 (d) t = 2

42. The maximum value of sin x cos x is

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$

(c) 1 (d) 2

43. Rolle's theorem is applicable in the interval $-1 \le x \le 1$ for the function
(a) f(x) = x (b) $f(x) = x^2$
(c) $f(b) = x^3$ (d) f(x) = |x|

44. The function $f(x) = \frac{\log x}{x}$ is increasing in the interval
(a) (1, e) (b) (0, e)
(c) (2, 2e) (d) (2, e)

45. Slope of the normal to the curve $y = x^2 - \frac{1}{x^2}$ at (-1, 0) is

(a) $\frac{1}{4}$ (b) $-\frac{1}{4}$

(c) 4 (d) -4

46. $\int e^x \left(\log x + \frac{1}{x}\right) dx =$

(a) $e^x \log x + c$

(b) $\frac{e^x}{x} + c$

(c) $e^x \log\left(\frac{1}{x}\right) + c$

(d) $e^x \frac{1}{x} + \log x + c$, where c is a constant

47. $\int_{\frac{\pi}{2}}^{\frac{\pi}{6}} \frac{\cos x}{\sin^2 x} dx =$

(a) 0 (b) -1
(c) 2 (d) 3

48. $\int_0^1 |x-1| dx$

(a) $\frac{1}{2}$ (b) $-\frac{1}{2}$

(c) 2 (d) -2

49. $\lim_{n\to\infty} \sum_{r=0}^{n-1} \frac{1}{\sqrt{n^2 - r^2}} =$

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$

(c) π (d) 2π

50. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin|x| dx =$

(a) $2\int_0^{\frac{\pi}{2}} \sin x\, dx$ (b) $2\int_0^{\frac{\pi}{2}} \sin|x| dx$

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(c) $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin x\,dx$ (d) $2\int_{-\frac{\pi}{2}}^{0} \sin x\,dx$

51. $\int_0^4 \int_0^5 dx\,dy =$
(a) 4 (b) 5
(c) 1 (d) 20

52. The centre of gravity of a uniform lamina bounded by the co-ordinate axes and the arc of x = a cosθ, y = a sinθ in the first quadrant is at
(a) (0, 0) (b) (a, 0)
(c) (a, a) (d) $\left(\frac{4a}{3\pi}, \frac{4a}{3\pi}\right)$

53. If x = r cos θ, y = r sin θ, then the Jacobian $\frac{\partial(x,y)}{\partial(r,\theta)}$ is
(a) sin θ (b) r sin θ
(c) r cos θ (d) r

54. An integrating factor to make a differential equation xdy – ydx = 0 exact is
(a) $-\frac{1}{x^2}$ (b) $\frac{1}{x}$
(c) $\frac{1}{y}$ (d) $\frac{1}{y^2}$

55. The equation y = px + f(p) is known as
(a) Bernoulli's equation
(b) exact equation
(c) Clairut's equation
(d) linear equation

56. The differential equation of the orthogonal trajectory of the family of curves $f\left(x, y, \frac{dy}{dx}\right) = 0$ is
(a) $f\left(x, y, \frac{dx}{dy}\right) = 0$
(b) $f\left(x, y, -\frac{dx}{dy}\right) = 0$
(c) $f\left(x, y, -\frac{dy}{dx}\right) = 0$
(d) $f\left(-x, -y, -\frac{dy}{dx}\right) = 0$

57. Particular integral of the differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-3x}$ is
(a) xe^{-3x} (b) $\frac{x}{2}e^{-3x}$
(c) $-\frac{x}{2}e^{-3x}$ (d) $\frac{1}{2}e^{-3x}$

58. By means of the transformation z = log x, the equation
$$x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$$
becomes
(a) $(D^3 - D^2 - 2)\,y = 10\,(e^z + e^{-z})$
(b) $(D^3 - D^2 + 2)\,y = 10\,(e^z + e^{-z})$
(c) $(D^3 - 2D + 2)\,y = 10\,(e^z + e^{-z})$
(d) $(D^3 + 2D^2 + 2)\,y = 10\,(e^z + e^{-z})$ where $D = \frac{d}{dz}$.

59. If $J_n(x)$ is the Bessel function of the first kind, then $\int_0^{\pi} [J_{-2}(x) - J_2(x)]dx =$
(a) 2 (b) -2
(c) 0 (d) 1

60. If $\int_{-1}^{1} P_n(x)\,dx = 2$, then n is
(a) 0
(b) 1
(c) -1
(d) 2, here $P_n(x)$ is Legendre polynomial of order n

61. The Wronskian W of the two solutions of the differential equation $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$ is
(a) 2 (b) -2
(c) 1 (d) -1

62. If A = (1, -3, -2), B = (2, -1, -4) then unit vector $\vec{AB}$ is
(a) $i + 2\vec{j} - 2\vec{k}$ (b) $i - 2\vec{j} + 2\vec{k}$
(c) $i + 2\vec{j} - 3\vec{k}$ (d) $\frac{1}{3}(i + 2\vec{j} - 2\vec{k})$

63. If θ is the angle between two unit vectors $\vec{a}$ and $\vec{b}$ then sin θ is equal to

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(a) $\vec{a}.\vec{b}$ (b) $\vec{a}\times\vec{b}$
(c) $|\vec{a}\times\vec{b}|$ (d) $|\vec{a}.\vec{b}|$

64. The position vectors of A and B are $\vec{a}$ and $\vec{b}$, respectively. P divides AB in the ratio 3 : 1, Q is the mid-point of AP. The position vector of Q is

(a) $5\vec{a}+3\vec{b}$ (b) $\frac{5\vec{a}+3\vec{b}}{8}$
(c) $3\vec{a}+5\vec{b}$ (d) $\frac{3\vec{a}+5\vec{b}}{8}$

65. If $\vec{u},\vec{v}$ and $\vec{w}$ are vectors such that $\vec{u}+\vec{v}+\vec{w}=\vec{0},|\vec{u}|=3,|\vec{v}|=4,|\vec{w}|=5$ then $\vec{u}.\vec{v}+\vec{v}.\vec{w}+\vec{w}.\vec{u}$ is
(a) 25 (b) -25
(c) 0 (d) 60

66. If $\vec{a},\vec{b}$ and $\vec{c}$ are unit coplanar vectors, then the scalar triple product $[2\vec{a}-\vec{b}\ \ 2\vec{b}-\vec{c}\ 2\vec{c}-\vec{a}]=$
(a) 0 (b) 1
(c) $\sqrt{3}$ (d) $-\sqrt{3}$

67. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the acute angle between them, then $|\vec{a}-\vec{b}|=$
(a) 2 cosθ (b) 2sinθ
(c) $2\cos\frac{\theta}{2}$ (d) $2\sin\frac{\theta}{2}$

68. The projection of $\vec{a}=3\vec{i}-\vec{j}+5\vec{k}$ on $\vec{b}=2\vec{i}+3\vec{j}+\vec{k}$ is
(a) $\sqrt{14}$ (b) $\frac{8}{\sqrt{14}}$
(c) $\frac{\sqrt{8}}{14}$ (d) $\frac{8}{\sqrt{35}}$

69. The solution set of $6+x-x^2>0$ is
(a) $-1<x<2$ (b) $-2<x<3$
(c) $-2<x<-1$ (d) $1<x<2$

70. The solution set of $\frac{2-3x}{3}<\frac{1-x}{3}$ is
(a) $]-\infty\ \frac{1}{4}[$ (b) $]\frac{1}{4}\ \infty[$
(c) $]-\infty\ \frac{1}{4}]$ (d) $]-\frac{1}{4}\ \frac{1}{4}[$

71. Which one of the following is true?
(a) Every vector space has a finite basis
(b) The 0-vector may be a part of basis
(c) The vectors in a basis are linearly dependent
(d) Every finite dimensional vector space has a basis

72. If T_1 and T_2 are linear transformations on the plane R^2 such that $T_1(x, y) = (0, x)$, $T_2(x, y) = (y, 0)$ then
(a) $T_1^2 = 0$ (b) $T_2^2 \neq 0$
(c) $T_1T_2 = 0$ (d) $T_1^2 \neq 0$

73. The line $\frac{x}{a}-\frac{y}{b}=1$ cuts the X-axis at P. The equation of the line through P and perpendicular to the given line is
(a) x + y = ab (b) x + y = a + b
(c) ax + by = a^2 (d) bx + ay = b^2

74. The angle between the lines 2x – y + 3 = 0 and x + 2y + 3 = 0 is
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$

75. If the line 6x – 7y + 8 + λ (3x – y + 5) = 0 is parallel to Y-axis, then λ =
(a) 2 (b) -7
(c) 7 (d) -2

76. The equation of a straight line making equal intercepts on the axes and passing through (3, 2) is
(a) x + y = 2 (b) x + y = 3
(c) x + y = 5 (d) x + y = 15

77. The lines x cosα + y sinα = p_1 and x cosβ + y sinβ = p_2 will be perpendicular if
(a) α = β (b) $\alpha-\beta=\frac{\pi}{2}$
(c) $|\alpha-\beta|=\frac{\pi}{2}$ (d) α + β = 0

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78. If the line y = 2x + c is a tangent to the circle $x^2 + y^2 = 5$, then a value of c is
(a) 2 (b) 5
(c) 3 (d) 4

79. The equation of the circle concentric with $x^2 + y^2 + 6x + 2y = 1 = 0$ and passing through (-2, -1) is
(a) $x^2 + y^2 + 4x + 2y + 5 = 0$
(b) $x^2 + y^2 + 6x + y = 0$
(c) $x^2 + y^2 + 2y + 5 = 0$
(d) $x^2 + y^2 + 6x + 2y + 9 = 0$

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

81. The equation of the parabola with focus (3, 0) and directrix x + 3 = 0 is
(a) $y^2 = 3x$ (b) $y^2 = 2x$
(c) $y^2 = 12x$ (d) $y^2 = 6x$

82. The sum of the focal distances from any point on the ellipse $9x^2 + 16y^2 = 144$ is
(a) 8 (b) 16
(c) 32 (d) 4

83. The eccentricity of the conic $x^2 - 2x - 4y^2 = 0$ is
(a) $\frac{1}{4}$ (b) $\frac{3}{2}$
(c) $\frac{\sqrt{5}}{2}$ (d) $\frac{\sqrt{5}}{4}$

84. If e, e′ are the eccentricities of hyperbolas $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ and $\frac{x^2}{b^2}-\frac{y^2}{a^2}=1$, then
(a) e = e′ (b) e + e′ = 0
(c) ee′ = 1 (d) $\frac{1}{e^2}+\frac{1}{e'^2}=1$

85. The ratio in which the line joining points (2, 4, 5), (3, 5, -4) is divided by YZ – plane is
(a) 2:3 (b) 3:2
(c) -2:3 (d) 4:3

86. The equations of the line through the point (2, 3, -5) and equally inclined to the axes are
(a) x – 2 = y – 3 = z + 5
(b) $\frac{x+2}{3}=\frac{y+3}{-5}=\frac{z-5}{2}$
(c) $\frac{x-2}{2}=\frac{y-3}{3}=\frac{z+5}{-5}$
(d) x + 2 = y + 3 = z – 5

87. The foot of the perpendicular from (α, β, γ) on Y-axis is
(a) $(\alpha, 0, \gamma)$ (b) $(\alpha, 0, 0)$
(c) $(\alpha, \beta, 0)$ (d) $(0, \beta, 0)$

88. 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

89. If a line in space makes angles α, β and γ with the co-ordinate axes, then $\cos2\alpha+\cos2\beta+\cos2\gamma+\sin^2\alpha+\sin^2\beta+\sin^2\gamma$ =
(a) -1 (b) 0
(c) 1 (d) 2

90. The angle between the lines 2x = 3y = -z and 6x = -y = -4z is
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{6}$

91. The distance between the planes $\vec{r}.(2\vec{i}-\vec{j}+3\vec{k})=4$ and $\vec{r}.(6\vec{i}-3\vec{j}+9\vec{k})=-13$ is
(a) $\frac{5}{3\sqrt{14}}$ (b) $\frac{10}{3\sqrt{14}}$
(c) $\frac{25}{3\sqrt{14}}$ (d) $\frac{1}{\sqrt{14}}$

92. The shortest distance between the two lines $\vec{r}=(-3\vec{i}+6\vec{j})+s(-4\vec{i}+3\vec{j}+2\vec{k})$ and $\vec{r}=(-2\vec{i}+7\vec{k})+t(-4\vec{i}+\vec{j}+\vec{k})$ is
(a) 7 (b) 1/3
(c) 8 (d) 11

93. If θ is the angle between the planes 2x – y + 2z = 3, 6x – 2y + 3z = 5, then $\cos\theta$ is equal to
(a) $\frac{20}{21}$ (b) $\frac{21}{20}$
(c) $\frac{11}{20}$ (d) $\frac{20}{11}$

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94. If z is a complex number then $|z+1|=\sqrt{3}|z-1|$ represents
(a) a straight line (b) a circle
(c) an Ellipse (d) a Hyperbola

95. The complex number $\frac{1+2i}{1-i}$ lies in
(a) first quadrant
(b) second quadrant
(c) third quadrant
(d) fourth quadrant

96. Number of solutions $z^2 + |z|^2 = 0$, z is a non-zero complex number is
(a) 1 (b) 2
(c) 0 (d) infinitely many

97. The modulus of $\frac{1+2i}{1-(1-i)^2}$ is
(a) 0 (b) 1
(c) 2 (d) $\sqrt{2}$

98. The multiplicative inverse of 7 + 24i is
(a) $\frac{7+24i}{625}$ (b) $\frac{7-24i}{625}$
(c) $\frac{24i-7}{625}$ (d) $-\frac{7+24i}{625}$

99. $\left(\frac{1-i}{1+i}\right)^{100}$ is equal to
(a) 1 (b) 0
(c) $\frac{1-i^{100}}{1+i^{100}}$ (d) $\frac{1-i}{1+i}$

100. The difference between two acute angles of a right angled triangle is $\frac{3\pi}{10}$ radians. The angles in degrees are
(a) 60^0, 30^0 (b) 70^0, 20^0
(c) 72^0, 18^0 (d) 38^0, 52^0

101. If $\tan A=\frac{1}{2}$ and $\tan B=\frac{1}{3}$, then A + B =
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{2}$
(c) $\frac{\pi}{4}$ (d) zero

102. If $\sin x + \sin^2 x = 1$ then $\cos^2 x + \cos^4 x$ =
(a) 0 (b) 1
(c) -1 (d) 2

103. The value of $\frac{\cot x-\tan x}{\cot 2x}$ is
(a) 1 (b) -1
(c) 2 (d) 4

104. The general solution of $\sin\theta=\frac{\sqrt{3}}{2}$ is
(a) $n\pi+\frac{\pi}{3}$
(b) $n\pi-\frac{\pi}{3}$
(c) $n\pi+(-1)^n\frac{\pi}{3}$
(d) $n\pi+(-1)^n\frac{\pi}{6}$, n is an integer

105. The number of values of x for $2\sin^2 x + 5\sin x - 3 = 0$ in $[0, \pi]$ is
(a) 0 (b) 1
(c) 2 (d) 3

106. If $z=xyf\left(\frac{x}{y}\right)$ then $x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}=$
(a) z (b) 0
(c) $\frac{1}{z}$ (d) 2z

107. If $u = e^{xyz}$ then $\frac{\partial u}{\partial x}=$
(a) e^{xyz} (b) e^{xyz-1}
(c) xe^{xyz} (d) yze^{xyz}

108. $\lim_{(x,y)\to(0,0)}\frac{2xy^2}{x^2+y^4}$
(a) is equal to 0 (b) is equal to 2
(c) is infinite (d) does not exist

109. If f_x and f_y are both differentiable at a point (a, b) of the domain of definition of a function f, then f_{xy} (a, b) = f_{yx} (a, b) is
(a) Schwartz's Theorem
(b) Young's Theorem
(c) Implicit Function Theorem
(d) Inverse Function Theorem

110. For the function

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$$f(x,y)=\begin{cases}\dfrac{xy}{x^2+y^2}, & (x,y)\neq(0,0)\\ 0, & (x,y)=(0,0)\end{cases}$$

(a) f_x (0, 0) does not exist
(b) f_y (0, 0) does not exist
(c) f_x (0, 0) and f_y (0, 0) both exist
(d) f(x, y) is continuous at (0, 0)

111. The number of ways in which a committee of 6 members can be formed from 8 gentlemen and 4 ladies so that the committee contains at least 3 ladies is
(a) 252 (b) 96
(c) 15 (d) 420

112. Out of letters of word CALCUTTA number of different words formed are
(a) 5040 (b) 2520
(c) 840 (d) 210

113. In an examination, a student has to answer 4 questions out of 6. Questions 1 and 2 are compulsory. The number of ways in which the student can make the choice is
(a) 4 (b) 6
(c) 24 (d) 12

114. Among 14 players, 5 are bowlers. In how many ways a team of 11 may be formed with at least 4 bowlers?
(a) 262 (b) 265
(c) 264 (d) 263

115. 'The factoring of any integer n into primes is unique, apart from the order of the prime factors' is
(a) Fundamental Theorem of algebra
(b) Prime Number Theorem
(c) Chinese Remainder Theorem
(d) Fundamental Theorem of arithmetic

116. If a and b are positive integers such that HCF (a, b) = 1 then (a + b, a – b) is
(a) 1 (b) 2
(c) either 1 or 2 (d) neither 1 nor 2

117. In the group G = {1, 3, 7, 9} under multiplication modulo 10, the inverse of 3 is
(a) 3 (b) 7
(c) 1 (d) 9

118. The number of generators of an infinite cyclic group is
(a) 1 (b) 2
(c) 3 (d) infinite

119. In a group G under multiplication, if $a \in G$ is such that $a^2 = e$, where e is identity of G, then
(a) $a=\sqrt{e}$ (b) a = e
(c) $a=\dfrac{1}{e}$ (d) $a = a^{-1}$

120. If G is a group with order $o(G) = p^2$, p prime then
(a) G is cyclic
(b) G is abelian
(c) G is neither cyclic nor abelian
(d) G is both cyclic and abelian

121. Which one of the following statements is false?
(a) Every field is a principal ideal domain
(b) Every Euclidean domain is a principal ideal domain
(c) In a commutative ring without unity every maximal ideal is prime
(d) every principal ideal domain is a unique factorization domain

122. A division ring is
(a) an integral domain
(b) a field
(c) a simple ring
(d) of prime power order

123. The maximum number of real roots of the equation $x^{2n} - 1 = 0$ is
(a) n (b) 2
(c) 3 (d) 2n

124. Using Bisection method, the interval in which the real rot of the equation
$x^4 + 2x^3 – x – 1 = 0$ lies in
(a) (-1, 0) (b) (1, 2)
(c) (2, 3) (d) (0, 1)

125. $\Delta \cos x$ =
(a) – sin x
(b) $2\sin\left(x+\dfrac{h}{2}\right)\sin\dfrac{h}{2}$
(c) $-2\sin\left(x+\dfrac{h}{2}\right)\sin\dfrac{h}{2}$
(d) $\cos\left(x+\dfrac{h}{2}\right)$, where Δ is forward difference operator and h is interval of differencing

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126. In Simpson's $\frac{1}{3}$ rule the number of intervals should be
(a) even (b) odd
(c) prime (d) 3

127. Runge-Kutta method is used to solve
(a) partial differential equations
(b) ordinary differential equations
(c) integral equations
(d) wave equations

128. If a, b, c are different integers such that the greatest common divisor (a, b) = c then
(a) a divides c (b) c divides b
(c) b divides a (d) none of these

129. If $a \equiv b \pmod m$ and (a, m) = 1 then
(a) (a, b) = 1 (b) (b, m) = 1
(c) (b, m) = a (d) (a, b) = m

130. If a and b are natural numbers such that $a^2 - b^2$ is a prime number, then
(a) $a^2 - b^2 = 1$ (b) $a^2 - b^2 = a + b$
(c) $a^2 - b^2 = a - b$ (d) $a^2 - b^2 = 2$

131. The negative of the proposition 'If 2 is prime then 3 is odd' is
(a) 2 is prime and 3 is not odd
(b) If 2 is not prime then 3 is not odd
(c) If 2 is not prime then 3 is odd
(d) 2 is not prime and 3 is odd

132. For the series a, a + d, a + 2d, …, a + 2nd, S.D. (Standard deviation) is
(a) $\sqrt{n(n+1)}$ (b) $\frac{\sqrt{n(n+1)}}{2}.d$
(c) $\sqrt{\frac{n(n+1)}{3}}.d$ (d) $\sqrt{n(n+2)}.d$

133. In a moderately skewed distribution, the values of mean and median are 5 and 6 respectively. The value of mode in such a situation is nearly equal to
(a) 8 (b) 11
(c) 12 (d) 16

134. The median of 10, 14, 11, 9, 8, …, 12, 6 is
(a) 10 (b) 12
(c) 11 (d) 14

135. The difference between the greatest and the least value of observation is called
(a) variance
(b) mean deviation
(c) standard deviation
(d) range

136. If r is the correlation coefficient, then
(a) $r \le 1$ (b) $r \ge 1$
(c) $|r| \le 1$ (d) $|r| \ge 1$

137. A bag contains 5 black balls, 4 white balls and 3 red balls. If a ball is selected random wise, the probability that it is a black or a red ball is
(a) $\frac{1}{3}$ (b) $\frac{1}{4}$
(c) $\frac{5}{12}$ (d) $\frac{2}{3}$

138. In a Binomial distribution mean = 5 and variance = 4, then the number of trials is
(a) 20 (b) 25
(c) 16 (d) 5

139. A coin is tossed 8 times. The probability of getting a head three times is
(a) $\frac{7}{16}$ (b) $\frac{7}{64}$
(c) $\frac{7}{128}$ (d) $\frac{7}{32}$

140. If $P(A) = \frac{1}{2}$ and $P(B) = \frac{1}{5}$ when A, B are independent events, then P (A/B) =
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$
(c) $\frac{7}{10}$ (d) $\frac{2}{5}$

141. A single letter is selected at random from the word 'PROBABILITY'. The probability that it is a vowel is
(a) $\frac{3}{11}$ (b) $\frac{4}{11}$
(c) $\frac{2}{11}$ (d) $\frac{8}{11}$

142. In a throw of two dice, the probability of getting a sum of 7 or 11 is
(a) $\frac{2}{9}$ (b) $\frac{3}{8}$
(c) $\frac{7}{9}$ (d) $\frac{5}{9}$

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143. The objective function of a Linear Programming Problem is:
(a) a polynomial (b) an equation
(c) an inequation (d) none of these

144. If $x + y \le 2$, $x \ge 0$, $y \ge 0$, the point at which maximum value of $3x + 2y$ is attained at
(a) (0, 0) (b) (0, 2)
(c) (2, 0) (d) $\left(\frac{1}{2}, \frac{1}{2}\right)$

145. A particle is in equilibrium under three forces. Two of the forces act at right angles to one another, one being double the other. The third force has a magnitude of 10 Newtons. The magnitude of the other two (in Newtons) is
(a) 2, 4 (b) 3, 6
(c) $2\sqrt{5}, 4\sqrt{5}$ (d) $2\sqrt{3}, 4\sqrt{3}$

146. Two parallel forces not having the same line of action form a couple if they are
(a) like and unequal
(b) like and equal
(c) unequal and unlike
(d) equal and unlike

147. Forces of 3 dynes, 5 dynes and 7 dynes acting on a particle are in equilibrium. The angle between the first two forces is
(a) 30^0 (b) 45^0
(c) 60^0 (d) 90^0

148. If a particle moves with uniform acceleration, the distance traversed by it in consecutive seconds are in
(a) A.P. (b) G.P.
(c) H.P. (d) none of these

149. A body dropped from a height h at time t = 0 reaches the ground at time t_0. It would have reached a height $\frac{h}{2}$ at time
(a) $\frac{t_0}{2}$ (b) $\frac{t_0}{\sqrt{2}}$
(c) $\frac{t_0}{3}$ (d) $\frac{t_0}{\sqrt{3}}$

150. If the greatest height attained by a particle is one quarter of its range on the horizontal plane, then the angle of projection is
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$
(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

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