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MATHEMATICS

Standard: XII - A **ONEWORD TEST** **MARKS: 250**

CHOOSE THE CORRECT ANSWER:

1. If z = x + iy is a complex number such that $|z+2| = |z-2|$, then the locus of z is

a. real axis b. imaginary axis c. ellipse d. circle

2. The polynomial $x^3 + 2x + 3$ has

a. one negative and two imaginary roots b. one positive and two imaginary roots
c. three real roots d. no zeros

3. If $\sin^{-1}x + \sin^{-1}y = \frac{2\pi}{3}$; then $\cos^{-1}x + \cos^{-1}y$ is equal to

a. $\frac{2\pi}{3}$ b. $\frac{\pi}{3}$ c. $\frac{\pi}{6}$ d. π

4. If the coordinates at one end of a diameter of the circle $x^2 + y^2 - 8x - 4y + c = 0$ are (11, 2), the coordinates of the other end are

a)(- 5,2) b) (2, - 5) c) (5, - 2) d) (- 2, 5)

5. Tangents are drawn to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ parallel to the straight line 2x – y = 1. One of the points of contact of tangents on the hyperbola is

a) $\left(\frac{9}{2\sqrt{2}}, \frac{-1}{\sqrt{2}}\right)$ b) $\left(\frac{-9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ c) $\left(\frac{9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ d) $(3\sqrt{3}, -2\sqrt{2})$

6. If $[\vec{a}, \vec{b}, \vec{c}] = 1$, then the value of $\frac{\vec{a}\,.\,(\vec{b}\times\vec{c})}{(\vec{c}\times\vec{b}).\,\vec{b}} + \frac{\vec{b}\,.\,(\vec{c}\times\vec{a})}{(\vec{a}\times\vec{b}).\,\vec{c}} + \frac{\vec{a}\,.\,(\vec{a}\times\vec{b})}{(\vec{c}\times\vec{b}).\,\vec{a}}$ is

a) 1 b) – 1 c) 2 d) 3

7. If w(x, y) = x^y, x > 0, then $\frac{\partial w}{\partial x}$ is equal to

a) $x^y \log x$ b) y log x c) $y\, x^{y-1}$ d) x log y

8. The value of the limit $\lim_{x \to 0}\left(\cot x - \frac{1}{x}\right)$ is

a) 0 b) 1 c) 2 d) ∞

9. The value of $\int_0^{\frac{\pi}{6}} cos^3 3x\, dx$ is

a) $\frac{2}{3}$ b) $\frac{2}{9}$ c) $\frac{1}{9}$ d) $\frac{1}{3}$

10. The slope at any point of a curve $y = f(x)$ is given by $\frac{dy}{dx} = 3x^2$ and it passes through (-1,1). Then the equation of the curve is

a) $y = x^3 + 2$ b) $y = 3x^2 + 4$ c) $y = 3x^3 + 4$ d) $y = x^3 + 5$

11. The solution of the differential equation $\frac{dy}{dx}$ = 2xy is

a) y = Ce^{x^2} b) y = $2x^2 + C$ c) y = $Ce^{-x^2} + C$ d) y = $x^2 + C$

12. If $P(X = 0) = 1 - P(X = 1)$. If $E(X) = 3Var(X)$, then $P(X = 0)$ is

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

13. The equation of the normal to the circle $x^2 + y^2 - 2x - 2y + 1 = 0$ = which is parallel to the line $2x + 4y = 3$ 3 is

a) x + 2y = 3 b) x + 2y + 3 = 0 c) 2x + 4y + 3 = 0 d) x − 2y + 3 = 0

14. The number of arbitrary constants in the general solutions of order *n* and *n* +1are respectively

a) *n* −1, *n* b) *n*, *n* +1 c) *n* +1, *n* + 2 d) *n* +1, *n*

15. If α and β are the roots of $x^2 + x + 1 = 0$, then $\alpha^{2020} + \beta^{2020}$ is

a. -2 b. -1 c. 1 d. 2

16. If z is a complex number such that z ∈ C\ℝ and z + $\frac{1}{z}$ ∈ ℝ, then |z| is

a. 0 b. 1 c. 2 d. 3

17. If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \frac{3\pi}{2}$; the value of $x^{2017} + y^{2018} + z^{2019} - \frac{9}{x^{101}+y^{101}+z^{101}}$ is

a. 0 b. 1 c. 2 d. 3

18. The area of quadrilateral formed with foci of the hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is

a) $4(a^2 + b^2)$ b) $2(a^2 + b^2)$ c) $(a^2 + b^2)$ d) $\frac{1}{2}(a^2 + b^2)$

19. The principal argument of $\frac{3}{-1+i}$ is

a. $-\frac{5\pi}{6}$ b. $-\frac{2\pi}{3}$ c. $-\frac{3\pi}{4}$ d. $-\frac{\pi}{2}$

20. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar, non-zero vectors such that $[\vec{a}, \vec{b}, \vec{c}] = 3$, then $\{[\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}]\}^2$ is equal to

a) 81 b) 9 c) 27 d) 18

21. The value of $\int_{-1}^{2} |x|\, dx$ is

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

22. The position of a particle moving along a horizontal line of any time *t* is given by $s(t) = 3t^2 - 2t - 8$. The time at which the particle is at rest is

a) $t = 0$ b) $t = \frac{1}{3}$ c) $t = 1$ d) $t = 3$

23. The order and degree of the differential equation $\frac{d^2y}{dx^2} + (\frac{dy}{dx})^{1/3} + x^{1/4} = 0$ are respectively

a) 2, 3 b) 3, 3 c) 2, 6 d) 2, 4

24. Suppose that *X* takes on one of the values 0, 1, and 2. If for some constant *k*, $P(X = i) = k\,P(X = i - 1)$ for $i = 1, 2$ and $P(X = 0) = 1/7$, then the value of *k* is

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

25. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{\lambda}$ is

a) $\frac{x}{e^\lambda}$ b) $\frac{e^\lambda}{x}$ c) λe^x d) e^x

26. If the distance of the point (1,1,1) from the origin is half of its distance from the plane x + y + z + k = 0, then the values of *k* are

a) ± 3 b) ± 6 c) - 3, 9 d) 3, - 9

27. The number given by the Rolle's theorem for the function $x^3 - 3x^2$, $x \in [0,3]$ is

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

28. If the function $f(x) = \frac{1}{12}$ $a < x < b$ for, represents a probability density function of a continuous random variable *X*, then which of the following cannot be the value of *a* and *b*?

a) 0 and 12 b) 5 and 17 c) 7 and 19 d) 16 and 24

29. According to the rational root theorem, which number is not possible rational zero of $4x^7 + 2x^4 - 10x^3 - 5$?

a. -1 b. $\frac{5}{4}$ c. $\frac{4}{5}$ d. 5

30. Which one is the inverse of the statement $(p \vee q) \rightarrow (p \wedge \_q)$?

a) $(p \wedge q) \rightarrow (p \vee \_q)$ b) $\neg (p \vee q) \rightarrow (p \wedge q)$

c) $(\neg p \vee \neg q) \rightarrow (\neg p \wedge \neg q)$ d) $(\neg p \wedge \neg q) \rightarrow (\neg p \vee \neg q)$

31. The locus of a point whose distance from (- 2, 0) is 2/3 times its distance from the line $x = -\frac{9}{2}$ is

a) a parabola b) a hyperbola c) an ellipse d) a circle

32. The percentage error of fifth root of 31 is approximately how many times the percentage error in 31?

a) $\frac{1}{31}$ b) $\frac{1}{5}$ c) 5 d) 31

33. If the direction cosines of a line are $\frac{1}{c},\frac{1}{c},\frac{1}{c}$ then

a) c = ± 3 b) c = ± $\sqrt{3}$ c) c > 0 d) 0 < c < 1

34. If $g(x, y) = 3x^2 - 5y + 2y^2$, $x(t) = e^t$ and $y(t) = \cos t$, then $\frac{dg}{dt}$ is equal to

a) $6e^{2t} + 5\sin t - 4\cos t \sin t$ b) $6e^{2t} - 5\sin t + 4\cos t \sin t$

c) $3e^{2t} + 5\sin t + 4\cos t \sin t$ d) $3e^{2t} - 5\sin t + 4\cos t \sin t$

35. Which one of the following statements has truth value F ?

a) Chennai is in India or $\sqrt{2}$ is an integer b) Chennai is in India or $\sqrt{2}$ is an irrational number

c) Chennai is in China or $\sqrt{2}$ is an integer d) Chennai is in China or $\sqrt{2}$ is an irrational number

36. If $\int_0^a \frac{1}{4+x^2}dx = \frac{\pi}{8}$ then a is

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

37. If A = $\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $\lambda A^{-1} = A$, then λ is __________.

a. 17 b. 14 c. 19 d. 21

38. If z_1, z_2 and z_3 are complex numbers such that $z_1 + z_2 + z_3$ and $|z_1| = |z_2| = |z_3| = 1$ then $z_1^2 + z_2^2 + z_3^2$ is

a. 3 b. 2 c. 1 d. 0

39. Consider an ellipse whose centre is of the origin and its major axis is along x-axis. If its eccentrcity is $\frac{3}{5}$ and the distance between its foci is 6, then the area of the quadrilateral inscribed in the ellipse with diagonals as major and minor axis of the ellipse is

a) 8 b) 32 c) 80 d) 40

40. If $|adj(adj\ A)| = |A|^9$, then the order of the square matrix A is

a. 3 b. 4 c. 2 d. 5

41. The tangent to the curve $y^2 - xy + 9 = 0$ is vertical when

a) $y = 0$ b) $y = \pm\sqrt{3}$ c) $y = \frac{1}{2}$ d) $y = \pm 3$

42. P is the amount of certain substance left in after time t. If the rate of evaporation of the substance is proportional to the amount remaining, then

a) $P = Ce^{kt}$ b) $P = Ce^{-kt}$ c) $P = Ckt$ d) $Pt = C$

43. The value of $\int_0^{\pi} \frac{dx}{1+5^{\cos x}}$ is

a) $\frac{\pi}{2}$ b) $\frac{3\pi}{2}$ c) π d) 2π

44. If ω ≠ 1 is a cubic root of unit and $(1 + \omega)^7$ = A + B = A + Bω, then (A, B) equals

a. (1, 0) b. (-1, 1) c. (0, 1) d. (1, 1)

45. If $0 \le \theta \le \pi$ and the system of equations $x + (\sin\theta)y - (\cos\theta)z = 0$, $(\cos\theta)x - y + z = 0$, $(\sin\theta)x + y - z = 0$ has a non-trivial solution then θ is __________.

a. $\frac{2\pi}{3}$ b. $\frac{3\pi}{4}$ c. $\frac{5\pi}{6}$ d. $\frac{\pi}{4}$

46. Four buses carrying 160 students from the same school arrive at a football stadium. The buses carry, respectively, 42, 36, 34, and 48 students. One of the students is randomly selected. Let X denote the number of students that were on the bus carrying the randomly selected student. One of the 4 bus drivers is also randomly selected. Let Y denote the number of students on that bus. Then $E(X)$ and $E(Y)$ respectively are

a) 50, 40 b) 40,50 c) 40.75, 40 d) 41,41

47. The product of all four values of $(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3})^{\frac{3}{4}}$ is

a. -2 b. -1 c. 1 d. 2

48. If ϖ ≠ 1 is a cubic root of unit and $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\varpi^2 - 1 & \varpi^2 \\ 1 & \varpi^2 & \varpi^7 \end{vmatrix}$ = 3k, then k is equal to

a. 1 b. -1 c. $\sqrt{3}$i d. -$\sqrt{3}$i

49. The value of $\left(\frac{1+i\sqrt{3}}{1-i\sqrt{3}}\right)^{10}$ is

a. cis $\frac{2\pi}{3}$ b. cis $\frac{4\pi}{3}$ c. –cis $\frac{2\pi}{3}$ d. –cis $\frac{4\pi}{3}$

50. If $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} - \hat{k}, \vec{b} = \hat{\imath} + 2\hat{\jmath} - 5\hat{k}, \vec{c} = 3\hat{\imath} + 5\hat{\jmath} - \hat{k}$, then a vector perpendicular to $\vec{a}$ *lies in the plane containing* $\hat{b}$ *and* $\hat{c}$ is

a) - $17\hat{\imath} + 21\hat{\jmath} - 97\hat{k}$ b) $17\hat{\imath} + 21\hat{\jmath} - 123\hat{k}$ c) - $17\hat{\imath} - 21\hat{\jmath} + 97\hat{k}$ d) - $17\hat{\imath} - 21\hat{\jmath} - 97\hat{k}$

51. A stone is thrown up vertically. The height it reaches at time *t* seconds is given by $x = 80t - 16t^2$. The stone reaches the maximum height in time *t* seconds is given by

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

52. The circle passing through (1, - 2) and touching the axis of *x* at (3, 0) passing through the point

a) (-5, 2) b) (2, - 5) c) (5, - 2) d) (- 2, 5)

53. If f(x) = $\int_1^u \frac{e^{\sin u}}{u} du$, x > 1 and $\int_1^3 \frac{e^{\sin x^2}}{x} dx = \frac{1}{2}[f(a) - f(1)]$,then one of the possible value of a is

a) 3 b) 6 c) 9 d) 5

54. If u(x, y) = $x^2 + 3xy + y - 2019$, then $\frac{\partial u}{\partial x}|_{(4,\,-5)}$ is equal to

a) – 4 b) – 3 c) – 7 d) 13

55. The point on the curve $6y = x^3 + 2$ at which *y*-coordinate changes 8 times as fast as *x*-coordinate is

a) (4,11) b) (4,−11) c) (−4,11) d) (−4,−11)

56. The maximum slope of the tangent to the curve $y = e^x \sin x$, x_[0,2π] is at

a) $x = \frac{\pi}{4}$ b) $x = \frac{\pi}{2}$ c) $x = \pi$ d) $x = \frac{3\pi}{2}$

57. If p and q are the order and degree of the differential equation $y\frac{dy}{dx} + x^3\left(\frac{d^2y}{dx^2}\right) + xy = \cos x$, when

a) p < q b) p = q c) p > q d) p exists and q does not exist

58. If $x^3 + 12x^2 + 10ax + 1999$ definitely has a positive zero, if and only if

a. a ≥ 0 b. a > 0 c. a < 0 d. a ≤ 0

59. If A is 3 X 3 non-singular matrix $AA^T = A^T$ and $B = A^{-1}A^T$, then BB^T = _____.

a. A b. B c. I_3 d. B^T

60. The general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x}$ is

a) $xy = k$ b) $y = k \log x$ c) $y = kx$ d) $\log y = kx$

61. The value of $\sin^{-1}(\cos x)$, 0 ≤ x ≤ π is

a. π – x b. x - $\frac{\pi}{2}$ c. $\frac{\pi}{2}$ – x d. x – π

62. If A = $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$, B = adj A and C = 3A, then $\frac{|adj\,B|}{|C|}$ = ________.

a. 1/3 b. 1/9 c. ¼ d. 1

63. A balloon rises straight up at 10 m/s. An observer is 40 m away from the spot where the balloon left the ground. The rate of change of the balloon's angle of elevation in radian per second when the balloon is 30 metres above the ground.

a) $\frac{3}{25}$ radians/sec b) $\frac{4}{25}$ radians/sec c) $\frac{1}{5}$ radians/sec d) $\frac{1}{3}$ radians/sec

64. The approximate change in the volume *V* of a cube of side *x* metres caused by increasing the side by 1% is

a) $0.3x\,dx\,m^3$ b) $0.03x\,m^3$ c) $0.03x^2\,m^3$ d) $0.03x^3\,m^{3;}$

65. $\sin^{-1}(\cos x) = \frac{\pi}{2} - x$ is valid for

a. $-\pi \le x \le 0$ b. $0 \le x \le \pi$ c. $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$ d. $-\frac{\pi}{4} \le x \le \frac{3\pi}{4}$

66. If adj A = $\begin{bmatrix} 2 & 3 \\ 4 & -1 \end{bmatrix}$ and adj B = $\begin{bmatrix} 1 & -2 \\ -3 & 1 \end{bmatrix}$ then adj(AB) is ________.

a. $\begin{bmatrix} -7 & -1 \\ 7 & -9 \end{bmatrix}$ b. $\begin{bmatrix} -6 & 5 \\ -2 & -10 \end{bmatrix}$ c. $\begin{bmatrix} -7 & 7 \\ -1 & -9 \end{bmatrix}$ d. $\begin{bmatrix} -6 & -2 \\ 5 & -10 \end{bmatrix}$

67. If $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath} + \hat{\jmath}, \vec{c} = \hat{\imath}$ and $(\overrightarrow{a} \times \vec{b}) \times \vec{c} = \lambda\vec{a} + \mu\vec{b}$, then the value of $\lambda + \mu$ is

a) 0 b) 1 c) 6 d) 3

68. A circular template has a radius of 10 cm. The measurement of radius has an approximate error of 0.02 cm. Then the percentage error in calculating area of this template is

a) 0.2% b) 0.4% c) 0.04% d) 0.08%

69. If $x = \frac{1}{5}$, the value of $\cos(\cos^{-1}x + 2\sin^{-1}x)$ is

a. $-\sqrt{\frac{24}{25}}$ b. $\sqrt{\frac{24}{25}}$ c. $\frac{1}{5}$ d. $-\frac{1}{5}$

70. If $a * b = \sqrt{a^2 + b^2}$ on the real numbers then * is

a) commutative but not associative b) associative but not commutative

c) both commutative and associative d) neither commutative nor associative

71. The differential equation representing the family of curves $y = A\cos(x + B)$, where A and B are parameters, is

a) $\frac{d^2y}{dx^2} - y = 0$ b) $\frac{d^2y}{dx^2} + y = 0$ c) $\frac{d^2y}{dx^2} = 0$ d) $\frac{d^2x}{dy^2} = 0$

72. Which one of the following is not true?

(1) Negation of a negation of a statement is the statement itself.

(2) If the last column of the truth table contains only T then it is a tautology.

(3) If the last column of its truth table contains only F then it is a contradiction

(4) If p and q are any two statements then $p \leftrightarrow q$ is a tautology

73. The order and degree of the differential equation $\sqrt{\sin x}\,(dx + dy) = \sqrt{\cos x}\,(dx - dy)$ is

a) 1, 2 b) 2, 2 c) 1, 1 d) 2, 1

74. Area of the greatest rectangle inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

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

75. If the line $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+2}{2}$ lies in the plane $x + 3y - \alpha z + \beta = 0$, then (α, β) is

a) (- 5, 5) b) (- 6, 7) c) (5, - 5) d) (6, - 7)

76. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^2 x \cos x \, dx$ is

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

77. The distance between the planes x + 2y + 3z + 7 = 0 and 2x + 4y + 6z + 7 = 0 is

a) $\frac{\sqrt{7}}{2\sqrt{2}}$ b) $\frac{7}{2}$ c) $\frac{\sqrt{7}}{2}$ d) $\frac{7}{2\sqrt{2}}$

78. Distance from the origin to the plane $3x - 6y + 2z + 7 = 0$ is

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

79. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \left(\frac{2x^7 - 3x^5 + 7x^3 - x + 1}{\cos^2 x}\right) dx$ is

a) 4 b) 3 c) 2 d) 0

80. $\sin(\tan^{-1}x)$, $|x| < 1$ is equal to

a. $\frac{x}{\sqrt{1-x^2}}$ b. $\frac{1}{\sqrt{1-x^2}}$ c. $\frac{1}{\sqrt{1+x^2}}$ d. $\frac{x}{\sqrt{1+x^2}}$

81. The equation of the circle passing through (1, 5) and (4, 1) and touching y-axis is $x^2 + y^2 - 5x - 6y + 9 + \lambda(4x + 3y - 19) = 0$ where λ is equal to

a) 0, $-\frac{40}{9}$ b) 0 c) $\frac{40}{9}$ d) $-\frac{40}{9}$

82. If a compound statement involves 3 simple statements, then the number of rows in the truth table is

a) 9 b) 8 c) 6 d) 3

83. If f(x) = $\int_0^x t\cos t\, dt$, then $\frac{df}{dx}$ =

a) cos x – x sin x b) sin x + x cos x c) x cos x d) x sin x

84. The length of the diameter of the circle which touches the x -axis at the point (1, 0) and passes through the point (2, 3)

a) $\frac{6}{5}$ b) $\frac{5}{3}$ c) $\frac{10}{3}$ d) $\frac{3}{5}$

85. The probability mass function of a random variable is defined as:

x	-2	-1	0	1	2
$f(x)$	k	$2k$	$3k$	$4k$	$5k$

Then $E(X)$ is equal to:

a) $\frac{1}{15}$ b) $\frac{1}{10}$ c) $\frac{1}{3}$ d) $\frac{2}{3}$

86. The centre of the circle inscribed in a square formed by the lines $x^2 - 8x - 12 = 0$ and $y^2 - 14y + 15 = 0$ is

a) (4, 7) b) (7, 4) c) (9, 4) d) (4, 9)

87. If A = $\begin{bmatrix} \frac{3}{5} & \frac{2}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$, then the value of x is ______________.

a. $\frac{-4}{5}$ b. $\frac{-3}{5}$ c. $\frac{3}{5}$ d. $\frac{4}{5}$

88. If P(x, y) be any point on $16x^2 + 25y^2 = 400$ = with foci $F_1(3, 0)$ and $F_2(-3, 0)$ then $PF_1 + PF_2$ is

a) 8 b) 6 c) 10 d) 12

89. If $\vec{a} \times (\vec{b} \times \vec{c}) = \overrightarrow{(a} \times \vec{b}) \times \vec{c}$ where $\vec{a}, \vec{b}, \vec{c}$ are any three vectors such that $\vec{b} \cdot \vec{c} \neq 0$ and $\vec{a} \cdot \vec{b} \neq 0$, then $\vec{a}$ and $\vec{c}$ are

a) perpendicular b) parallel c) inclined at an angle $\frac{\pi}{3}$ d) inclined at an angle $\frac{\pi}{6}$

90. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ -1 & -2 & -3 & -4 \end{bmatrix}$ is ____________.

a. 1 b. 2 c. 4 d. 3

91. If $\sin^{-1}x = 2\sin^{-1}\alpha$ has a solution, then

a. $|\alpha| \leq \frac{1}{\sqrt{2}}$ b. $|\alpha| \geq \frac{1}{\sqrt{2}}$ c. $|\alpha| < \frac{1}{\sqrt{2}}$ d. $|\alpha| > \frac{1}{\sqrt{2}}$

92. Two coins are to be flipped. The first coin will land on heads with probability 0.6, the second with Probability 0.5. Assume that the results of the flips are independent, and let *X* equal the total number of heads that result. The value of *E*(*X*) is

a) 0.11 b) 1.1 c)11 d)1

93. The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line 3x – 4y = m at two distinct points if

a) 15 < m < 65 b) 35 < m < 85 c) − 85 < m < − 35 d) - 35 < m < 15

94. If A = $\begin{bmatrix} 7 & 3 \\ 4 & 2 \end{bmatrix}$, then $9I_2 - A$ = ________________.

a. A^{-1} b. $\frac{A^{-1}}{2}$ c. $3A^{-1}$ d. $2A^{-1}$

95. If $\frac{z-1}{z+1}$ is purely imaginary, then $|z|$ is

a. ½ b. 1 c. 2 d. 3

96. Let C be the circle with centre at (1, 1) and radius = 1. If T is the circle centered at (0, y) passing through the origin and touching the circle C externally, then the radius of T is equal to

a) $\frac{\sqrt{3}}{\sqrt{2}}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{2}$ d) $\frac{1}{4}$

97. $\sin^{-1}\frac{3}{5} - \cos^{-1}\frac{12}{13} + \sec^{-1}\frac{5}{3} - \operatorname{cosec}^{-1}\frac{13}{12}$ is

a. 2π b. π c. 0 d. $\tan^{-1}\frac{12}{65}$

98. The number of real numbers in [0, 2π] satisfying $\sin^4 x - 2\sin^2 x + 1$ is

a. 2 b. 4 c. 1 d. ∞

99. An ellipse has OB as semi minor axes, F and F' its foci and the angle FBF' is a right angle. Then the eccentricity of the ellipse is

a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{2}$ c) $\frac{1}{4}$ d) $\frac{1}{\sqrt{3}}$

100. If the function $f(x) = \sin^{-1}x(x^2 - 3)$ then x belongs to

a. [-1, 1] b. $[\sqrt{2}, 2]$ c. $[-2, -\sqrt{2}] \cup [\sqrt{2}, 2]$ d. $[-2, -\sqrt{2}]$

101. The maximum value of the function $x^2 e^{-2x}$, $x > 0$ is

a) 1/e b) 1/2e c) $\frac{1}{e^2}$ d) $\frac{4}{e^4}$

102. If f and g are polynomials of degree m and n respectively, and if h(x) = (f ∘ g)(x), then the degree of h is

a. mn b. m + n c. m^n d. n^m

103. If z is a non zero complex number, such that $2i\, z^2 = \bar{z}$ then $|z|$ is

a. ½ b. 1 c. 2 d. 3

104. The values of m for which the line $y = mx + 2\sqrt{5}$ touches the hyperbola $16x^2 - 9y^2 = 144$ are the roots of $x^2 - (a + b)x - 4 = 0$, then the value of $(a + b)$ is

a) 2 b) 4 c) 0 d) -2

105. Which one of the following is incorrect? For any two propositions p and q, we have

a) $\neg(p \vee q) \equiv \neg p \wedge \neg q$ b) $\neg(p \wedge q) \equiv \neg p \vee \neg q$

c) $\neg(p \vee q) \equiv \neg p \vee \neg q$ d) $\neg(\neg p) \equiv p$

106. The principal argument of the complex number $\frac{(1+i\sqrt{3})^2}{4i(1-i\sqrt{3})}$ is

a. $\frac{2\pi}{3}$ b. $\frac{\pi}{6}$ c. $\frac{5\pi}{6}$ d. $\frac{\pi}{2}$

107. If a vector $\vec{\alpha}$ lies in the plane of $\vec{\beta}$ and $\vec{\gamma}$, then

a) $[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 1$ b) $[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = -1$ c) $[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 0$ d) $[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 2$

108. $\sin^{-1}[\tan\frac{\pi}{4}] - \sin^{-1}[\frac{\sqrt{3}}{x}] = \frac{\pi}{6}$. Then x is a root of the equation

a. $x^2 - x - 6 = 0$ b. $x^2 - x - 12 = 0$ c. $x^2 + x - 12 = 0$ d. $x^2 + x - 6 = 0$

109. If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a}$ is perpendicular to $\vec{b}$ and is parallel to $\vec{c}$ then $\vec{a} \times (\vec{b} \times \vec{c})$ is equal to

a) $\vec{a}$ b) $\vec{b}$ c) $\vec{c}$ d) $\vec{0}$

110. The volume of the parallelepiped with its edges represented by the vectors $\hat{\imath} + \hat{\jmath}, \hat{\imath} + 2\hat{\jmath}, \hat{\imath} + \hat{\jmath} + \pi\hat{k}$ is

a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) π d) $\frac{\pi}{4}$

111. If $\cot^{-1}(\sqrt{\sin\alpha}) + \tan^{-1}(\sqrt{\sin\alpha}) = u$, then cos 2u is equal to

a. $\tan^2\alpha$ b. 0 c. -1 d. $\tan 2\alpha$

112. If $\cot^{-1}x = \frac{2\pi}{5}$ for some x ∈ R, the value of $\tan^{-1}x$ is

a. $-\frac{\pi}{10}$ b. $\frac{\pi}{5}$ c. $\frac{\pi}{10}$ d. $-\frac{\pi}{5}$

113. Which of the following is/are correct?
(i) Adjoint of a symmetric matrix is also a symmetric matrix
(ii) Adjoint of a diagonal matrix is also a diagonal matrix
(iii)If A is a square matrix of order n and λ is a scalar, then adj(λA) = λ^nadj(A)
(iv) A(adj A) = (adj A)A = $|A|$I

a. only (i)   b. (ii) and (iii)   c. (iii) and (iv)   d. (i), (ii) and (iv)

114. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors such that $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{\vec{b}+\vec{c})}{\sqrt{2}}$, then the angle between $\vec{a}$ and $\vec{b}$ is

a) $\frac{\pi}{2}$ b) $\frac{3\pi}{4}$ c) π d) $\frac{\pi}{4}$

115. If A = $\begin{bmatrix} 2 & 0 \\ 1 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 4 \\ 2 & 0 \end{bmatrix}$ then $|adj\ (AB)|$ = ___________.

a. -40   b. -80   c. -60   d. -20

116. If the volume of the parallelepiped with, $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}$ as coterminous edges is 8 cubic units, then the volume of the parallelepiped with $(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c})$, $(\vec{b} \times \vec{c}) \times (\vec{c} \times \vec{a})$ as coterminous edges is,

a) 8 cubic units   b) 512 cubic units   c)64 cubic units   d) 24 cubic units

117. $\sin^{-1}(2\cos^2 x - 1) + \cos^{-1}(1 - 2\sin^2 x)$ =

a. $\frac{\pi}{2}$ b. $\frac{\pi}{3}$ c. $\frac{\pi}{4}$ d. $\frac{\pi}{6}$

118. If x + y = k is a normal to the parabola y^2 =12x, then the value of k is

a) 3   b) -1   c) 1   d) 9

119. If ω = cis $\frac{2\pi}{3}$, then the number of distinct roots of $\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix}$ = 0 is

a. 1   b. 2   c. 3   d. 4

120. The angle between the lines $\frac{x-2}{3} = \frac{y+1}{-2}, z = 2$ and $\frac{x-1}{1} = \frac{2y+3}{3} = \frac{z+5}{2}$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

121. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a}, \vec{b}, \vec{a} \times \vec{b}] = \frac{\pi}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

122. The number of positive zeros of the polynomial $\sum_{j=0}^{n} nc_r\,(-1)^r x^r$ is

a. 0   b. n   c. < n   d. r

123. The ellipse E_1: $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is inscribed in a rectangle R whose sides are parallel to the coordinate axes. Another ellipse E_2 passing through the point (0, 4) circumscribes the rectangle R. The eccentricity of the ellipse is

a) $\frac{\sqrt{2}}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{2}$ d) $\frac{3}{4}$

124. If $\sin^{-1}x + \cot^{-1}(\frac{1}{2}) = \frac{\pi}{2}$, then x is equal to

a. $\frac{1}{2}$ b. $\frac{1}{\sqrt{5}}$ c. $\frac{2}{\sqrt{5}}$ d. $\frac{\sqrt{3}}{2}$

125. The equation $\tan^{-1}x - \cot^{-1}x = \tan^{-1}(\frac{1}{\sqrt{3}})$ has

a. no solution   b. unique solution
c. two solutions   d. infinite number of solutions

126. If $\left|z - \frac{3}{z}\right|$ = 2, then the least value of $|z|$ is

a. 1   b. 2   c. 3   d. 5

127. Consider the vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ such that $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = \vec{0}$. Let P_1 and P_2 be the planes determined by the pairs of vectors , $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$ *d* respectively. Then the angle between P_1 and P_2 is

a) 0° b) 45° c) 60° d) 90°

128. $i^n + i^{n+1} + i^{n+2} + i^{n+3}$

a. 0 b. 1 c. -1 d. i

129. If the planes $\vec{r}.(2\hat{i} - \lambda\hat{j} + \hat{k}) = 3$ and $\vec{r}.(4\hat{i} + \hat{j} - \mu\hat{k})$ are parallel, then the value of λ and μ are

a) $\frac{1}{2}, -2$ b) $-\frac{1}{2}, 2$ c) $-\frac{1}{2}, -2$ d) $\frac{1}{2}, 2$

130. If the length of the perpendicular from the origin to the plane $2x + 3y + \lambda z = 1$, $\lambda > 0$ is $\frac{1}{5}$, then the value of λ is

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

131. The proposition $p \wedge (\neg p \vee q)$ is

a) a tautology b) a contradiction

c) logically equivalent to $p \wedge q$ d) logically equivalent to $p \vee q$

132. If $\vec{a}$ and $\vec{b}$ are parallel vectors, then $[\vec{a}, \vec{c}, \vec{b}]$ is equal to

a) 2 b) – 1 c) 1 d) 0

133. The solution of the equation $|z| - z = 1 + 2i$ is

a. $\frac{3}{2} - 2i$ b. $-\frac{3}{2} + 2i$ c. $2 - \frac{3}{2}i$ d. $2 + \frac{3}{2}i$

134. A zero of $x^3 + 64$ is

a. 0 b. 4 c. 4i d. -4

135. The conjugate of a complex number is $\frac{1}{i-2}$. Then the complex number is

a. $\frac{1}{i+2}$ b. $\frac{-1}{i+2}$ c. $\frac{-1}{i-2}$ d. $\frac{1}{i-2}$

136. If the normals of the parabola $y^2 = 4ax$ drawn at the end points of its latus rectum are tangents to the circle $(x-3)^2 + (y+2)^2 = r^2$, then the value of r^2 is

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

137. If α, β *and* γ are the zeros of $x^3 + px^2 + qx + r$, then $\sum \frac{1}{\alpha}$ is

a. $-\frac{q}{r}$ b. $-\frac{p}{r}$ c. $\frac{q}{r}$ d. $-\frac{q}{p}$

138. If $x^a y^b = e^m$, $x^c y^d = e^n$, $\Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}$, $\Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}$, $\Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$, then the values of x and y are respectively.

a. $e^{(\Delta_2/\Delta_1)}, e^{(\Delta_3/\Delta_1)}$ b. $\log(\Delta_1/\Delta_3), \log(\Delta_2/\Delta_3)$

c. $\log(\Delta_2/\Delta_1), \log(\Delta_3/\Delta_1)$ d. $e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$

139. If $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$, then the value of $[\vec{a}, \vec{b}, \vec{c}]$ is

a) $|\vec{a}||\vec{b}||\vec{c}|$ b) $\frac{1}{3}|\vec{a}||\vec{b}||\vec{c}|$ c) 1 d) – 1

140. If $A = \begin{bmatrix} 3 & 1 & -1 \\ 2 & -2 & 0 \\ 1 & 2 & -1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ then the value of a_{23} is ________.

a. 0 b. -2 c. -3 d. -1

141. The function $\sin^4 x + \cos^4 x$ is increasing in the interval

a) $[\frac{5\pi}{8}, \frac{3\pi}{4}]$ b) $[\frac{\pi}{2}, \frac{5\pi}{8}]$ c) $[\frac{\pi}{4}, \frac{\pi}{2}]$ d) $[0, \frac{\pi}{4}]$

142. The value of $\sum_{i=1}^{13} i^n + i^{n-1}$

a. 1+ i b. i c. 1 d. 0

143. The number given by the Mean value theorem for the function $\frac{1}{x}$, $x \in [1, 9]$ is

a) 2　　b) 2.5　　c) 3　　d) 3.5

144. The dual of $\neg (p \vee q) \vee [p \vee (p \wedge \neg r)]$ is

a) $\neg (p \wedge q) \wedge [p \vee (p \wedge \neg r)]$　　b) $(p \wedge q) \wedge [p \wedge (p \vee \neg r)]$

c) $\neg (p \wedge q) \wedge [p \wedge (p \wedge r)]$　　d) $\neg (p \wedge q) \wedge [p \wedge (p \vee \neg r)]$

145. The polynomial $x^3 - kx^2 + 9x$ has three real zeros if and only if, k satisfies

a. $|k| \leq 6$　　b. $k = 0$　　c. $|k| > 0$　　d. $k \geq 6$

146. The abscissa of the point on the curve $f(x) = 8 - 2x$ at which the slope of the tangent is -0.25?

a) -8　　b) -4　　c) -2　　d) 0

147. One of the closest points on the curve $x^2 - y^2 = 4$ to the point (6,0) is

a) (2,0)　　b) $(\sqrt{5}, 1)$　　c) $(3, \sqrt{5})$　　d) $(\sqrt{13}, -\sqrt{3})$

148. The maximum value of the product of two positive numbers, when their sum of the squares is 200, is

a) 100　　b) $25\sqrt{7}$　　c) 28　　d) $24\sqrt{14}$

149. The augmented matrix of a system of linear equations is $\begin{bmatrix} 1 & 2 & 7 & 3 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & \lambda - 7 & \mu + 5 \end{bmatrix}$. The system has infinitely many solution if ______________.

a. $\lambda = 7, \mu \neq -5$　　b. $\lambda = -7, \mu = 5$　　c. $\lambda \neq 7, \mu \neq -5$　　d. $\lambda = 7, \mu = -5$

150. The point of inflection of the curve $y = (x - 1)^3$ is

a) (0,0)　　b) (0,1)　　c) (1,0)　　d) (1,1)

151. The domain of the function defined by $f(x) = \sin^{-1}\sqrt{x-1}$ is

a. [1, 2]　　b. [-1, 1]　　c. [0, 1]　　d. [-1, 0]

152. If $|z - 2 + i| \leq 2$, then the greatest value of $|z|$ is

a. $\sqrt{3} - 2$　　b. $\sqrt{3} + 2$　　c. $\sqrt{5} - 2$　　d. $\sqrt{5} + 2$

153. If $u(x, y) = e^{x^2 + y^2}$, then $\frac{\partial u}{\partial x}$ is equal to

a) $e^{x^2 + y^2}$　　b) 2xu　　c) x^2u　　d) y^2u

154. The slope of the line normal to the curve $f(x) = 2\cos 4x$ at $x = \frac{\pi}{12}$ is

a) $-4\sqrt{3}$　　b) -4　　c) $\frac{\sqrt{3}}{12}$　　d) $4\sqrt{3}$

155. If $P = \begin{bmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{bmatrix}$ is the adjoint of 3 X 3 matrix A and $|A| = 4$, then x is _______.

a. 15　　b. 12　　c. 14　　d. 11

156. If $f(x, y) = e^{xy}$, then $\frac{\partial^2 f}{\partial x \partial y}$ is equal to

a) xye^{xy}　　b) $(1 + xy)\, e^{xy}$　　c) $(1 + y)\, e^{xy}$　　d) $(1 + x)\, e^{xy}$

157. If we measure the side of a cube to be 4 cm with an error of 0.1 cm, then the error in our calculation of the volume is

a) 0.4 cu.cm　　b) 0.45 cu.cm　　c) 2 cu.cm　　d) 4.8 cu.cm

158. The change in the surface area $S = 6x^2$ of a cube when the edge length varies from x_0 to $X_0 + dx$ is

a) $12x_0 + dx$　　b) $12\, x_0\, dx$　　c) $6\, x_0\, dx$　　d) $6\, x_0 + dx$

159. The vector equation $\vec{r} = (\hat{\imath} - 2\hat{\jmath} - \hat{k}) + t(2\hat{\imath} - \hat{k})$ represents a straight line passing through the points

a) (0, 6, - 1) and (1, - 2, - 1)　　b) (0, 6, - 1) and (- 1, - 4, - 2)

c) (1, - 2, - 1) and (1, 4, - 2)　　d) (1, - 2,- 1) and (0, - 6,1)

160. If $|z| = 1$, then the value of $\frac{1+z}{1+\bar{z}}$.

a. z   b. $\bar{z}$ c. $\frac{1}{z}$ d. 1

161. If f(x) = $\frac{x}{x+1}$, then its differential is given by

a) $\frac{-1}{(x+1)^2}\,dx$ b) $\frac{1}{(x+1)^2}\,dx$ c) $\frac{1}{x+1}dx$ d) $\frac{-1}{x+1}dx$

162. The radius of the circle passing through the point (6, 2)two of whose diameter are $x + y = 6$ and $x + 2y = 4$ is

a) 10   b) $2\sqrt{5}$ c) 6   d) 4

163. Linear approximation for g(x) = cos x at x = $\frac{\pi}{2}$ is

a) x + $\frac{\pi}{2}$ b) - x + $\frac{\pi}{2}$ c) x - $\frac{\pi}{2}$ d) - x - $\frac{\pi}{2}$

164. If two tangents drawn from a point *P* to the parabola *yx* 2 4= are at right angles then the locus of *P* is

a) 2 *x* + 1= 0   b) *x* = −1   c) 2 *x* − 1 = 0   d) *x* =1

165. If f(x, y, z) = xy + yz + zx, then $f_x - f_y$ is equal to

a) z – x   b) y – z   c) x – z   d) y – x

166. The value of $\int_0^{\frac{2}{3}} \frac{dx}{\sqrt{4-9x^2}}$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) π

167. If ρ(A) = ρ([A|B]), then the system AX = B of linear equation is

a. Consistent and has a unique solution   b. consistent

c. Consistent and has infinitely many solution   d. inconsistent

168. For any value of n ∈ $\mathbb{Z}$, $\int_0^{\pi} e^{\cos^2 x} \cos^3[(2n+1)x]\,dx$ is

a) $\frac{\pi}{2}$ b) π c) 0   d) 2

169. Determine the truth value of each of the following statements:

(a) 4+2=5 and 6+3=9 (b) 3+2=5 and 6+1=7

(c) 4+5=9 and1+2= 4 (d) 3+2=5 and 4+7=11

(a) (b) (c) (d)

(1) *F T F T*

(2) *T F T F*

(3) *T T F F*

(4) *F F T T*

170. The value of $\int_{-4}^{4} \left[\tan^{-1}\left(\frac{x^2}{x^4+1}\right) + \tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right] dx$ is

a) π b) 2π c) 3π d) 4π

171. If $\sin^{-1}\left(\frac{x}{5}\right) + \cot^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then the value of x is

a. 4   b. 5   c. 2   d. 3

172. The principal argument of $(\sin 40° + i \cos 40°)^5$ is

a. - 110°   b. -70°   c. 70°   d. 110°

173. The area between $y^2 = 4x$ and its latus rectum is

a) $\frac{2}{3}$ b) $\frac{4}{3}$ c) $\frac{8}{3}$ d) $\frac{5}{3}$

174. The value of $\int_0^1 x(1-x)^{99} dx$ is

a) $\frac{1}{11000}$ b) $\frac{1}{10100}$ c) $\frac{1}{10010}$ d) $\frac{1}{10001}$

175. If (1 + i)(1 + 2i)(1 + 3i)…..(1 + ni) = x + iy, then 2.5.10…..$(1 + n^2)$ is

a. 1   b. i   c. $x^2 + y^2$ d. $1 + n^2$

176. If v(x, y) = log$(e^x + e^y)$, then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial x}$ is equal to

a) $e^x + e^y$ b) $\frac{1}{e^x + e^y}$ c) 2 d) 1

177. If A, B and C are invertible matrices of some order, then which one of the following is not true?

a. adj A = $|A|$ A^{-1} b. adj (AB) = (adj A)(adj B)

c. det A^{-1} = $(\det A)^{-1}$ d. $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

178. The value of $\int_0^{\pi} cos^4 x\, dx$ is

a) $\frac{3\pi}{10}$ b) $\frac{3\pi}{8}$ c) $\frac{3\pi}{4}$ d) $\frac{3\pi}{2}$

179. The value of $\int_0^{\infty} e^{-3x} x^2\, dx$ is

a) $\frac{7}{27}$ b) $\frac{5}{27}$ c) $\frac{4}{27}$ d) $\frac{2}{27}$

180. If $|z_1|$ = 1, $|z_2|$ = 2, $|z_3|$ = 9 and $|9 z_1 z_2 + 4 z_1 z_3 + z_3 z_2|$ = 12, then the value of $|z_1 + z_2 + z_3|$ is

a. 1 b. 2 c. 3 d. 4

181. The volume of solid of revolution of the region bounded by $y^2 = x(a - x)$ about x-axis is

a) πa^3 b) $\frac{\pi a^3}{4}$ c) $\frac{\pi a^3}{5}$ d) $\frac{\pi a^3}{6}$

182. If $\frac{\Gamma(n+2)}{\Gamma(n)}$ = 90 then n is

a) 10 b) 5 c) 8 d) 9

183. The value of $\int_0^1 (sin^{-1} x)^2\, dx$ is

a) $\frac{\pi^2}{4} - 1$ b) $\frac{\pi^2}{4} + 2$ c) $\frac{\pi^2}{4} + 1$ d) $\frac{\pi^2}{4} - 2$

184. The value of $\int_0^a (\sqrt{a^2 - x^2})^3$dx is

a) $\frac{\pi a^3}{16}$ b) $\frac{3\pi a^4}{16}$ c) $\frac{3\pi a^2}{8}$ d) $\frac{3\pi a^4}{8}$

185. If $\int_0^x f(t)dt = x + \int_x^1 t\, f(t)dt$, then the value of f(1) is

a) ½ b) 2 c) 1 d) ¾

186. The curve $y = ax^4 + bx^2$ with $ab > 0$

a) has no horizontal tangent b) is concave up

c) is concave down d) has no points of inflection

188. If w(x, y, z) = $x^2(y - z) + y^2(z - x) + z^2(x - y)$, then $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z}$ is

a) xy + yz + zx b) x(y + z) c) y(z + x) d) 0

189. The order of the differential equation of all circles with centre at (h, k) and radius 'a' is

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

190. The differential equation of the family of curves $y = Ae^x + Be^{-x}$, where A and B are arbitrary constants is

a) $\frac{d^2y}{dx^2} + y = 0$ b) $\frac{d^2y}{dx^2} - y = 0$ c) $\frac{dy}{dx} + y = 0$ d) $\frac{dy}{dx} - y = 0$

191. The coordinates of the point where the line $\vec{r} = (6\hat{\imath} - \hat{\jmath} - 3\hat{k}) + t(-\hat{\imath} + 4\hat{k})$ meets the plane $\vec{r}\,.(\hat{\imath} + \hat{\jmath} - \hat{k})$ = 3 are

a) (2,1,0) b) (7, - 1,- 7) c) (1,2, - 6) d) (5,- 1,1)

192. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents

a) straight lines b) circles c) parabola d) ellipse

193. Angle between $y^2 = x$ and $x^2 = y$ at the origin is

a) $\tan^{-1}\frac{3}{4}$ b) $\tan^{-1}\frac{4}{3}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

194. If A = $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then adj(adj A) is __________.

a. $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ b. $\begin{bmatrix} 6 & -6 & 8 \\ 4 & -6 & 8 \\ 0 & -2 & 2 \end{bmatrix}$ c. $\begin{bmatrix} -3 & 3 & -4 \\ -2 & 3 & -4 \\ 0 & 1 & -1 \end{bmatrix}$ d. $\begin{bmatrix} 3 & -3 & 4 \\ 0 & -1 & 1 \\ 2 & -3 & 4 \end{bmatrix}$

195. The integrating factor of the differential equation $\frac{dy}{dx} + P(x)y = Q(x)$ is x, then P(x)

a) x b) $\frac{x^2}{2}$ c) $\frac{1}{x}$ d) $\frac{1}{x^2}$

196. The degree of the differential equation $y(x) = 1 + \frac{dy}{dx} + \frac{1}{1\,.\,2}\left(\frac{dy}{dx}\right)^2 + \frac{1}{1.2.3}\left(\frac{dy}{dx}\right)^3 + \cdots$ is

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

197. The solution of $\frac{dy}{dx} + p(x)y = 0$ is

a) $y = ce^{\int pdx}$ b) $y = ce^{-\int pdx}$ c) $x = ce^{-\int pdy}$ d) $x = ce^{\int pdy}$

198. If A^TA^{-1} is symmetric, then A^2 = ____________.

a. A^{-1} b. $(A^T)^2$ c. A^T d. $(A^{-1})^2$

199. The general solution of the differential equation $\log\left(\frac{dy}{dx}\right) = x + y$ is

a) $e^x + e^y = C$ b) $e^x + e^{-y} = C$ c) $e^{-x} + e^y = C$ d) $e^{-x} + e^{-y} = C$

200. A polynomial equation in x of degree n always has

a. n distinct roots b. n real roots

c. n complex roots d. at most one root

201. In the set $\mathbb{R}$ of real numbers '* ' is defined as follows. Which one of the following is not a binary operation on $\mathbb{R}$?

a) $a * b = \min(a\,.\,b)$ b) $a * b = \max(a,b)$ c) $a * b = a$ d) $a * b = a^b$

202. The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is

a) $x\,\phi\left(\frac{y}{x}\right) = k$ b) $\phi\left(\frac{y}{x}\right) = kx$ c) $y\,\phi\left(\frac{y}{x}\right) = k$ d) $\phi\left(\frac{y}{x}\right) = ky$

203. Subtraction is not a binary operation in

a) $\mathbb{R}$ b) $\mathbb{Z}$ c) $\mathbb{N}$ d) $\mathbb{Q}$

204. If A = $\begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and AB = I_2, then B = __________.

a. $(\cos^2\frac{\theta}{2})A$ b. $(\cos^2\frac{\theta}{2})A^T$ c. $(\cos^2\theta)A$ d. $(\sin^2\frac{\theta}{2})A$

205. Which one of the following is a binary operation on $\mathbb{N}$?

a) Subtraction b) Multiplication c) Division d) All the above

206. Integrating factor of the differential equation $\frac{dy}{dx} = \frac{x+y+1}{x+1}$ is

a) $\frac{1}{x+1}$ b) $x + 1$ c) $\frac{1}{\sqrt{x+1}}$ d) $\sqrt{x+1}$

207. The solution of the differential equation $\frac{dy}{dx} + \frac{1}{\sqrt{1-x^2}} = 0$ is

a) $y + \sin^{-1}x = c$ b) $x + \sin^{-1}y = c$ c) $y^2 + 2\sin^{-1}x = C$ d) $x^2 + 2\sin^{-1}y = c$

208. The equation of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ having centre at (0, 3) is

a) $x^2 + y^2 - 6y - 7 = 0$ b) $x^2 + y^2 - 6y + 7 = 0$

c) $x^2 + y^2 - 6y - 5 = 0$ d) $x^2 + y^2 - 6y + 5 = 0$

209. If the solution of the differential equation $\frac{dy}{dx} = \frac{ax+3}{2y+f}$ represents a circle, then the value of a is

a) 2 b) −2 c) 1 d) −1

210. If $(AB)^{-1} = \begin{bmatrix} 12 & -17 \\ -19 & 27 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$, then B^{-1} = ___________.

a. $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$ b. $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$ c. $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ d. $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

211. Let X be random variable with probability density function $(x) = \begin{cases} \frac{2}{x^3} & x \geq 1 \\ 0 & x < 1 \end{cases}$. Which of the following statement is correct?

a) both mean and variance exist b) mean exists but variance does not exist

c) both mean and variance do not exist d) variance exists but Mean does not exist

212. A rod of length $2l$ is broken into two pieces at random. The probability density function of the shorter of the two pieces is $(x) = \begin{cases} \frac{1}{l} & 0 < x < 1 \\ 0 & l \leq x < 2l \end{cases}$. The mean and variance of the shorter of the two pieces are respectively

a) $\frac{l}{2}, \frac{l^2}{3}$ b) $\frac{l}{2}, \frac{l^2}{6}$ c) $l, \frac{l^2}{12}$ d) $\frac{l}{2}, \frac{l^2}{12}$

213. The population P in any year t is such that the rate of increase in the population is proportional to the population. Then

a) $P = Ce^{kt}$ b) $P = Ce^{-kt}$ c) $P = Ckt$ d) $P = C$

214. A pair of dice numbered 1, 2, 3, 4, 5, 6 of a six-sided die and 1, 2, 3, 4 of a four-sided die is rolled and the sum is determined. Let the random variable X denote this sum. Then the number of elements in the inverse image of 7 is

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

215. The truth table for $(p \wedge q) \rightarrow \neg q$ is given below

p	q	$(p \wedge q) \vee (\neg q)$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is true?

(a) (b) (c) (d)

(1) T T T T

(2) T F T T

(3) T T F T

(4) T F F F

216. Consider a game where the player tosses a six-sided fair die. If the face that comes up is 6, the player wins Rs. 36, otherwise he loses Rs.k^2, where k is the face that comes up $k = \{1, 2, 3, 4, 5\}$. The expected amount to win at this game in ` is

a) $\frac{19}{6}$ b) $-\frac{19}{6}$ c) $\frac{3}{2}$ d) $-\frac{3}{2}$

217. The area of the triangle formed by the complex numbers z, iz and z + iz in the Argand's diagram is

a. $\frac{1}{2}|z|^2$ b. $|z|^2$ c. $\frac{3}{2}|z|^2$ d. $2|z|^2$

218. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and $A(\text{adj } A) = \begin{bmatrix} k & 0 \\ 0 & k \end{bmatrix}$, then k = ______.

a. 0 b. $\sin\theta$ c. $\cos\theta$ d. 1

219. A random variable X has binomial distribution with $n = 25$ and $p = 0.8$ then standard deviation of X is

a) 6 b) 4 c) 3 d) 2

220. On a multiple-choice exam with 3 possible destructives for each of the 5 questions, the

probability that a student will get 4 or more correct answers just by guessing is

a) $\frac{11}{243}$ b) $\frac{3}{8}$ c) $\frac{1}{243}$ d) $\frac{5}{243}$

221. If A is non-singular matrix such that $A^{-1} = \begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$, then $(A^T)^{-1}$ = ______.

a. $\begin{bmatrix} -5 & 3 \\ 2 & 1 \end{bmatrix}$ b. $\begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$ c. $\begin{bmatrix} -1 & -3 \\ 2 & 5 \end{bmatrix}$ d. $\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

222. If X is a binomial random variable with expected value 6 and variance 2.4, then $P(X = 5)$ is

a) $\binom{10}{5}\left(\frac{3}{5}\right)^6\left(\frac{2}{5}\right)^4$ b) $\binom{10}{5}\left(\frac{3}{5}\right)^{10}$ c) $\binom{10}{5}\left(\frac{3}{5}\right)^4\left(\frac{2}{5}\right)^6$ d) $\binom{10}{5}\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$

223. Let X represent the difference between the number of heads and the number of tails obtained when a coin is tossed n times. Then the possible values of X are

a) $i + 2n$, $i = 0,1,2...n$ b) $2i - n$, $i = 0,1,2...n$
c) $n - i$, $i = 0,1,2...n$ d) $2i + 2n$, $i = 0,1,2...n$

224. Let A = $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and 4B = $\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & x \\ -1 & 1 & 3 \end{bmatrix}$. If B is the inverse of A, then the value of x is __________.

a. 2 b. 4 c. 3 d. 1

225. Which of the following is a discrete random variable?
I. The number of cars crossing a particular signal in a day.
II. The number of customers in a queue to buy train tickets at a moment.
III. The time taken to complete a telephone call.

a) I and II b) II only c) III only d) II and III

226. If $f(x) = \begin{cases} 2x & 0 \le x \le a \\ 0 & otherwise \end{cases}$ is a probability density function of a random variable, then the value of a is

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

227. The operation * defined by $a * b = \frac{ab}{7}$ is not a binary operation on

a) $\mathbb{Q}^+$ b) $\mathbb{Z}$ c) $\mathbb{R}$ d) $\mathbb{C}$

228. Let X have a Bernoulli distribution with mean 0.4, then the variance of $(2X-3)$ is

a) 0.24 b) 0.48 c) 0.6 d) 0.96

229. If in 6 trials, X is a binomial variable which follows the relation $9P(X=4) = P(X=2)$, then the probability of success is

a)0.125 b) 0.25 c) 0.375 d) 0.75

230. A computer salesperson knows from his past experience that he sells computers to one in every twenty customers who enter the showroom. What is the probability that he will sell a computer to exactly two of the next three customers?

a) $\frac{57}{20^3}$ b) $\frac{57}{20^2}$ c) $\frac{19^3}{20^3}$ d) $\frac{57}{20}$

231. In the last column of the truth table for $\neg(p \vee \neg q)$ the number of final outcomes of the truth value 'F' are

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

232. If $\sin x$ is the integrating factor of the linear differential equation $\frac{dy}{dx} + Py = Q$, then P is

a) $\log \sin x$ b) $\cos x$ c) $\tan x$ d) $\cot x$

233. The number of arbitrary constants in the particular solution of a differential equation of third order is

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

234. The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half the distance between the foci is

a) $\frac{4}{3}$ b) $\frac{4}{\sqrt{3}}$ c) $\frac{2}{\sqrt{3}}$ d) $\frac{3}{2}$

235. If A $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$, then A = ____________.

a. $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$ b. $\begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ c. $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$ d. $\begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$

236. In the set $\mathbb{Q}$ define $a \odot b = a + b + ab$. For what value of y, $3\odot(y \odot 5)=7$?

a) $y = \frac{2}{3}$ b) $y = \frac{2}{3}$ c) $y = -\frac{3}{2}$ d) $y = 4$

237. $\tan^{-1}(\frac{1}{4}) + \tan^{-1}(\frac{2}{9})$ is equal to

a. $\frac{1}{2}\cos^{-1}(\frac{3}{5})$ b. $\frac{1}{2}\sin^{-1}(\frac{3}{5})$ c. $\frac{1}{2}\tan^{-1}(\frac{3}{5})$ d. $\tan^{-1}(\frac{1}{2})$

238. Which one of the following statements has the truth value *T* ?

a) sin *x* is an even function.

b) Every square matrix is non-singular

c) The product of complex number and its conjugate is purely imaginary

d) $\sqrt{5}$ is an irrational number

239. The angle between the line $\vec{r} = (\hat{\imath} + 2\hat{\jmath} - 3\hat{k}) + t(2\hat{\imath} + \hat{\jmath} - 2\hat{k})$ and the plane $\vec{r}\,.(\hat{\imath} + \hat{\jmath} - \hat{k}) = 3$ are

a) 0° b) 30° c) 45° d) 90°

240. The random variable X has the probability density function

$f(x) = \begin{cases} ax + b & 0 < x < 1 \\ 0 & otherwise \end{cases}$ and $E(X) = \frac{7}{12}$, then *a* and *b* are respectively

a) 1 and ½ b) ½ and 1 c) 2 and 1 d) 1 and 2

241. If $z = \frac{(\sqrt{3}+i)^3 (3i+4)^2}{(8+6i)^2}$, then $|z|$ is equal to

a. 0 b. 1 c. 2 d. 3

242. Which one is the contrapositive of the statem tvent $(p \vee q) \rightarrow r$?

a) $\neg r \rightarrow (\neg p \wedge \neg q)$ b) $\neg r \rightarrow (p \vee q)$ c) $r \rightarrow (p \wedge q)$ d) $p \rightarrow (q \vee r)$

243. The solution of $\frac{dy}{dx} = 2^{y-x}$ is

a) $2^x + 2^y = C$ b) $2^x - 2^y = C$ c) $\frac{1}{2^x} - \frac{1}{2^y} = C$ d) x + y = C

244. A binary operation on a set *S* is a function from

a) $S \rightarrow S$ b) $(S\times S) \rightarrow S$ c) $S \rightarrow (S\times S)$ d) $(S\times S) \rightarrow (S\times S)$

245. The radius of the circle $3x^2 + by^2 + 4bx - 6by + b^2 = 0$ is

a) 1 b) 3 c) $\sqrt{10}$ d) $\sqrt{11}$

246.

p	q	$(p\wedge q)\rightarrow\neg p$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is correct for the truth value of $(p \wedge q) \rightarrow \neg p$?

(a) (b) (c) (d)

(1) *T T T T*

(2) *F T T T*

(3) *F F T T*

(4) *T T T F*

247. The minimum value of the function $|3-x| + 9$ is

a) 0 b) 3 c) 6 d) 9

248. The volume of a sphere is increasing in volume at the rate of 3 πcm^3 / sec. The rate of change of its radius when radius is ½ cm

a) 3 cm/s b) 2 cm/s c) 1 cm/s d) ½ cm/s

249. If $|x| \leq 1$, then $2\tan^{-1}x - \sin^{-1}\frac{2x}{1-x^2}$ is equal to

a. $\tan^{-1}x$ b. $\sin^{-1}x$ c. 0 d. π

250. If $\cot^{-1}2$ and $\cot^{-1}3$ are two angles of a triangle, then the third angle is

a. $\frac{\pi}{4}$ b. $\frac{3\pi}{4}$ c. $\frac{\pi}{6}$ d. $\frac{\pi}{3}$

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