MCQ BB

12th Standard

Maths

250 x 1 = 250

1) $i^n+i^{n+1}+i^{n+2}+i^{n+3}$ is

(a) 0 (b) 1 (c) -1 (d) i

2) The value of $\sum_{n=1}^{13}\left(i^n+i^{n-1}\right)$ is

(a) 1+ i (b) i (c) 1 (d) 0

3) 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) $2|z|^2$

4) 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) $\frac{1}{i-2}$

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

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

6) If z is a non zero complex number, such that $2iz^2=\bar{z}$ then |z| is

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

7) If |z - 2 + i | ≤ 2, then the greatest value of |z| is

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

8) If $\left|z-\frac{3}{z}\right|=2$ then the least value |z| is

(a) 1 (b) 2 (c) 3 (d) 5

9) If |z| = 1, then the value of $\frac{1+z}{1+\bar{z}}$ is

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

10) 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) $2 + \frac{3}{2}i$

11) If $|z_1| = 1$, $|z_2| = 2|z_3| = 3$ and $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 12$, then the value of $|z_1+z_2+z_3|$ is

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

12) A zero of $x^3 + 64$ is

(a) 0 (b) 4 (c) 4i (d) -4

13) If f and g are polynomials of degrees 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

14) A polynomial equation in x of degree n always has

(a) n distinct roots (b) n real roots (c) n imaginary roots (d) at most one root

15) If α, β and γ are the roots of $x^3 + px^2 + qx + r$, then $\Sigma\frac{1}{\alpha}$ is

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

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

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

17) 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) $|k| > 6$ (d) $|k| \geq 6$

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

(a) 2 (b) 4 (c) 1 (d) ∞

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

(a) $a \geq 0$ (b) $a > 0$ (c) $a < 0$ (d) $a \leq 0$

20) The polynomial $x^3 + 2x + 3$ has

(a) one negative and two imaginary zeros (b) one positive and two imaginary zeros

(c) three real zeros (d) no zeros

21) The number of positive zeros of the polynomial $\sum_{j=0}^{n} n_{C_r}$ $(-1)^r x^r$ is

(a) 0 (b) n (c) < n (d) r

22) If z is a complex number such that $z \in \mathbb{C}\backslash\mathbb{R}$ and $z+\frac{1}{z}\epsilon R$, then |z| is

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

23) z_1, z_2 and z_3 are complex number such that $z_1 + z_2 + z_3 = 0$ and $|z_1| = |z_2| = |z_3| = 1$ then $z_1^2 + z_2^2 + z_3^3$ is

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

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

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

25) 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

26) The principal argument of $\dfrac{3}{-1+i}$ is

(a) $\dfrac{-5\pi}{6}$ (b) $\dfrac{-2\pi}{3}$ (c) $\dfrac{-3\pi}{4}$ (d) $\dfrac{-\pi}{2}$

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

(a) −110° (b) −70° (c) 70° (d) 110°

28) If (1+i)(1+2i)(1+3i)…(1+ni) = x + iy, then $2 \cdot 5 \cdot 10 \ldots \left(1+n^2\right)$ is

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

29) If $\omega \neq 1$ is a cubic root of unity and $(1+\omega)^7 = A + B\omega$, then (A, B) equals

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

30) 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) $\frac{\pi}{2}$

31) 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

32) The product of all four values of $\left(cos\frac{\pi}{3} + isin\frac{\pi}{3}\right)^{\frac{3}{4}}$ is

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

33) If $\omega \neq 1$ is a cubic root of unity and $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2-1 & \omega^2 \\ 1 & \omega^2 & \omega^7 \end{vmatrix}$ = 3k, then k is equal to

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

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

(a) $cis\frac{2\pi}{3}$ (b) $cis\frac{4\pi}{3}$ (c) $-cis\frac{2\pi}{3}$ (d) $-cis\frac{4\pi}{3}$

35) If $\omega = cis\frac{2\pi}{3}$, 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

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

36) The value of $\sin^{-1}$ (cos x), $0 \leq x \leq \pi$ is

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

37) 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

38) $\sin^{-1}\frac{3}{5} - \cos^{-1}\frac{12}{13} + \sec^{-1}\frac{5}{3} - \text{cosec}^{-1}\frac{13}{12}$ is equal to

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

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

(a) $|\alpha| \le \frac{1}{\sqrt{2}}$ (b) $|\alpha| \ge \frac{1}{\sqrt{2}}$ (c) $|\alpha| < \frac{1}{\sqrt{2}}$ (d) $|\alpha| > \frac{1}{\sqrt{2}}$

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

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

41) 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

42) 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) $-\frac{\pi}{5}$

43) 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]

44) 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) $-\frac{1}{5}$

45) $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right)$ is equal to

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

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

(a) [-1, 1] (b) $[\sqrt{2}, 2]$ (c) $\left[-2, -\sqrt{2}\right] \cup \left[\sqrt{2}, 2\right]$ (d) $\left[-2, -\sqrt{2}\right]$

47) 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) $\frac{\pi}{3}$

48) $\sin^{-1}\left(\tan\frac{\pi}{4}\right) - \sin^{-1}\left(\sqrt{\frac{3}{x}}\right) = \frac{\pi}{6}$. 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) $x^2+x-6 = 0$

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

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

50) If $\cot^{-1}(\sqrt{\sin\alpha}) + \tan^{-1}(\sqrt{\sin\alpha}) = u$, then cos2u is equal to

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

51) 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

52) The equation $\tan^{-1} x - \cot^{-1} x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ has

(a) no solution (b) unique solution (c) two solutions

(d) infinite number of solutions

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

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

54) If $\sin^{-1} \frac{x}{5} + \operatorname{cosec}^{-1} \frac{5}{4} = \frac{\pi}{2}$, then the value of x is

(a) 4 (b) 5 (c) 2 (d) 3

55) $\sin(\tan^{-1}x)$, $|x| < 1$ 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) $\frac{x}{\sqrt{1+x^2}}$

56) 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) $\frac{-40}{9}$

57) 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) $\frac{3}{2}$

58) 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) $-35 < m < 15$

59) 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) $\frac{3}{5}$

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

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

61) The centre of the circle inscribed in a square formed by the lines $x^2 - 8x - 12 = 0$ and $y^2 - 14y + 45 = 0$ is

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

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

(a) $x + 2y = 3$ (b) $x + 2y + 3 = 0$ (c) $2x + 4y + 3 = 0$ (d) $x - 2y + 3 = 0$

63) 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

64) 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

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

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

66) If the normals of the parabola $y^2 = 4x$ 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

67) 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

68) 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) $\frac{3}{4}$

69) 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) $(3\sqrt{3}, -2\sqrt{2})$

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

71) 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) $\frac{1}{4}$

72) 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

73) 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) $\frac{a}{b}$

74) 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) $\frac{1}{\sqrt{3}}$

75) The eccentricity of the ellipse $(x-3)^2 + (y-4)^2 = \frac{y^2}{9}$ is

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

76) If the two tangents drawn from a point P to the parabola $y^2 = 4x$ are at right angles then the locus of P is

(a) $2x + 1 = 0$ (b) $x = -1$ (c) $2x - 1 = 0$ (d) $x = 1$

77) 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)

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

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

79) 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

80) 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) (-3, 2) (c) (5, -2) (d) (-2, 5)

81) 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

82) 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) $[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 2$

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

(a) $|\vec{a}|\left|\vec{b}\right||\vec{c}|$ (b) $\frac{1}{3}|\vec{a}|\left|\vec{b}\right||\vec{c}|$ (c) 1 (d) -1

84) 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) $\vec{0}$

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

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

86) The volume of the parallelepiped with its edges represented by the vectors $\hat{i}+\hat{j}, \hat{i}+2\hat{j}, \hat{i}+\hat{j}+\pi\hat{k}$ is

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

87) If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a}, \vec{b}, \vec{a}\times\vec{b}] = \frac{1}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is

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

88) If $\vec{a} = \hat{i}+\hat{j}+\hat{k}$, $\vec{b} = \hat{i}+\hat{j}$, $\vec{c} = \hat{i}$ and $(\vec{a}\times\vec{b})\times\vec{c}$ = $\lambda\vec{a}+\mu\vec{b}$ then the value of $\lambda+\mu$ is

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

89) 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

90) 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) $\frac{\pi}{4}$ (d) π

91) 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 $(\vec{a}\times\vec{b})\times(\vec{b}\times\vec{c}), (\vec{b}\times\vec{c})\times(\vec{c}\times\vec{a})$ and $(\vec{c}\times\vec{a})\times(\vec{a}\times\vec{b})$ as coterminous edges is,

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

92) 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 $\vec{c}, \vec{d}$ respectively. Then the angle between P_1 and P_2 is

(a) 0° (b) 45° (c) 60° (d) 90°

93) If $\vec{a}\times(\vec{b}\times\vec{c}) = (\vec{a}\times\vec{b})\times\vec{c}$ 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 $\frac{\pi}{6}$

94) If $\vec{a}=2\hat{i}+3\hat{j}-\hat{k},\vec{b}=\hat{i}+2\hat{j}-5\hat{k},\vec{c}=3\hat{i}+5\hat{j}-\hat{k}$ then a vector perpendicular to $\vec{a}$ and lies in the plane containing $\vec{b}$ and $\vec{c}$ is

(a) $-17\hat{i}+21\hat{j}-97\hat{k}$ (b) $17\hat{i}+21\hat{j}-123\hat{k}$ (c) $-17\hat{i}-21\hat{j}+97\hat{k}$

(d) $-17\hat{i}-21\hat{j}-97\hat{k}$

95) 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) $\frac{\pi}{2}$

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

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

97) The angle between the line $\vec{r}=(\hat{i}+2\hat{j}-3\hat{k})+t(2\hat{i}+\hat{j}-2\hat{k})$ and the plane $\vec{r}.(\hat{i}+\hat{j})+4=0$ is

(a) 0° (b) 30° (c) 45° (d) 90°

98) The coordinates of the point where the line $\vec{r}=(6\hat{i}-\hat{j}-3\hat{k})+t(\hat{i}+4\hat{j})$ meets the plane $\vec{r}=(\hat{i}+\hat{j}-\hat{k})$ = 3 are

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

99) Distance from the origin to the plane 3x − 6y + 2z + 7 = 0 is

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

100) The distance between the planes x + 2y + 3z + 7 = 0 and 2x + 4y + 6z + 7 = 0

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

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

(a) $c=\pm3$ (b) $c=\pm\sqrt{3}$ (c) c > 0 (d) 0 < c < 1

102) The vector equation $\vec{r}=(\hat{i}-2\hat{j}-\hat{k})+t(6\hat{i}-\hat{k})$ 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)

103) 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

104) If the planes $\vec{r}.(2\hat{i} - \lambda\hat{j} + \hat{k}) = 3$ and $\vec{r}.(4\hat{i} + \hat{j} - \mu\hat{k}) = 5$ 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) $\frac{1}{2}, 2$

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

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

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

(a) 3 (b) 4 (c) 2 (d) 5

107) If A is a 3 × 3 non-singular matrix such that $AA^T = A^TA$ and $B = A^{-1}A^T$, then BB^T =

(a) A (b) B (c) I_3 (d) B^T

108) If A = $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$, B = adj A and C = 3A, then $\frac{|adjB|}{|C|}$ =

(a) $\frac{1}{3}$ (b) $\frac{1}{9}$ (c) $\frac{1}{4}$ (d) 1

109) 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) $\begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$

110) 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) $2A^{-1}$

111) 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

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

(a) 15 (b) 12 (c) 14 (d) 11

113) 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

114) 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) $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

115) 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) $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

116) If A^TA^{-1} is symmetric, then A^2 =

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

117) If A is a 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) $\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

118) If A = $\begin{bmatrix} \frac{3}{5} & \frac{4}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$,then the value of x is

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

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

(a) $\left(\cos^2\frac{\theta}{2}\right)A$ (b) $\left(\cos^2\frac{\theta}{2}\right)A^T$ (c) $\left(\cos^2\theta\right)I$ (d) $(\text{Sin}^2\frac{\theta}{2})A$

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

(a) 0 (b) sin θ (c) cos θ (d) 1

121) 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

122) 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) $\begin{bmatrix} -6 & -2 \\ 5 & -10 \end{bmatrix}$

123) 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

124) 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) $e^{(\Delta_1 / \Delta_3)}, e^{(\Delta_2 / \Delta_3)}$

125) 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 $\text{adj}(\lambda A) = \lambda^n \text{adj}(A)$.

(iv) $A(\text{adj}A) = (\text{adj}A)A = |A|\, I$

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

126) If $\rho(A) = \rho([A|\, B])$, then the system AX = B of linear equations is

(a) consistent and has a unique solution (b) consistent

(c) consistent and has infinitely many solution (d) inconsistent

127) 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) $\frac{\pi}{4}$

128) 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 solutions if

(a) $\lambda = 7, \mu \neq -5$ (b) $\lambda = -7, \mu = 5$ (c) $\lambda \neq 7, \mu \neq -5$

(d) $\lambda = 7, \mu = -5$

129) 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

130) 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) $\begin{bmatrix} 3 & -3 & 4 \\ 0 & -1 & 1 \\ 2 & -3 & 4 \end{bmatrix}$

131) 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 $\frac{1}{2}$ cm

(a) 3 cm/s (b) 2 cm/s (c) 1 cm/s (d) $\frac{1}{2} cm/s$

132) A balloon rises straight up at 10 m/s. An observer is 40 m away from the spot where the balloon left the ground. Find 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

133) 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

134) 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

135) Find 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)

136) The abscissa of the point on the curve $f(x) = \sqrt{8-2x}$ at which the slope of the tangent is -0.25 ?

(a) -8 (b) -4 (c) -2 (d) 0

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

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

138) 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) $y = \pm 3$

139) Angle between y^2 = x and x^2= y at the origin is

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

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

(a) 0 (b) 1 (c) 2 (d) ∞

141) The function sin^4 x + cos^4 x is increasing in the interval

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

142) The number given by the Rolle's theorem for the functlon x^3 - 3x^2, x ∈ [0,3] is

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

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

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

144) The minimum value of the function |3 - x| + 9 is

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

145) 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) $x = \frac{3\pi}{2}$

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

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

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 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

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

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

152) The differential equation representing the family of curves y = Acos(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) $\frac{d^2x}{dy^2} = 0$

153) The order and degree of the differential equation

$\sqrt{sinx}(dx+dy)=\sqrt{cosx}(dx-dy)$

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

154) 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

155) 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) $\frac{dy}{dx}-y=0$

156) 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

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

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

158) 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) $x=ce^{\int pdy}$

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

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

160) 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) $\frac{1}{x^2}$

161) The degree of the differential equation y

$y(x)=1+\frac{dy}{dx}+\frac{1}{1.2}\left(\frac{dy}{dx}\right)^2+\frac{1}{1.2.3}\left(\frac{dy}{dx}\right)^3+\ldots.$ is

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

162) If p and q are the order and degree of the differential equation

$y=\frac{dy}{dx}+x^3\left(\frac{d^2y}{dx^2}\right)+xy=cosx,$ When

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

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

(a) $y + \sin^{-1} x = c$ (b) $x + \sin^{-1} y = 0$ (c) $y^2 + 2\sin^{-1} x = c$ (d) $x^2 + 2\sin^{-1} y = c$

164) 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) $y = x^2 + C$

165) 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) $e^{-x}+e^{-y}=C$

166) 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) $x+y=C$

167) 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) $\phi\left(\frac{y}{x}\right)=ky$

168) 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

169) The number of arbitrary constants in the general solutions of order n and n +1 are respectively

(a) n-1,n (b) n,n+1 (c) n+1,n+2 (d) n+1,n

170) 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

171) 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) $\sqrt{x+1}$

172) 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

173) 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

174) 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

175) 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) $y=3x^4+4$ (d) $y=3x^2+5$

176) Let X be random variable with probability density function

$$f(x) = \begin{cases} \frac{2}{x^3} & x \geq 1 \\ 0 & x < 1 \end{cases}$$

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

177) A rod of length $2l$ is broken into two pieces at random. The probability density function of the shorter of the two pieces is

\(f(x)= \begin{cases}\frac{1}{l} & 0

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) $\frac{l}{2}, \frac{l^2}{12}$

178) 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 Rs is

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

179) 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

180) 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

181) 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

182) If the function $f(x) = \frac{1}{12}$ for a < x < b, 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

183) 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

184) 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

185) 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) $\frac{5}{243}$

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

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

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

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

(d) $\left(\frac{10}{5}\right)\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$

188) The random variable X has the probability density function
\(f(x)= \begin{cases}a x+b & 0 and $E(X)=\frac{7}{12}$ then a and b are respectively.

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

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

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

190) 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

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

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

192) 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) $\frac{2}{3}$

193) 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

194) 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

195) 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) $\frac{57}{20}$

196) 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%

197) 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

198) 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

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

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

200) 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) yx^{y-1} (d) x log y

201) 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) $(1 + x)e^{xy}$

202) 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

203) The change in the surface area S = $6x^2$ of a cube when the edge length varies from x_o to x_o+ dx is

(a) 12 x_o+dx (b) 12x_o dx (c) 6x_o dx (d) 6x_o+ dx

204) The approximate change in the volume V of a cube of side x metres caused by increasing the side by 1% is

(a) 0.3xdx m^3 (b) 0.03x m^3 (c) 0.03x^2 m^3 (d) 0.03x^3 m^3

205) 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

206) 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) $\frac{1}{1+x}dx$ (d) $\frac{-1}{1+x}dx$

207) 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

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

(a) -4 (b) -3 (c) -7 (d) 13

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

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

210) 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

211) The area between y^2 = 4x and its latus rectum is

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

212) 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) $\frac{1}{10001}$

213) 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) $-x - \frac{\pi}{2}$

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

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

215) The value of $\frac{\Gamma(n+2)}{\Gamma(n)} = 90$ then n is

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

216) The value of $\int_0^{\frac{\pi}{6}} cos^3 3x dx$

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

217) 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

218) If (x,y, z) = xy +yz +zx, then f_x - f_z is equal to

(a) z - x (b) y - z (c) x - z (d) y - x

219) The value of $\int_0^{\pi} sin^4 x dx$ is

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

220) 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) $\frac{2}{27}$

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

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

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

(a) πa^2 (b) $\frac{\pi a^2}{4}$ (c) $\frac{\pi a^2}{5}$ (d) $\frac{\pi a^2}{6}$

223) If f(x)$f(x) = \int_1^{x} \frac{e^{\sin u}}{u} du, x > 1$ 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

224) The value of $\int_0^1 (sin^{-1}x)^2 dx$

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

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

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

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

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

227) 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

228) The value of $\int_{-1}^2 |x| dx$

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

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

(a) $\frac{\pi}{2}$ (b) π (c) 0 (d) 2

230) The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sin^2x \; cos \; x \; dx$ is

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

231) A binary operation on a set S is a function from

(a) S $\longrightarrow$ S (b) (SxS) $\longrightarrow$ S (c) S$\longrightarrow$ (SxS) (d) (SxS) $\longrightarrow$ (SxS)

232) Subtraction is not a binary operation in

(a) R (b) Z (c) N (d) Q

233) Which one of the following is a binary operation on N?

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

234) In the set R of real numbers '*' is defined as follows. Which one of the following is not a binary operation on R?

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

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

(a) Q^+ (b) Z (c) R (d) C

236) In the set Q define a⊙b = a+b+ab. For what value of y, 3⊙(y⊙5) = 7?

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

237) 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

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) 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

240) 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

241) Which one is the inverse of the statement (pVq)→(p∧q)?

(a) (p∧q)→(pVq) (b) ¬(pvq)→(p∧q) (c) (¬pv¬q)→(¬p∧¬q)

(d) (¬p∧¬q)→(¬pV¬q)

242) Which one is the contrapositive of the statement (pVq)⟶r?

(a) ¬r→(¬p∧¬q) (b) ¬r⟶(p∨q) (c) r⟶(p∧q) (d) p⟶(q∨r)

243) The truth table for (p ∧ q) ∨ ¬q is given below

p	q	(p ∧ q) ∨ (¬q)
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is true?

(a)

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

(b)

(a)	(b)	(c)	(d)
T	F	T	T

(c)

(a)	(b)	(c)	(d)
T	T	F	T

(d)

(a)	(b)	(c)	(d)
T	F	F	F

244) In the last column of the truth table for ¬(p ∨ ¬q) the number of final outcomes of the truth value 'F' are

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

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

(a) ¬ (p∨q) ≡ ¬ p ∧ ¬q (b) ¬ (p∧ q)≡¬p ∨ ¬q (c) ¬ (p ∨ q)≡¬p∨¬q (d) ¬(¬p)≡ p

246)

p	q	(p ∧ q) ⟶ ¬q
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 ∧ q)⟶ ¬p p?

(a)

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

(b)

(a)	(b)	(c)	(d)
F	T	T	T

(c)

(a)	(b)	(c)	(d)
F	F	T	T

(d)

(a)	(b)	(c)	(d)
T	T	T	F

247) The dual of ¬(p V q) V [p V (p ∧ ¬r)] is

(a) ¬(p ∧ q) ∧ [p V (p ∧ ¬r)] (b) (p ∧ q) ∧ [p ∧ (p V ¬r)] (c) ¬(p ∧ q) ∧ [p ∧ (p ∧ r)]

(d) ¬(p ∧ q) ∧ [p ∧ (pV ¬r)]

248) The proposition p ∧ (¬p ∨ q) is

(a) a tautology (b) a contradiction (c) logically equivalent to p ∧ q

(d) logically equivalent to p ∨ q

249) 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 and 1 + 2 = 4

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

(a)

(a)	(b)	(c)	(d)
F	T	F	T

(b)

(a)	(b)	(c)	(d)
T	F	T	F

(c)

(a)	(b)	(c)	(d)
T	T	F	F

(d)

(a)	(b)	(c)	(d)
F	F	T	T

250) Which one of the following is not true?

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

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

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

(d) If p and q are any two statements then p↔q is a tautology.

****

250 x 1 = 250

1) (a) 0

2) (a) 1+ i

3) (a) $\frac{1}{2}|z|^2$

4) (b) $\frac{-1}{i+2}$

5) (c) 2

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

7) (d) $\sqrt{5}+2$

8)

(a) 1

9)

(a) z

10)

(a) $\frac{3}{2} - 2i$

11)

(b) 2

12)

(d) -4

13)

(a) mn

14)

(a) n distinct roots

15)

(a) $-\frac{q}{r}$

16)

(c) $\frac{4}{5}$

17)

(d) $|k| \geq 6$

18)

(a) 2

19)

(c) $a < 0$

20)

(a) one negative and two imaginary zeros

21)

(b) n

22)

(b) 1

23)

(d) 0

24)

(b) 1

25)

(b) imaginary axis

26)

(c) $\frac{-3\pi}{4}$

27)

(a) −110°

28)

(c) x^2+y^2

29)

(d) (1, 1)

30)

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

31)

(b) -1

32)

(c) 1

33)

(d) $-\sqrt{3i}$

34)

(a) $cis\frac{2\pi}{3}$

35)

(a) 1

36)

(c) $\frac{\pi}{2} - x$

37)

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

38)

(c) 0

39)

(a) $|\alpha| \leq \frac{1}{\sqrt{2}}$

40)

(b) $0 \leq x \leq 0$

41)

(a) 0

42)

(c) $\frac{\pi}{10}$

43)

(a) $[1, 2]$

44)

(d) $-\frac{1}{5}$

45)

(d) $tan^{-1}\left(\frac{1}{2}\right)$

46)

(c) $\left[-2, -\sqrt{2}\right] \cup \left[\sqrt{2}, 2\right]$

47)

(b) $\frac{3\pi}{4}$

48)

(b) $x^2 - x - 12 = 0$

49)

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

50)

(c) -1

51)

(c) 0

52)

(b) unique solution

53)

(b) $\frac{1}{\sqrt{5}}$

54)

(d) 3

55)

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

56)

(a) $0, -\frac{40}{9}$

57)

(c) $\frac{2}{\sqrt{3}}$

58)

(d) −35 < m < 15

59)

(c) $\frac{10}{3}$

60)

(c) $\sqrt{10}$

61)

(a) (4, 7)

62)

(a) $x + 2y = 3$

63)

(c) 10

64)

(b) $2\sqrt{5}$

65)

(b) $2(a^2+b^2)$

66)

(a) 2

67)

(d) 9

68)

(c) $\frac{1}{2}$

69)

(c) $\left(\frac{9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

70)

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

71)

(d) $\frac{1}{4}$

72)

(d) 40

73)

(a) 2ab

74)

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

75)

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

76)

(b) $x = -1$

77)

(c) (5, -2)

78)

(c) an ellipse

79)

(c) 0

80)

(b) (-3, 2)

81)

(d) 0

82)

(c) $[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 0$

83)

(a) $|\vec{a}| \left|\vec{b}\right| |\vec{c}|$

84)

(b) $\vec{b}$

85)

(a) 1

86)

(c) π

87)

(a) $\frac{\pi}{6}$

88)

(a) 0

89)

(a) 81

90)

(b) $\frac{3\pi}{4}$

91)

(c) 64 cubic units

92)

(a) 0°

93)

(b) parallel

94)

(d) $-17\hat{i}-21\hat{j}-97\hat{k}$

95)

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

96)

(b) (-6, 7)

97)

(c) 45°

98)

(d) (5,1,1)

99)

(b) 1

100)

(a) $\frac{\sqrt{7}}{2\sqrt{2}}$

101)

(b) $c=\pm\sqrt{3}$

102)

(c) (1, -2, -1) and (1, 4, -2)

103)

(d) 3, -9

104)

(c) $-\frac{1}{2}, -2$

105)

(a) $2\sqrt{3}$

106)

(b) 4

107)

(c) I_3

108)

(b) $\frac{1}{9}$

109)

(c) $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$

110)

(d) $2A^{-1}$

111)

(b) -80

112)

(d) 11

113)

(d) -1

114)

(b) adj(AB) = (adj A)(adj B)

115)

(a) $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$

116)

(b) $(A^T)^2$

117)

(d) $\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

118)

(a) $\frac{-4}{5}$

119)

(b) $\left(\cos^2 \frac{\theta}{2}\right) A^T$

120)

(d) 1

121)

(c) 19

122)

(b) $\begin{bmatrix} -6 & 5 \\ -2 & -10 \end{bmatrix}$

123)

(a) 1

124)

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

125)

(d) (i), (ii) and (iv)

126)

(b) consistent

127)

(d) $\frac{\pi}{4}$

128)

(d) $\lambda = 7, \mu = -5$

129)

(d) 1

130)

(a) $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$

131)

(a) 3 cm/s

132)

(b) $\frac{4}{25}$ radians /sec

133)

(b) $t = \dfrac{1}{3}$

134)

(b) 2.5

135)

(a) (4,11)

136)

(b) -4

137)

(c) $\dfrac{\sqrt{3}}{12}$

138)

(d) $y = \pm 3$

139)

(c) $\dfrac{\pi}{2}$

140)

(d) ∞

141)

(c) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$

142)

(d) 2

143)

(c) 3

144)

(d) 9

145)

(b) $x = \frac{\pi}{2}$

146)

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

147)

(c) $\left(3, \sqrt{5}\right)$

148)

(a) 100

149)

(d) has no points of inflection

150)

(c) (1,0)

151)

(a) 2, 3

152)

(b) $\frac{d^2y}{dx^2} + y = 0$

153)

(c) 1,1

154)

(a) 2

155)

(b) $\frac{d^2y}{dx^2} - y = 0$

156)

(c) y = kx

157)

(c) parabola

158)

(b) $y = ce^{-\int pdx}$

159)

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

160)

(c) $\frac{1}{x}$

161)

(c) 1

162)

(c) p > q

163)

(a) $y + \sin^{-1} x = c$

164)

(a) $y = Ce^{x^2}$

165)

(b) $e^x+e^{-y}=C$

166)

(c) $\frac{1}{2^x} - \frac{1}{2^y} = C$

167)

(b) $\phi\left(\frac{y}{x}\right) = kx$

168)

(d) cot x

169)

(b) n,n+1

170)

(d) 0

171)

(a) $\frac{1}{x+1}$

172)

(a) P=Ce^{kt}

173)

(b) P=ce^{-kt}

174)

(b) -2

175)

(a) y=x^{3}+2

176)

(b) mean exists but variance does not exist

177)

(d) $\frac{l}{2}, \frac{l^2}{12}$

178)

(b) $-\frac{19}{6}$

179)

(d) 4

180)

(d) 2

181)

(b) 2i- n, i = 0,1,2... n

182)

(d) 16 and 24

183)

(c) 40.75,40

184)

(b) 1.1

185)

(a) $\frac{11}{243}$

186)

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

187)

(d) $\left(\frac{10}{5}\right)\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$

188)

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

189)

(b) 2

190)

(a) I and II

191)

(a) 1

192)

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

193)

(d) 0.96

194)

(b) 0.25

195)

(a) $\frac{57}{20^3}$

196)

(b) 0.4%

197)

(b) $\frac{1}{5}$

198)

(b) 2xu

199)

(d) 1

200)

(c) yx^{y-1}

201)

(b) $(1 + xy)e^{xy}$

202)

(d) 4.8 cu.cm

203)

(b) $12x_o$ dx

204)

(c) $0.03x^2$ m^3

205)

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

206)

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

207)

(d) 4π

208)

(c) -7

209)

(c) 2

210)

(c) x cos x

211)

(c) $\frac{8}{3}$

212)

(b) $\frac{1}{10100}$

213)

(b) $-x+\frac{\pi}{2}$

214)

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

215)

(d) 9

216)

(b) $\frac{2}{9}$

217)

(d) 0

218)

(a) z - x

219)

(b) $\frac{3\pi}{8}$

220)

(d) $\frac{2}{27}$

221)

(d) 2

222)

(d) $\frac{\pi a^2}{6}$

223)

(c) 9

224)

(d) $\frac{\pi^2}{4} - 2$

225)

(b) $\frac{3\pi a^4}{16}$

226)

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

227)

(a) $\frac{\pi}{6}$

228)

(c) $\frac{5}{2}$

229)

(c) 0

230)

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

231)

(b) (SxS) $\longrightarrow$ S

232)

(c) N

233)

(b) Multiplication

234)

(d) a*b = a^b

235)

(b) Z

236)

(b) y = $\frac{-2}{3}$

237)

(c) both commutative and associative

238)

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

239)

(c) Chennai is in China or $\sqrt{2}$ is an integer

240)

(b) 8

241)

(d) (¬p∧¬q)→(¬p∨¬q)

242)

(a) ¬r→(¬p∧¬q)

243)

(c)

(a)	(b)	(c)	(d)
T	T	F	T

244)

(c) 3

245)

(c) ¬ (p ∨ q)≡¬p∨¬q

246)

(b)

(a)	(b)	(c)	(d)
F	T	T	T

247)

(d) ¬(p ∧ q) ∧ [p ∧ (pV ¬r)]

248)

(c) logically equivalent to p ∧ q

249)

(a)

(a)	(b)	(c)	(d)
F	T	F	T

250)

(d) If p and q are any two statements then p↔q is a tautology.

RAVI MATHS TUITION CENTER , WHATSAPP - 8056206308

ANNUAL MINIMUM MATERIALS 2 MARKS

12th Standard

Maths

FREE ANSWERS UPLOAD SOON IN MY YOUTUBE CHANNEL NAME - RAVI MATHS TUITION CENTER

DO DAILY 15 QUESTIONS. IN 10 DAYS YOU CAN FINISH 2 MARKS ONE TIME REVISION. 150 x 2 = 300

1) If A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is non-singular, find A^{-1}.

2) If adj(A) = $\begin{bmatrix} 2 & -4 & 2 \\ -3 & 12 & -7 \\ -2 & 0 & 2 \end{bmatrix}$, find A.

3) If adj(A) = $\begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$, find A^{-1}.

4) Find adj(adj (A)) if adj A = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ -1 & 0 & 1 \end{bmatrix}$.

5) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}$ by reducing it to a row-echelon form.

6) Find the inverse of the non-singular matrix A = $\begin{bmatrix} 0 & 5 \\ -1 & 6 \end{bmatrix}$, by Gauss-Jordan method.

7) Solve the following system of linear equations, using matrix inversion method:
$5x + 2y = 3$, $3x + 2y = 5$.

8) Solve, by Cramer's rule, the system of equations
$x_1 - x_2 = 3$, $2x_1 + 3x_2 + 4x_3 = 17$, $x_2 + 2x_3 = 7$.

9) Test for consistency of the following system of linear equations and if possible solve:
$x - y + z = -9$, $2x - 2y + 2z = -18$, $3x - 3y + 3z + 27 = 0$.

10) Find the rank of the following matrices by minor method:
$\begin{bmatrix} 1 & -2 & -1 & 0 \\ 3 & -6 & -3 & 1 \end{bmatrix}$

11) Find the rank of the following matrices which are in row-echelon form :
$\begin{bmatrix} 6 & 0 & -9 \\ 0 & 2 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

12) Simplify the following

$i^{1947} + i^{1950}$

13) If z_i = 2− i and z_2 = -4+3i , find the inverse of $z_1 z_2$ and $\frac{z_1}{z_2}$

14) Find the following $\left|\frac{2+i}{-1+2i}\right|$

15) Which one of the points i, −2 + i, and 3 is farthest from the origin?

16) Find the square root of 6−8i .

17) If |z| = 3, show that $7 \leq |z+6-8i| \leq 13$.

18) Write in polar form of the following complex numbers

$2+i2\sqrt{3}$

19) Simplify the following

$\sum_{n=1}^{12} i^n$

20) Simplify the following

$i\, i^2 i^3 \ldots i^{2000}$

21) Simplify the following

$\sum_{n=1}^{10} i^{n+50}$.

22) Evaluate the following if z = 5−2i and w = −1+3i

$z^2 + 2zw + w^2$

23) Write the following in the rectangular form:

$\overline{3i} + \frac{1}{2-i}$.

24) Find the modulus of the following complex number $\frac{2-i}{1+i} + \frac{1-2i}{1-i}$

25) Find the square roots of −6+8i

26) Find the square roots of

−5 −12i .

27) Write in polar form of the following complex numbers

-2 - i2

28) Write in polar form of the following complex numbers

$\frac{i-1}{cos\frac{\pi}{3}+isin\frac{\pi}{3}}$

29) Find the following $\left|\overline{(1+i)}(2+3i)(4i-3)\right|$

30) Findthe polar form of $-3\sqrt{2}+3\sqrt{2}i$

31) Simplify: $\left[\frac{1-\cos\frac{\pi}{10}+i\sin\frac{\pi}{10}}{1-\cos\frac{\pi}{10}-i\sin\frac{\pi}{10}}\right]^{10}$

32) Construct a cubic equation with roots 1, 2 and 3

33) If α, β and γ are the roots of the cubic equation $x^3+2x^2+3x+4 = 0$, form a cubic equation whose roots are, 2α, 2β, 2γ

34) If $x^2+2(k+2)x+9k = 0$ has equal roots, find k.

35) Obtain the condition that the roots of $x^3+ px^2+ qx + r = 0$ are in A.P.

36) If α, β and γ are the roots of the cubic equation $x^3+ 2x^2+ 3x + 4 = 0$, form a cubic equation whose roots are $\frac{1}{\alpha}, \frac{1}{\beta}, \frac{1}{\gamma}$

37) If α, β and γ are the roots of the cubic equation $x^3+ 2x^2+ 3x + 4 = 0$, form a cubic equation whose roots are −α, -β, -γ

38) Construct a cubic equation with roots 2, $\frac{1}{2}$ and 1

39) Find the principal value of

$Sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$

40) Find the period and amplitude of y = sin 7x

41) Sketch the graph of y = $\sin(\frac{1}{3}x)$ for $0\leq x < 6\pi$.

42) For what value of x does sinx = $\sin^{-1}x$?

43) Find the principal value of $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

44) Find all values of x such that $-6\pi \leq x \leq 6\pi$ and cos x = 0

45) State the reason for $\cos^{-1}[cos(-\frac{\pi}{6})] \neq \frac{\pi}{6}$.

46) Is $\cos^{-1}(-x) = \pi-\cos^{-1}(x)$ true? Justify your answer.

47) Find the value of

$2cos^{-1}\left(\frac{1}{2}\right) + sin^{-1}\left(\frac{1}{2}\right)$

48) Find the principal value of $\tan^{-1}(\sqrt{3})$

49) Find the value of

$tan(tan^{-1}(\frac{7\pi}{4}))$

50) Find the value of $tan^{-1}\left(\sqrt{3}\right) - sec^{-1}(-2)$

51) Prove that $\frac{\pi}{2} \leq sin^{-1}x + 2cos^{-1}x \leq \frac{3\pi}{2}$

52) Prove that

$\tan^{-1}\frac{1}{2} + tan^{-1}\frac{1}{3} = \frac{\pi}{4}$

53) Solve $\tan^{-1}\left(\frac{1-x}{1+x}\right) = \frac{1}{2}tan^{-1}$ x for x > 0

54) Solve $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$, if $6x^2 < 1$

55) Solve $tan^{-1}\left(\frac{x-1}{x-2}\right) + tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}$

56) Find the value of
$cos^{-1}\left(\frac{1}{2}\right) + sin^{-1}(-1)$

57) Find the value of $cos^{-1}\left(cos\frac{\pi}{7}cos\frac{\pi}{17} - sin\frac{\pi}{7}sin\frac{\pi}{17}\right)$.

58) Find the value, if it exists. If not, give the reason for non-existence
$tan^{-1}\left(sin\left(-\frac{5\pi}{2}\right)\right)$

59) Find the value of $cos\left[\frac{1}{2}cos^{-1}\left(\frac{1}{8}\right)\right]$

60) Prove that $2tan^{-1}\frac{1}{2} + tan^{-1}\frac{1}{7} = tan^{-1}\frac{31}{17}$

61) Prove that $tan^{-1}\left(\frac{1}{7}\right) + tan^{-1}\left(\frac{1}{13}\right) = tan^{-1}\left(\frac{2}{9}\right)$

62) Find the general equation of a circle with centre (-3, -4) and radius 3 units.

63) Determine whether $x + y - 1 = 0$ is the equation of a diameter of the circle $x^2 + y^2 - 6x + 4y + c = 0$ for all possible values of c .

64) Examine the position of the point (2, 3) with respect to the circle $x^2 + y^2 - 6x - 8y + 12 = 0$.

65) Find the centre and radius of the circle $3x^2 + (a + 1)y^2 + 6x - 9y + a + 4 = 0$.

66) Find the equation of the circle with centre (2, -1) and passing through the point (3, 6) in standard form.

67) Find the equation of the circle with centre (2, 3) and passing through the intersection of the lines $3x - 2y - 1 = 0$ and $4x + y - 27 = 0$.

68) If $y = 2\sqrt{2}x + c$ is a tangent to the circle $x^2 + y^2 = 16$, find the value of c.

69) Find the equation of the parabola with focus $\left(-\sqrt{2}, 0\right)$ and directrix $x = \sqrt{2}$.

70) Find the equation of the ellipse with foci (±2, 0), vertices (±3, 0)

71) Find the vertices, foci for the hyperbola $9x^2 - 16y^2 = 144$.

72) Find the vertex, focus, equation of directrix and length of the latus rectum of the following:
$y^2 = 16x$

73) Identify the type of the conic for the following equations:
(1) $16y^2 = -4x^2 + 64$
(2) $x^2 + y^2 = -4x - y + 4$
(3) $x^2 - 2y = x + 3$
(4) $4x^2 - 9y^2 - 16x + 18y - 29 = 0$

74) Find centre and radius of the following circles.
$x^2 + y^2 + 6x - 4y + 4 = 0$

75) Find centre and radius of the following circles.
$2x^2 + 2y^2 - 6x + 4y + 2 = 0$

76) Find the equation of the parabola in each of the cases given below:
vertex (1, -2) and focus(4,-2)

77) A particle is acted upon by the forces $(3\hat{i} - 2\hat{j} + 2\hat{k})$ and $(2\hat{i} + \hat{j} - \hat{k})$ is displaced from the point (1, 3, -1) to the point (4, 1, -λ). If the work done by the forces is 16 units, find the value of λ.

78) Prove by vector method that if a line is drawn from the centre of a circle to the midpoint of a chord, then the line is perpendicular to the chord.

79) Prove by vector method that the median to the base of an isosceles triangle is perpendicular to the base.

80) Prove by vector method that an angle in a semi-circle is a right angle.

81) Using vector method, prove that if the diagonals of a parallelogram are equal, then it is a rectangle

82) If $\vec{a} = -\hat{3i} - \hat{j} + 5\hat{k}$, $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$, $\vec{c} = 4\hat{i} - 4\hat{k}$ *and* find $\vec{a}.(\vec{b} \times \vec{c})$

83) Find the volume of the parallelepiped whose coterminous edges are represented by the vectors $-6\hat{i} + 14\hat{j} + 10\hat{k}, 14\hat{i} - 10\hat{j} - 6\hat{k}$ and $2\hat{i} + 4\hat{j} - 2\hat{k}$

84) For any vector $\vec{a}$, prove that $\hat{i} \times (\vec{a} \times \hat{i}) + \hat{j} \times (\vec{a} \times \hat{j}) + \hat{k} \times \vec{a} \times \hat{k} = 2\vec{a}$.

85) Prove that $[\vec{a} - \vec{b}, \vec{b} - \vec{c}, \vec{c} - \vec{a}]$ = 0

86) Find the vector and Cartesian equations of the plane passing through the point with position vector $4\hat{i} + 2\hat{j} - 3\hat{k}$ and normal to vector $2\hat{i} - \hat{j} + \hat{k}$

87) Verify whether the line $\frac{x-3}{-4} = \frac{y-4}{-7} = \frac{z+3}{12}$ lies in the plane 5x-y+z = 8.

88) Find the angle between the planes $\vec{r}.(\hat{i} + \hat{j} - 2\hat{k})$ = 3 and 2x - 2y + z =2

89) Forces $2\hat{i} + 7\hat{j}$, $2\hat{i} - 5\hat{j} + 6\hat{k}$, $-\hat{i} + 2\hat{j} - \hat{k}$ act at a point P whose position vector is $4\hat{i} - 3\hat{j} - 2\hat{k}$. Find the vector moment of the resultant of these forces acting at P about this point Q whose position vector is $6\hat{i} + \hat{j} - 3\hat{k}$

90) For what value of m the vectors $\vec{a}$ and $\vec{b}$ perpendicular to each other.
$(i)\ \vec{a} = m\hat{i} + 2\hat{j} + \hat{k}\ and\ \vec{b} = 4\hat{i} - 9\hat{j} + 2\hat{k}$
$(ii)\ \vec{a} = 5\hat{i} - 9\hat{j} + 2\hat{k}\ and\ \vec{b} = m\hat{i} + 2\hat{j} + \hat{k}$

91) Find the projection of the vector $7\hat{i} + \hat{j} - 4\hat{k}$ on $2\hat{i} + 6\hat{j} + 3\hat{k}$

92) If $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$ prove that $(\vec{c} \times \vec{a}) \times \vec{b} = \vec{0}$

93) If the volume of a cube of side length x is v = x^3. Find the rate of change of the volume with respect to x when x = 5 units.

94) Find the absolute extrema of the following function on the given closed interval
f(x) = x^2 -12x + 10; [1, 2]

95) Find the absolute extrema of the following functions on the given closed interval.

$f(x) = 6x^{\frac{3}{4}} - 3x^{\frac{1}{3}}; [-1, 1]$

96) Find the absolute extrema of the following functions on the given closed interval.

$f(x) = 2cosx + sin2x; \left[0, \frac{\pi}{2}\right]$

97) Find the asymptotes of the following curve $f(x) = \frac{x^2}{x^2-1}$

98) Compute the limit $\lim_{x \to a}\left(\frac{x^n - a^n}{x-a}\right)$

99) Evaluate the limit $\lim_{x \to 0}\left(\frac{\sin mx}{x}\right)$

100) $\lim_{\theta \to 0}\left(\frac{1-\cos m\theta}{1-\cos n\theta}\right)$ =1, then prove that, $m = \pm n$

101) Use the linear approximation to find approximate values of $(123)^{\frac{2}{3}}$

102) Use the linear approximation to find approximate values of $\sqrt[4]{15}$

103) Use the linear approximation to find approximate values of $\sqrt[3]{26}$

104) Let w(x, y) = xy+$\frac{e^y}{y^2+1}$ for all (x, y) ∈ R^2. Calculate $\frac{\partial^2 w}{\partial y \partial x}$ and $\frac{\partial^2 w}{\partial x \partial y}$

105) Find the partial derivatives of the following functions at the indicated point.

f(x, y) = $3x^2 - 2xy + y^2 + 5x + 2$, (2,-5)

106) If U(x, y, z) = log ($x^3 + y^3 + z^3$), find $\frac{\partial U}{\partial x} + \frac{\partial U}{\partial y} + \frac{\partial U}{\partial z}$

107) If v(x, y, z) = $x^3 + y^3 + z^3 + 3xyz$, show that $\frac{\partial^2 v}{\partial y \partial z} = \frac{\partial^2 v}{\partial z \partial y}$

108) If u(x, y, z) = xy^2z^3, x = sin t, y = cos t, z = 1+ e^{2t}, find $\frac{du}{dt}$

109) If w(x, y) = $6x^2 - 3xy + 2y^2$, x = e^x, y = cos s, s ∈ R find $\frac{dw}{ds}$, and evaluate at s = 0

110) If u(x, y) = $\frac{x^2+y^2}{\sqrt{x+y}}$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{3}{2}u$

111) If f (x, y) = $2x^3 - 11x^2y + 3y^3$, prove that $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = 3f$

112) Evaluate $\int_1^2 \frac{x}{(x+1)(x+2)}dx$

113) Evaluate: $\int_{\frac{\pi}{2}}^{\frac{\pi}{2}}$ x cos x dx.

114) Evaluate the following definite integrals:

$\int_{-1}^{1} \frac{dx}{x^2+2x+5}$

115) Evaluate $\int_0^{\frac{\pi}{2}}$ ($\sin^2$ x + $\cos^4$ x) dx

116) Find the values of the following:

$\int_0^{\frac{\pi}{2}} \sin^5 x \cos^4 x dx$

117) Find the values of the following:

$\int_0^{\frac{\pi}{2}} sin^4 x x cos^6 x \quad dx$

118) Evaluate the following

$\int_0^{\pi/2} sin^{10}x \quad dx$

119) Evaluate the following

$\int_0^{\frac{\pi}{2}} sin^2xcos^4xdx$

120) Show that Γ(n) = $2\int_0^{\infty} e^{-x^2}x^{2n-1}dx$

121) Find, by integration, the volume of the solid generated by revolving about y-axis the region bounded by the curves y = log x, y = 0, x = 0 and y = 2.

122) Evaluate $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}dx$

123) Prove that $\int_0^{\frac{\pi}{2}} \frac{f(\sin x)}{f(\sin x)+f(\cos x)}dx = \frac{\pi}{4}$

124) For each of the following differential equations, determine its order, degree (if exists)

$\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = xsin\left(\frac{d^2y}{dx^2}\right)$

125) For each of the following differential equations, determine its order, degree (if exists)

$y\left(\frac{dy}{dx}\right) = \frac{x}{\left(\frac{dy}{dx}\right)+\left(\frac{dy}{dx}\right)^3}$

126) For each of the following differential equations, determine its order, degree (if exists)

$x^2\frac{d^2y}{dx^2} + \left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{1}{2}} = 0$

127) Find the differential equation corresponding to the family of curves represented by the equation y = Ae^{8x} + Be^{-8x}, where A and B are arbitrary constants.

128) Find the differential equation of the curve represented by xy = ae^x + be^{-x} + x^2.

129) Show that each of the following expressions is a solution of the corresponding given differential equation.

y = ae^x + be^{-x}; y − y = 0

130) Find the differential equation for the family of all straight lines passing through the origin.

131) Form the differential equation by eliminating the arbitrary constants A and B from y = A cos x + B sin x.

132) Show that y = mx + $\frac{7}{m}$, m ≠ 0 is a solution of the differential equation xy'+7$\frac{1}{y'}$-y = 0.

133) Show that y = a cos(log x) + bsin (log x), x > 0 is a solution of the differential equation x^2 y" + xy'+y = 0.

134) Solve: $\frac{dy}{dx}$ = $(3x+y+4)^2$.

135) solve: x dy + y dx = xy dx

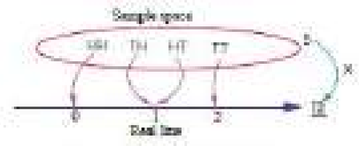
136) Three fair coins are tossed simultaneously. Find the probability mass function for number of heads occurred.

137) Suppose two coins are tossed once. If X denotes the number of tails,

(i) write down the sample space

(ii) find the inverse image of 1

(iii) the values of the random variable and number of elements in its inverse images



A mapping $X(.)$ from S to $\mathbb{R}$

138) The probability distribution of a random variable X is given below.

X	0	1	2	3
P(X)	K	$\frac{k}{2}$	$\frac{k}{4}$	$\frac{k}{8}$

i) Find k

ii) P(X > 2)

139) Is it possible that the mean of a binomial distribution is 15 and its standard deviation is 5?

140) Let X be a continuous random variable with p.d.f

$$f(x) = \begin{cases} 2x, 0 \le x \le 1 \\ 0, otherwise \end{cases}.$$

Find E(X)

141) Compute P(X = k) for the binomial distribution, B(n, p) where

$n = 10, p = \frac{1}{5}, k = 4$

142) The mean of a binomial distribution is 6 and its standard deviation is 3. Is this statement true or false?

143) Examine the binary operation (closure property) of the following operations on the respective sets (if it is not, make it binary)

$a*b = a + 3ab - 5b^2; \forall a,b \in Z$

144) Let A = $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ be any two boolean matrices of the same type. Find A∨B and A∧B.

145) How many rows are needed for following statement formulae?

$p \vee \neg t \wedge (p \vee \neg s)$

146) How many rows are needed for following statement formulae?

$((p \wedge q) \vee (\neg r \vee \neg s)) \wedge (\neg t \wedge v))$

147) Construct the truth table for the following statements.

$(p \vee q) \vee \neg q$

148) Construct the truth table for the following statements.

$(\neg p \longrightarrow r) \wedge (p \leftrightarrow q)$

149) Show that p v (~p) is a tautology.

150) Show that p v (q ∧ r) is a contingency.

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RAVI MATHS TUITION CENTER , WHATSAPP - 8056206308

ANNUAL MINIMUM MATERIALS 3 MARKS

12th Standard

Maths

ANSWERS AVAILABLE MY YOUTUBE CHANNEL NAME - RAVI MATHS TUITION CENTER

DO DAILY 10 QUESTIONS. IN 14 DAYS YOU CAN FINISH 3 MARKS ONE TIME REVISION. 140 x 3 = 420

1) If A = $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$, verify thatA(adj A)=(adj A)A = |A| I_3.

2) Find a matrix A if adj(A) = $\begin{bmatrix} 7 & 7 & -7 \\ -1 & 11 & 7 \\ 11 & 5 & 7 \end{bmatrix}$.

3) If A = $\begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix}$, show that $A^2 - 3A - 7I_2 = O_2$. Hence find A^{-1}.

4) If A = $\begin{bmatrix} 8 & -4 \\ -5 & 3 \end{bmatrix}$, verify that A(adj A) = (adj A)A = $|A|I_2$.

5) If A = $\begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} -1 & -3 \\ 5 & 2 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$

6) Decrypt the received encoded message $\begin{bmatrix} 2 & -3 \end{bmatrix}\begin{bmatrix} 20 & 4 \end{bmatrix}$ with the encryption matrix $\begin{bmatrix} -1 & -1 \\ 2 & 1 \end{bmatrix}$ and the decryption matrix as its inverse, where the system of codes are described by the numbers 1 - 26 to the letters A - Z respectively, and the number 0 to a blank space.

7) Find the rank of the matrix $\begin{bmatrix} 2 & -2 & 4 & 3 \\ -3 & 4 & -2 & -1 \\ 6 & 2 & -1 & 7 \end{bmatrix}$ by reducing it to an echelon form.

8) Find the inverse of A = $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 1 \\ 2 & 1 & 2 \end{bmatrix}$ by Gauss-Jordan method.

9) Solve the following systems of linear equations by Gaussian elimination method:
$2x - 2y + 3z = 2$, $x + 2y - z = 3$, $3x - y + 2z = 1$

10) Investigate for what values of λ and μ the system of linear equations $x + 2y + z = 7$, $x + y + \lambda z = \mu$, $x + 3y - 5z = 5$ has
(i) no solution (ii) a unique solution (iii) an infinite number of solutions

11) Find the value of k for which the equations
$kx - 2y + z = 1$, $x - 2ky + z = -2$, $x - 2y + kz = 1$ have

(i) no solution
(ii) unique solution
(iii) infinitely many solution

12) Determine the values of λ for which the following system of equations (3λ − 8)x + 3y + 3z = 0, 3x + (3λ − 8)y + 3z = 0, 3x + 3y + (3λ − 8)z = 0. has a non-trivial solution.

13) Solve the following system of homogenous equations.
2x + 3y − z = 0, x − y − 2z = 0, 3x + y + 3z = 0

14) Find the value of the real numbers x and y, if the complex number (2+i)x+(1−i)y+2i −3 and x+(−1+2i)y+1+i are equal

15) Simplify $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3$ into rectangular form

16) If $\frac{z+3}{z-5i} = \frac{1+4i}{2}$, find the complex number z in the rectangular form

17) The complex numbers u, v, and w are related by $\frac{1}{u} = \frac{1}{v} + \frac{1}{w}$ If v = 3−4i and w = 4+3i, find u in rectangular form.

18) If |z| = 2 show that $3 \le |z + 3 + 4i| \le 7$

19) If |z| = 1, show that $2 \le |z^2 - 3| \le 4$

20) If $\omega \neq 1$ is a cube root of unity, then the show that
$$\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2} + \frac{a + b\omega + c\omega^2}{c + a\omega + b\omega^2} = -1$$

21) Show that |z+2−i|< 2 represents interior points of a circle. Find its centre and radius.

22) If z = x + iy and arg$\left(\frac{z-1}{z+1}\right) = \frac{\pi}{2}$, then show that $x^2 + y^2 = 1$.

23) Simplify $\left(\frac{1+cos2\theta+isin2\theta}{1+cos2\theta-isin2\theta}\right)^{30}$

24) If $z = (cos\ \theta + isin\ \theta)$, show that $z^n + \frac{1}{z^n} = 2cos\ n\theta$ and $z^n - \frac{1}{z^n} = 2i\ sin\ n\theta$

25) Obtain the Cartesian equation for the locus of z = x + iy in each of the following cases:
$|z - 4|^2 - |z - 1|^2 = 16$

26) Show that the complex numbers 3 + 2i, 5i, -3 + 2i and -i form a square.

27) Simplify: $\frac{(\cos 2\theta - i \sin 2\theta)^4 (\cos 4\theta + i \sin 4\theta)^{-5}}{(\cos 3\theta + i \sin 3\theta)^{-2} (\cos 3\theta - i \sin 3\theta)^{-9}}$

28) If $(x_1 + iy_1)(x_2 + iy_2)(x_3 + iy_3)\ldots(x_n + iy_n) = a + ib$, show that
$\sum_{r=1}^{n} tan^{-1}\left(\frac{y_r}{x_r}\right) = tan^{-1}\left(\frac{b}{a}\right) + 2k\pi, k\epsilon Z$

29) If $2\ cos\ \alpha = x + \frac{1}{x}$ and $2\ cos\ \beta = y + \frac{1}{y}$, show that $\frac{x}{y} + \frac{y}{x} = 2cos\,(\alpha - \beta)$

30) If $2cos\ \alpha = x + \frac{1}{x}$ and $2cos\ \beta = y + \frac{1}{y}$, show that $xy - \frac{1}{xy} = 2isin\,(\alpha + \beta)$

31) If $2cos\ \alpha = x + \frac{1}{x}$ and $2cos\ \beta = y + \frac{1}{y}$, show that $\frac{x^m}{y^n} - \frac{y^n}{x^m} = 2isin\,(m\alpha - n\beta)$

32) Solve the equation $3x^3 - 16x^2 + 23x - 6 = 0$ if the product of two roots is 1.

33) Find the sum of squares of roots of the equation $2x^4 - 8x^3 + 6x^2 - 3 = 0$.

34) Solve the equation $x^4 - 9x^2 + 20 = 0$.

35) Solve the equation $x^3 - 3x^2 - 33x + 35 = 0$.

36) Solve the cubic equation : $2x^3 - x^2 - 18x + 9 = 0$ if sum of two of its roots vanishes.

37) Solve the equation $7x^3 - 43x^2 = 43x - 7$

38) Solve the following equations,

$\sin^2 x - 5 \sin x + 4 = 0$

39) Solve: $8x^{\frac{3}{2x}} - 8x^{\frac{-3}{2x}} = 63$

40) Show that the polynomial $9x^9 + 2x^5 - x^4 - 7x^2 + 2$ has at least six imaginary roots.

41) Solve: $2\sqrt{\frac{x}{a}} + 3\sqrt{\frac{a}{x}} = \frac{b}{a} + \frac{6a}{b}$

42) Find all real numbers satisfying $4^x - 3(2^{x+2}) + 2^5 = 0$

43) Discuss the maximum possible number of positive and negative roots of the polynomial equation $9x^9 - 4x^8 + 4x^7 - 3x^6 + 2x^5 + x^3 + 7x^2 + 7x + 2 = 0$

44) Find the exact number of real zeros and imaginary of the polynomial $x^9 + 9x^7 + 7x^5 + 5x^3 + 3x$.

45) Find the value of $\sin^{-1}\left(sin\frac{5\pi}{9}cos\frac{\pi}{9} + cos\frac{5\pi}{9}sin\frac{\pi}{9}\right)$.

46) Find the domain of $\cos^{-1}\left(\frac{2+sinx}{3}\right)$

47) Evaluate $sin\left[sin^{-1}\left(\frac{3}{5}\right) + sec^{-1}\left(\frac{5}{4}\right)\right]$

48) If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$ and $0 < x, y, z < 1$, show that $x^2 + y^2 + z^2 + 2xyz = 1$

49) Solve $cos\left(sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)\right) = sin\left\{cot^{-1}\left(\frac{3}{4}\right)\right\}$

50) Prove that

$tan^{-1}(\frac{2}{11}) + tan^{-1}(\frac{7}{24}) = tan^{-1}(\frac{1}{2})$

51) Solve $sin^{-1}\frac{5}{x} + sin^{-1}\frac{12}{x} = \frac{\pi}{2}$

52) Find the value of $cos^{-1}\left(cos\left(\frac{4\pi}{3}\right)\right) + cos^{-1}\left(cos\left(\frac{5\pi}{4}\right)\right)$

53) Find the value of

$cos\left(sin^{-1}\left(\frac{4}{5}\right) - tan^{-1}\left(\frac{3}{4}\right)\right)$

54) Find the value of

$tan\left(sin^{-1}\frac{3}{5} + cot^{-1}\frac{3}{2}\right)$

55) Solve $cot^{-1}x - cot^{-1}(x+2) = \frac{\pi}{12}, x > 0$

56) Prove that $tan^{-1}\left(\frac{m}{n}\right) - tan^{-1}\left(\frac{m-n}{m+n}\right) = \frac{\pi}{4}$

57) Prove that $2\tan^{-1}x = \cos\left(\frac{1-x^2}{1+x^2}\right), x \geq 0$

58) Solve $\tan^{-1}\left(\frac{x-1}{x-2}\right) + \tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}$

59) Find the equations of the tangent and normal to the circle $x^2 + y^2 = 25$ at P(-3, 4).

60) Find the equation of the ellipse in each of the cases given below:
foci (±3, 0), e = $\frac{1}{2}$

61) Find the equation of the ellipse in each of the cases given below:
foci (0, ±4) and end points of major axis are (0, ±5).

62) Find the equation of the ellipse in each of the cases given below:
length of latus rectum 8, eccentricity = $\frac{3}{5}$, centre (0, 0) and major axis on x -axis.

63) A particle acted upon by constant forces $2\hat{j} + 5\hat{j} + 6\hat{k}$ and $-\hat{i} - 2\hat{j} - \hat{k}$ is displaced from the point (4, −3, −2) to the point (6, 1, −3) . Find the total work done by the forces.

64) Find the magnitude and the direction cosines of the torque about the point (2, 0, -1) of a force $(2\hat{i} + \hat{j} - \hat{k})$, whose line of action passes through the origin

65) Find the magnitude and direction cosines of the torque of a force represented by $3\hat{i} + 4\hat{j} - 5\hat{k}$ about the point with position vector $2\hat{i} - 3\hat{j} + 4\hat{k}$ acting through a point whose position vector is $4\hat{i} + 2\hat{j} - 3\hat{k}$.

66) The volume of the parallelepiped whose coterminus edges are
$7\hat{i} + \lambda\hat{j} - 3\hat{k}, \hat{i} + 2\hat{j} - \hat{k}$, $-3\hat{i} + 7\hat{j} + 5\hat{k}$ is 90 cubic units. Find the value of λ.

67) Prove that $[\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}]$ = $[\vec{a}, \vec{b}, \vec{c}]^2$

68) Find the angle between the lines $\vec{r} = (\hat{i} + 2\hat{j} + 4\hat{k}) + t(2\hat{i} + 2\hat{j} + \hat{k})$ and the straight line passing through the points (5, 1, 4) and (9, 2, 12)

69) Show that the straight line passing through the points A (6, 7, 5) and B(8, 10, 6) is perpendicular to the straight line passing through the points C(10, 2, -5) and D(8, 3, -4)

70) Find the equation of the plane passing through the intersection of the planes
$\vec{r}.(\hat{i} + \hat{j} + \hat{k}) + 1 = 0$ and $\vec{r}.(2\hat{i} - 3\hat{j} + 5\hat{k}) = 2$ and the point (-1, 2, 1).

71) Find the tangent and normal to the following curves at the given points on the curve
x = cos t, y = 2sin t^2 at t = $\frac{\pi}{3}$

72) Compute the value of 'c' satisfied by the Rolle's theorem for the function f (x) = $x^2 (1 - x)^2$, x ∈ [0,1]

73) Evaluate: $\lim_{x\to 0^+}\left(\frac{1}{x} - \frac{1}{e^x-1}\right)$.

74) Evaluate the following limit, if necessary use l 'Hôpital Rule

$\lim_{x \to 1^+} \left(\frac{2}{x^2-1} - \frac{x}{x-1} \right)$

75) Evaluate the following limit, if necessary use l 'Hôpital Rule

$\lim_{x \to \frac{\pi}{2}} (sin x)^{tan x}$

76) Evaluate the following limit, if necessary use l 'Hôpital Rule

$\lim_{x \to 0^+} (cos x)^{\frac{1}{x^2}}$

77) Find the absolute maximum and absolute minimum values of the function f (x) = $2x^3 + 3x^2 - 12x$ on [−3, 2]

78) We have a 12 square unit piece of thin material and want to make an open box by cutting small squares from the corners of our material and folding the sides up. The question is, which cut produces the box of maximum volume?

79) Find the local maximum and minimum of the function $x^2 y^2$ on the line x + y = 10

80) Evaluate the following limits, if necessary use L'Hopitals rule

(i) $\lim_{x \to 0^+} x^{sin x}$

(ii) $\lim_{x \to 0} \frac{cot x}{cot 2x}$

(iii) $\lim_{x \to \frac{\pi}{2}^-} (tan x)^{cos x}$

81) Find the points of local maxima and local minima (if any) for the function

$f(x) = 2x^3 - 21x^2 + 36x - 20$

82) Discuss the curve y = $x^4 - 4x^3$ with respect to local extrema.

83) Verify Rolle's theorem for the function $f(x) = x^3 - 6x^2 + 11x - 6$ on the interval [1, 3]

84) Find the linear approximation for f(x) = $\sqrt{1+x}, x \geq -1$ at x_0 = 3. Use the linear approximation to estimate f(3.2)

85) Let $f(x) = \sqrt[3]{x}$. Find the linear approximation at x = 27. Use the linear approximation to approximate $\sqrt[3]{27.2}$

86) Find Δf and df for the function f for the indicated values of x, Δx and compare

(1) f(x) = $x^3 - 2x^2$; x = 2, Δ x = dx = 0.5

(2) f(x) = $x^2 + 2x + 3$; x = -0.5, Δx = dx = 0.1

87) For each of the following functions find the f_x, f_y, and show that $f_{xy} = f_{yx}$

f(x, y) = $\frac{3x}{y + sin x}$

88) If U(x, y, z) = $\frac{x^2+y^2}{xy} + 3z^2 y$, find $\frac{\partial U}{\partial x}$; $\frac{\partial U}{\partial y}$ and $\frac{\partial U}{\partial z}$

89) Let U(x, y, z) = xyz, x = e^{-t}, y = e^{-t} cos t, z = sin t, t ∈ R. Find $\frac{dU}{dt}$

90) Let z(x, y) = $x^3 - 3x^2y^3$, where x = se^t, y = se^{-t}, s, t ∈ R. Find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$

91) If v(x, y) = log $\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial v}{\partial x} + y\frac{\partial u}{\partial y}$ = 1

92) If u = $\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, Show that x $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}tanu$

93) If f = $\frac{x}{x^2+y^2}$ then show that = $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y}$ = -f

94) If w= $\log(x^2+y^2)$ and x=rcosθ and y=rsinθ then, find $\frac{\partial w}{\partial r} and \frac{\partial w}{\partial \theta}$

95) If u = log (tan x + tan y + tan z), prove that $\sum \sin 2x \frac{\partial u}{\partial x} = 2$

96) If U = (x - y) (y -z) (z- x) then show that $U_x + U_y + U_z = 0$

97) Using Euler's Theorem prove the following.

(i) If u = $\tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$. Prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$

(ii) u = $xy^2 \sin(x/y)$ Show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3u$

(iii) If $u = \sqrt{x^2+y^2}$ show that $\mathbf{x}\frac{\partial u}{\partial x} + \mathbf{y}\frac{\partial u}{\partial y} = u$

(iv) If u = $\mathbf{u} = e^{(x/y)}\sin(x/y) + e^{(y/x)}\cos(y/x)$ Show that x $\frac{\hat{c}u}{\partial x} + \mathbf{y}\frac{\partial u}{\partial y} = 0$

98) If u $= \sin 3x \ \cos 4y$ verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$

99) Find an approximate value of $\int_1^{1.5} x dx$ by applying the left-end rule with the partition {1.1, 1.2, 1.3, 1.4, 1.5}.

100) Evaluate $\int_1^4 (2x^2+3)$ dx, as the limit of a sum

101) Evaluate the following integrals as the limits of sums.

$\int_1^2 (4x^2-1)dx$

102) Evaluate: $\int_0^{\frac{\pi}{2}} \frac{cos\theta}{(1+sin\theta)(2+sin\theta)} d\theta$

103) Evaluate: $\int_0^{\frac{\pi}{2}} (\sqrt{tan\ x} + \sqrt{cot\ x})dx$

104) Prove that $\int_0^{\frac{\pi}{4}} \frac{sin2xdx}{sin^4x+cos^4x}$ = $\frac{\pi}{4}$

105) Prove that $\int_0^{\frac{\pi}{4}} \frac{dx}{a^2sin^2x+b^2cos^2x}$ = $\frac{1}{ab}tan^{-1}(\frac{a}{b})$ where a, b > 0

106) Evaluate the following $\int_0^{\frac{\pi}{\sqrt{2}}} \frac{dx}{5+4sin^2x}$

107) Find the area of the region bounded by the line 6x + 5y = 30, x − axis and the lines x = −1 and x = 3.

108) Find the area of the region bounded by the y-axis and the parabola x = 5 − 4y − y^2.

109) Find the area of the region bounded between the parabolas y^2 = 4x and x^2 = 4y.

110) Using integration find the area of the region bounded by triangle ABC, whose vertices A, B, and C are (−1, 1), (3, 2), and (0, 5) respectively

111) Find the volume of a sphere of radius a.

112) Find the volume of a right-circular cone of base radius r and height h.

113) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sqrt{cot\ x}}{\sqrt{cot\ x}+\sqrt{tan\ x}}dx$

114) Evaluate $\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x}+\sqrt{x}}dx$

115) Evaluate $\int_0^{\frac{\pi}{2}} \frac{cos^{3/2}x}{cos^{3/2}x+sin^{3/2}x}dx$

116) Solve : $\frac{dy}{dx} = \sqrt{4x+2y-1}$

117) Solve $(x^2 - 3y^2)\ dx + 2xydy = 0$.

118) Solve $\frac{dy}{dx} + 2y = e^{-x}$

119) Solve the Linear differential equation:

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

120) Form the differential equation for y = e^{-2x} [A cos 3x-B sin 3x]

121) Solve: $\frac{dy}{dx} = (4x + y + 1)^2$

122) Solve :$(x^2-yx^2)dy+(y^2+x^2y^2)dx=0$

123) Find the differential equation of the family of curves $y = Ae^{-x} + Be^{x}$ where A and B are arbitrary constants.

124) Verify that y = A cos 2x - B sin 2x is the general solution of the differential equation $\frac{d^2y}{dx^2} + 4y = 0$

125) Form the differential equation of y = e^{3x} (C cos 2x + D sin 2x), where C and D are atbitrary constants.

126) The probability density function of X is given by $f(x) = \begin{cases} kxe^{-2x} & for x > 0 \\ 0 \quad for & x \leq 0 \end{cases}$ Find the value of k.

127) An urn contains 2 white balls and 3 red balls. A sample of 3 balls are chosen at random from the urn. If X denotes the number of red balls chosen, find the values taken by the random variable X and its number of inverse images

128) Two balls are chosen randomly from an urn containing 6 white and 4 black balls. Suppose that we win Rs. 30 for each black ball selected and we lose Rs. 20 for each white ball selected. If X denotes the winning amount, then find the values of X and number of points in its inverse images.

129) Two fair coins are tossed simultaneously (equivalent to a fair coin is tossed twice). Find the probability mass function for number of heads occurred.

130) A random variable X has the following probability distribution

x	0	1	2	3	4	5	6	7

P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2$+k

Evaluate (i) k

(ii) $P(X \geq 6)$

(iii) P(0

131) Establish the equivalence property p → q ≡ ¬p v q

132) Establish the equivalence property connecting the bi-conditional with conditional: p ↔ q ≡ (p → q) ∧ (q→ p)

133) Let ∗ be defined on R by (a∗b)=a+b+ab-7. Is ∗ binary on R? If so, find $3 * \left(\frac{-7}{15}\right)$.

134) Let $A = \begin{pmatrix} 1 & 0\,1 & 0 \\ 0 & 1\,0 & 1 \\ 1 & 0\,0 & 1 \end{pmatrix}, B = \begin{pmatrix} 0 & 1\,0 & 1 \\ 1 & 0\,1 & 0 \\ 1 & 0\,0 & 1 \end{pmatrix}, C = \begin{pmatrix} 1 & 1\,0 & 1 \\ 0 & 1\,1 & 0 \\ 1 & 1\,1 & 1 \end{pmatrix}$ be any three boolean matrices of the same type.

Find (A∨B)∧C

135) Let $A = \begin{pmatrix} 1 & 0\,1 & 0 \\ 0 & 1\,0 & 1 \\ 1 & 0\,0 & 1 \end{pmatrix}, B = \begin{pmatrix} 0 & 1\,0 & 1 \\ 1 & 0\,1 & 0 \\ 1 & 0\,0 & 1 \end{pmatrix}, C = \begin{pmatrix} 1 & 1\,0 & 1 \\ 0 & 1\,1 & 0 \\ 1 & 1\,1 & 1 \end{pmatrix}$ be any three boolean matrices of the same type.

Find (A∧B)∨C

136) Show that ¬(p ∧ q) ≡ ¬p V ¬q

137) Prove that q → p ≡ ¬p → ¬q

138) Show that p → q and q → p are not equivalent

139) Show that ¬(p↔q) ≡ p↔¬q

140) Construct the truth table for (-p) v (q ∧ r)

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Maths

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1) Verify $(AB)^{-1} = B^{-1}A^{-1}$ with $A = \begin{bmatrix} 0 & -3 \\ 1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -2 & -3 \\ 0 & -1 \end{bmatrix}$.

2) If $A = \begin{bmatrix} 4 & 3 \\ 2 & 5 \end{bmatrix}$, find x and y such that $A^2 + xA + yI_2 = O_2$. Hence, find A^{-1}.

3) If $A = \frac{1}{7}\begin{bmatrix} 6 & -3 & a \\ b & -2 & 6 \\ 2 & c & 3 \end{bmatrix}$ is orthogonal, find a, b and c , and hence A^{-1}.

4) Given $A = \begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 3 & -2 \\ 1 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$, find a matrix X such that AXB = C.

5) If $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, show that $A^{-1} = \frac{1}{2}(A^2 - 3I)$.

6) (a) If $A = \begin{bmatrix} -5 & 1 & 3 \\ 7 & 1 & -5 \\ 1 & -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$, find the products AB and BA and hence solve the system of equations x + y + 2z = 1, 3x + 2y + z = 7, 2x + y + 3z = 2.

7) A man is appointed in a job with a monthly salary of certain amount and a fixed amount of annual increment. If his salary was Rs. 19,800 per month at the end of the first month after 3 years of service and Rs. 23,400 per month at the end of the first month after 9 years of service, find his starting salary and his annual increment. (Use matrix inversion method to solve the problem.)

8) Four men and 4 women can finish a piece of work jointly in 3 days while 2 men and 5 women can finish the same work jointly in 4 days. Find the time taken by one man

alone and that of one woman alone to finish the same work by using matrix inversion method.

9) The prices of three commodities A, B and C are Rs. x, y and z per units respectively. A person P purchases 4 units of B and sells two units of A and 5 units of C . Person Q purchases 2 units of C and sells 3 units of A and one unit of B . Person R purchases one unit of A and sells 3 unit of B and one unit of C . In the process, P, Q and R earn Rs. 15,000, Rs. 1,000 and Rs. 4,000 respectively. Find the prices per unit of A, B and C . (Use matrix inversion method to solve the problem.)

10) In a T20 match, a team needed just 6 runs to win with 1 ball left to go in the last over. The last ball was bowled and the batsman at the crease hit it high up. The ball traversed along a path in a vertical plane and the equation of the path is $y = ax^2 + bx + c$ with respect to a xy-coordinate system in the vertical plane and the ball traversed through the points (10, 8), (20, 16) (40, 22) can you conclude that the team won the match?
Justify your answer. (All distances are measured in metres and the meeting point of the plane of the path with the farthest boundary line is (70, 0).)

11) In a competitive examination, one mark is awarded for every correct answer while $\frac{1}{4}$ mark is deducted for every wrong answer. A student answered 100 questions and got 80 marks. How many questions did he answer correctly ? (Use Cramer's rule to solve the problem).

12) A chemist has one solution which is 50% acid and another solution which is 25% acid. How much each should be mixed to make 10 litres of a 40% acid solution? (Use Cramer's rule to solve the problem).

13) A fish tank can be filled in 10 minutes using both pumps A and B simultaneously. However, pump B can pump water in or out at the same rate. If pump B is inadvertently run in reverse, then the tank will be filled in 30 minutes. How long would it take each pump to fill the tank by itself ? (Use Cramer's rule to solve the problem).

14) A family of 3 people went out for dinner in a restaurant. The cost of two dosai, three idlies and two vadais is Rs. 150. The cost of the two dosai, two idlies and four vadais is Rs. 200. The cost of five dosai, four idlies and two vadais is Rs. 250. The family has Rs. 350 in hand and they ate 3 dosai and six idlies and six vadais. Will they be able to manage to pay the bill within the amount they had ?

15) Solve the following system of linear equations, by Gaussian elimination method : $4x + 3y + 6z = 25$, $x + 5y + 7z = 13$, $2x + 9y + z = 1$.

16) The upward speed v(t)of a rocket at time t is approximated by $v(t) = at^2 + bt + c$, $0 \leq t \leq 100$ where a, b and c are constants. It has been found that the speed at times t = 3, t = 6, and t = 9 seconds are respectively, 64, 133, and 208 miles per second respectively. Find the speed at time t = 15 seconds. (Use Gaussian elimination method.)

17) If $ax^2 + bx + c$ is divided by x + 3, x − 5, and x − 1, the remainders are 21, 61 and 9 respectively. Find a, b and c. (Use Gaussian elimination method.)

18) An amount of Rs. 65,000 is invested in three bonds at the rates of 6%, 8% and 9% per annum respectively. The total annual income is Rs. 4,800. The income from the third bond is Rs. 600 more than that from the second bond. Determine the price of each bond. (Use Gaussian elimination method.)

19) A boy is walking along the path $y = ax^2 + bx + c$ through the points (−6, 8),(−2, −12) , and (3, 8). He wants to meet his friend at P(7, 60). Will he meet his friend? (Use Gaussian elimination method.)

20) Test for consistency of the following system of linear equations and if possible solve:
x + 2y - z = 3, 3x - y + 2z = 1, x - 2y + 3z = 3, x - y + z + 1 = 0

21) By using Gaussian elimination method, balance the chemical reaction equation :
$C_5H_8 + O_2 \longrightarrow CO_2 + H_2O$.

22) If the system of equations px + by + cz = 0, ax + qy + cz = 0, ax + by + rz = 0 has a non-trivial solution and p ≠ a, q ≠ b, r ≠ c, prove that $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c} = 2$.

23) Determine the values of λ for which the following system of equations x + y + 3z = 0, 4x + 3y + λz = 0, 2x + y + 2z = 0 has
(i) a unique solution
(ii) a non-trivial solution

24) Solve the following systems of linear equations by Cramer's rule:
$\frac{3}{x} - \frac{4}{y} - \frac{2}{z} - 1 = 0$, $\frac{1}{x} + \frac{2}{y} + \frac{1}{z} - 2 = 0$, $\frac{2}{x} - \frac{5}{y} - \frac{4}{z} + 1 = 0$

25) Using Gaussian Jordan method, find the values of λ and μ so that the system of equations 2x - 3y + 5z = 12, 3x + y + λz =μ, x - 7y + 8z = 17 has
(i) unique solution
(ii) infinite solutions and
(iii) no solution.

26) Investigate for what values of λ, μ the simultaneous equations x + y + z = 6, x + 2y + 3z = 10, x + 2y + λz = μ have
(i) no solution

(ii) a unique solution and

(iii) an infinite number of solutions.

27) Find the values of the real numbers x and y, if the complex numbers $(3-i)x-(2-i)y+2i+5$ and $2x+(-1+2i)y+3+2i$ are equal.

28) Show that $\left(\frac{19+9i}{5-3i}\right)^{15}-\left(\frac{8+i}{1+2i}\right)^{15}$ is purely imaginary.

29) Let z_1, z_2 and z_3 be complex numbers such that $|z_1|=|z_2|=|z_3|=r>0$ and $z_1+z_2+z_3 \neq 0$ prove that $\left|\frac{z_1z_2+z_2z_3+z_3z_1}{z_1+z_2+z_3}\right|=r$

30) If z_1, z_2, and z_3 are three complex numbers such that $|z_1|=1$, $|z_2|=2|z_3|=3$ and $|z_1+z_2+z_3|=1$, show that $|9z_1z_2+4z_1z_2+z_2z_3|=6$

31) If z = x + iy is a complex number such that $\text{Im}\left(\frac{2z+1}{iz+1}\right)=0$ show that the locus of z is $2x^2+2y^2+x-2y=0$

32) If $\cos\alpha+\cos\beta+\cos\gamma=\sin\alpha+\sin\beta+\sin\gamma=0$ then show that

(i) $\cos 3\alpha+\cos 3\beta+\cos 3\gamma=3\cos(\alpha+\beta+\gamma)$

(ii) $\sin 3\alpha+\sin 3\beta+\sin 3\gamma+\sin 3\gamma=3\sin(\alpha+\beta+\gamma)$

33) If z = x + iy and $\arg\left(\frac{z-i}{z+2}\right)=\frac{\pi}{4}$, then show that $x^2+y^2+3x-3y+2=0$

34) If $\omega \neq 1$ is a cube root of unity, show that $\left(1-\omega+\omega^2\right)^6+\left(1+\omega-\omega^2\right)^6=128$

35) Find the quotient $\frac{2\left(\cos\frac{9\pi}{4}+i\sin\frac{9\pi}{4}\right)}{4\left(\cos\left(\frac{-3\pi}{2}\right)+i\sin\left(\frac{-3\pi}{2}\right)\right)}$ in rectangular form

36) Solve the equation $z^3+8i=0$, where $z \in C$

37) Find the fourth roots of unity.

38) Find the cube roots of unity.

39) Simplify: $(1+i)^{18}$

40) Show that $\left(\frac{19-7i}{9+i}\right)^{12}+\left(\frac{20-5i}{7-6i}\right)^{12}$ is real

41) If $\omega \neq 1$ is a cube root of unity, show that

$$(1+\omega)\left(1+\omega^2\right)\left(1+\omega^4\right)\left(1+\omega^8\right)\ldots\left(1+\omega^{2^{11}}\right)=1.$$

42) Simplify: $\left(-\sqrt{3}+3i\right)^{31}$

43) If the imaginary part of $\frac{2z+1}{iz+1}$ is -2 then prove that the locus of the point representing z in the complex plane is a straight line.

44) Show that the complex number 'z' satisfying $\arg\left(\frac{z-1}{z+1}\right)=\frac{\pi}{4}$ lies on a circle.

45) Solve the equation $x^3 - 9x^2 + 14x + 24 = 0$ if it is given that two of its roots are in the ratio 3:2.

46) If α, β, and γ are the roots of the polynomial equation $ax^3 + bx^2 + cx + d = 0$, find the value of $\Sigma\frac{\alpha}{\beta\gamma}$ in terms of the coefficients.

47) If 2+i and $3-\sqrt{2}$ are roots of the equation $x^6 - 13x^5 + 62x^4 - 126x^3 + 65x^2 + 127x - 140 = 0$, find all roots.

48) Solve the equation (x-2) (x-7) (x-3) (x+2)+19 = 0

49) Solve the equation (2x-3) (6x-1) (3x-2) (x-2)-5 = 0

50) Solve the equation $9x^3 - 36x^2 + 44x - 16 = 0$ if the roots form an arithmetic progression.

51) Solve the equation $3x^3 - 26x^2 + 52x - 24 = 0$ if its roots form a geometric progression.

52) Find all zeros of the polynomial $x^6 - 3x^5 - 5x^4 + 22x^3 - 39x^2 - 39x + 135$, if it is known that 1+2i and $\sqrt{3}$ are two of its zeros.

53) Solve the following equation: $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$

54) Solve the equations:

$6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$

55) Solve the equation $6x^4 - 5x^3 - 38x^2 - 5x + 6 = 0$ if it is known that $\frac{1}{3}$ is a solution.

56) Find the domain of $f(x) = \sin^{-1}\left(\frac{|x|-2}{3}\right) + \cos^{-1}\left(\frac{1-|x|}{4}\right)$

57) Find the value of $\tan^{-1}(-1) + \cos^{-1}\left(\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$

58) If $a_1, a_2, a_3, \ldots a_n$ is an arithmetic progression with common difference d, prove that

$$\tan\left[\tan^{-1}\left(\frac{d}{1+a_1a_2}\right)+\tan^{-1}\left(\frac{d}{1+a_2a_3}\right)+\ldots\tan^{-1}\left(\frac{d}{1+a_na_{n-1}}\right)\right]=\frac{a_n-a_1}{1+a_1a_n}$$

59) Prove that $\tan^{-1}x + \tan^{-1}z = \tan^{-1}\left[\frac{x+y+z-xyz}{1-xy-yz-zx}\right]$

60) If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$, show that $x + y + z = xyz$

61) Prove that $\tan^{-1}x + \tan^{-1}\frac{2x}{1-x^2} = \tan^{-1}\frac{3x-x^3}{1-3x^2}$, $|x| < \frac{1}{\sqrt{3}}$

62) Simplify: $\tan^{-1}\frac{x}{y} - \tan^{-1}\frac{x-y}{x+y}$

63) Find the number of solution of the equation $\tan^{-1}(x-1) + \tan^{-1}x + \tan^{-1}(x+1) = \tan^{-1}(3x)$

64) Find the value of $\cot^{-1}(1) + \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right) - \sec^{-1}(-\sqrt{2})$

65) Find the value of $\tan\left[\frac{1}{2}\sin^{-1}\left(\frac{2a}{1+a^2}\right)+\frac{1}{2}\cos^{-1}\left(\frac{1-a^2}{1+a^2}\right)\right]$

66) Solve: $\tan^{-1}\left(\frac{x-1}{x-2}\right) + \tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}$

67) Prove that $\tan^{-1}\left(\frac{1-x}{1+x}\right) - \tan^{-1}\left(\frac{1-y}{1+y}\right) = \sin^{-1}\left(\frac{y-x}{\sqrt{1+x^2}.\sqrt{1+y^2}}\right)$

68) Prove that $2\sin^{-1}\frac{3}{5} - \tan^{-1}\frac{17}{31} = \frac{\pi}{4}$

69) Solve for x: $\tan^{-1}x + 2\cot^{-1}x = \frac{2\pi}{3}$

70) Find the equation of the circle passing through the points (1 , 1) , (2 , -1) , and (3 , 2) .

71) Find the equation of the circle through the points (1, 0),(-1, 0) , and (0, 1)

72) Find the foci, vertices and length of major and minor axis of the conic $4x^2 + 36y^2 + 40x - 288y + 532 = 0$

73) For the ellipse $4x^2+y^2+24x-2y+21 = 0$, find the centre, vertices and the foci. Also prove that the length of latus rectum is 2

74) Find the centre, foci, and eccentricity of the hyperbola $11x^2 - 25y^2 - 44x + 50y - 256 = 0$

75) Find the equations of the two tangents that can be drawn from (5, 2) to the ellipse $2x^2+7y^2 = 14$.

76) A semielliptical archway over a one-way road has a height of 3m and a width of 12m. The truck has a width of 3m and a height of 2.7m. Will the truck clear the opening of the archway?

77) The maximum and minimum distances of the Earth from the Sun respectively are 152×10^6 km and 94.5×10^6 km. The Sun is at one focus of the elliptical orbit. Find the distance from the Sun to the other focus.

78) A search light has a parabolic reflector (has a cross-section that forms a 'bowl'). The parabolic bowl is 40 cm wide from rim to rim and 30 cm deep. The bulb is located at the focus.

(1) What is the equation of the parabola used for reflector?

(2) How far from the vertex is the bulb to be placed so that the maximum distance covered?

79) A room 34m long is constructed to be a whispering gallery. The room has an elliptical ceiling, as shown in Figure. If the maximum height of the ceiling is 8 m, determine where the foci are located.

80) Two coast guard stations are located 600 km apart at points A(0, 0) and B(0, 600). A distress signal from a ship at P is received at slightly different times by two stations. It is determined that the ship is 200 km farther from station A than it is from station B. Determine the equation of hyperbola that passes through the location of the ship.

81) A bridge has a parabolic arch that is 10 m high in the centre and 30 m wide at the bottom. Find the height of the arch 6 m from the centre, on either sides.

82) A tunnel through a mountain for a four lane highway is to have a elliptical opening. The total width of the highway (not the opening) is to be 16 m, and the height at the edge of the road must be sufficient for a truck 4 m high to clear if the highest point of the opening is to be 5 m approximately. How wide must the opening be?

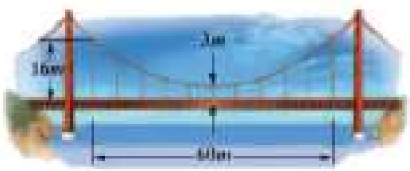
83) At a water fountain, water attains a maximum height of 4 m at horizontal distance of 0.5 m from its origin. If the path of water is a parabola, find the height of water at a horizontal distance of 0.75 m from the point of origin.

84) An engineer designs a satellite dish with a parabolic cross section. The dish is 5 m wide at the opening, and the focus is placed 1.2 m from the vertex

(a) Position a coordinate system with the origin at the vertex and the x -axis on the parabola's axis of symmetry and find an equation of the parabola.

(b) Find the depth of the satellite dish at the vertex.

85) Parabolic cable of a 60m portion of the roadbed of a suspension bridge are positioned as shown below. Vertical Cables are to be spaced every 6m along this portion of the roadbed. Calculate the lengths of first two of these vertical cables from the vertex.



86) Cross section of a Nuclear cooling tower is in the shape of a hyperbola with equation $\frac{x^2}{30^2} - \frac{y^2}{44^2} = 1$. The tower is 150 m tall and the distance from the top of the tower to the centre of the hyperbola is half the distance from the base of the tower to the centre of the hyperbola. Find the diameter of the top and base of the tower.

87) A rod of length 1.2 m moves with its ends always touching the coordinate axes. The locus of a point P on the rod, which is 0.3 m from the end in contact with x -axis is an ellipse. Find the eccentricity.

88) Assume that water issuing from the end of a horizontal pipe, 7. 5 m above the ground, describes a parabolic path. The vertex of the parabolic path is at the end of the pipe. At a position 2. 5 m below the line of the pipe, the flow of water has curved outward 3m beyond the vertical line through the end of the pipe. How far beyond this vertical line will the water strike the ground?

89) On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of 4 m when it is 6 m away from the point of projection. Finally it reaches the ground 12 m away from the starting point. Find the angle of projection.

90) Find the vertex, focus, equation of directrix and length of the latus rectum of the following:

$x^2-2x+8y+17=0$

91) Find the vertex, focus, equation of directrix and length of the latus rectum of the following: $y^2-4y-8x+12 = 0$

92) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :

$\frac{(x+1)^2}{100} + \frac{(y-2)^2}{64} = 1$

93) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :

$\frac{(y-2)^2}{25} \frac{(x+1)^2}{16} = 1$

94) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :

$18x^2+12y^2-144x+48y+120 = 0$

95) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :

$9x^2-y^2-36x-6y+18 = 0$

96) A cable of a suspension bridge hangs in the form of a parabola when the load is uniformly distributed horizontally. The distance between two towers is 1500 ft, the points of support of
the cable on the towers are 200 ft above the road way and the lowest point on the cable is 70 ft above the roadway. Find the vertical distance to the cable (parallel to the roadway) from a pole whose height is 122 ft.

97) The ceiling in a hallway 20 ft wide is in the shape of a semi ellipse and 18 ft high at the center. Find the height of the ceiling 4 feet from either wall if the height of the side walls is 12 ft.

98) By vector method, prove that cos(α + β) = cos α cos β - sin α sin β

99) Prove by vector method that sin(α −β) = sinα cosβ −cosα sinβ

100) Prove by vector method that the perpendiculars (attitudes) from the vertices to the opposite sides of a triangle are concurrent.

101) Using vector method, prove that cos(α − β) = cos α cos β +sin α sin β

102) Prove by vector method that sin(α + β)=sin α cos β + cos α sin β

103) A particle acted on by constant forces $8\hat{i} + 2\hat{j} - 6\hat{k}$ and $6\hat{i} + 2\hat{j} - 2\hat{k}$ is displaced from the point (1, 2, 3) to the point (5, 4, 1). Find the total work done by the forces.

104) Forces of magnit $5\sqrt{2}$ and $5\sqrt{2}$ units acting in the directions $3\hat{i} + 4\hat{j} + 5\hat{k}$ and $10\hat{i} + 6\hat{j} - 8\hat{k}$ respectively, act on a particle which is displaced from the point with

position vector $4\hat{i} + 3\hat{j} - 2\hat{k}$ to the point with position vector $6\hat{i} + \hat{j} - 3\hat{k}$. Find the work done by the forces.

105) Find the torque of the resultant of the three forces represented by $-3\hat{i} + 6\hat{j} + 3\hat{k}$, $4\hat{i} - 10\hat{j} + 12\hat{k}$ and $4\hat{i} + 7\hat{j}$ acting at the point with position vector $8\hat{i} - 6\hat{j} - 4\hat{k}$, about the point with position vector $18\hat{i} + 3\hat{j} - 9\hat{k}$

106) Determine whether the three vectors $2\hat{i} + 3\hat{j} + \hat{k}$, $\hat{i} - 2\hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} + 2\hat{k}$ are coplanar.

107) If $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}, \vec{b} = 3\hat{i} + 5\hat{j} + 2\hat{k}, \vec{c} = -\hat{i} - 2\hat{j} + 3\hat{k}$, verify that

(i) $(\vec{a} \times \vec{b}) \times \vec{c} = (\vec{a}.\vec{c}) \times \vec{b} - (\vec{b}.\vec{c})\vec{a}$

(ii) $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a}.\vec{c}) \times \vec{b} - (\vec{a}.\vec{b})\vec{c}$

108) A straight line passes through the point (1, 2, −3) and parallel to $4\hat{i} + 5\hat{j} - 7\hat{k}$. Find

(i) vector equation in parametric form

(ii) vector equation in non-parametric form

(iii) Cartesian equations of the straight line.

109) Find the equation of a straight line passing through the point of intersection of the straight lines $\vec{r} = (\hat{i} + 3\hat{j} - \hat{k}) + t(2\hat{i} + 3\hat{j} + 2\hat{k})$ and $\frac{x-2}{1} = \frac{y-4}{2} = \frac{z+3}{4}$ and perpendicular to both straight lines.

110) Determine whether the pair of straight lines $\vec{r}(2\hat{i} + 3\hat{j} - \hat{k}) + t(2\hat{i} + 3\hat{j} + 2\hat{k})$, $\vec{r} = (2\hat{j} - 3\hat{k}) + s(\hat{i} + 2\hat{j} + 3\hat{k})$are parallel. Find the shortest distance between them.

111) Show that the lines $\frac{x-3}{3} = \frac{y-3}{-1} = z - 1$ and $\frac{x-6}{2} = \frac{z-1}{3}, y - 2 = 0$ intersect. Also find the point of intersection.

112) Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points (-1, 2, 0), (2, 2, -1)and parallel to the straight line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$

113) Find the non-parametric form of vector equation, and Cartesian equation of the plane passing through the point (2, 3, 6) and parallel to the straight lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-3}{1}$ and $\frac{x+3}{2} = \frac{y-3}{-5} = \frac{z+1}{-3}$

114) Find the non-parametric form of vector equation, and Cartesian equations of the plane passing through the points (2, 2, 1), (9, 3, 6) and perpendicular to the plane 2x +

$6y + 6z = 9$

115) Find parametric form of vector equation and Cartesian equations of the plane passing through the points (2, 2, 1), (1, −2, 3) and parallel to the straight line passing through the points (2, 1, −3) and (−1, 5, −8)

116) Find the non-parametric form of vector equation of the plane passing through the point (1, −2, 4) and perpendicular to the plane x + 2y −3z = 11 and parallel to the line $\frac{x+7}{3} = \frac{y+3}{-1} = \frac{z}{1}$

117) Find the parametric form of vector equation and Cartesian equations of the plane containing the line $\vec{r} = (\hat{i} - \hat{j} + 3\hat{k}) + t(2\hat{i} - \hat{j} + 4\hat{k})$ and perpendicular to plane $\vec{r}.(\hat{i} + 2\hat{j} + \hat{k}) = 8$

118) Find the parametric vector, non-parametric vector and Cartesian form of the equations of the plane passing through the points (3, 6, −2), (−1,−2, 6) , and (6, −4, −2).

119) Show that the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{3}$ and $\frac{x-1}{-3} = \frac{y-4}{2} = \frac{z-5}{1}$ coplanar. Also, find the plane containing these lines.

120) Find the coordinates of the foot of the perpendicular and length of the perpendicular from the point (4, 3, 2) to the plane x + 2y + 3z = 2.

121) If $\vec{p} = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{q} = 6\hat{i} + 2\hat{j} - 3\hat{k}$ then find $\vec{p} \times \vec{q}$. Verify that $\vec{p}$ and $\vec{p} \times \vec{q}$ are perpendicular to each other and also verify that $\vec{q}$ and $\vec{p} \times \vec{q}$ are perpendicular to each other,

122) A particle moves along a horizontal line such that its position at any time t ≥ 0 is given by $s(t) = t^3 - 6t^2 + 9t + 1$, where s is measured in metres and t in seconds?

(1) At what time the particle is at rest?

(2) At what time the particle changes direction?

(3) Find the total distance travelled by the particle in the first 2 seconds.

123) A road running north to south crosses a road going east to west at the point P. Car A is driving north along the first road, and car B is driving east along the second road. At a particular time car A 10 kilometres to the north of P and traveling at 80 km/hr, while car B is 15 kilometres to the east of P and traveling at 100 km/hr. How fast is the distance between the two cars changing?

124) A particle moves along a line according to the law $s(t) = 2t^3 - 9t^2 + 12t - 4$, where t ≥ 0.

(i) At what times the particle changes direction?

(ii) Find the total distance travelled by the particle in the first 4 seconds.

(iii) Find the particle's acceleration each time the velocity is zero.

125) A conical water tank with vertex down of 12 metres height has a radius of 5 metres at the top. If water flows into the tank at a rate 10 cubic m/min, how fast is the depth of the water increases when the water is 8 metres deep?

126) A ladder 17 metre long is leaning against the wall. The base of the ladder is pulled away from the wall at a rate of 5 m/s. When the base of the ladder is 8 metres from the wall.

(i) How fast is the top of the ladder moving down the wall?

(ii) At what rate, the area of the triangle formed by the ladder, wall and the floor is changing?

127) A ladder 17 metre long is leaning against the wall. The base of the ladder is pulled away from the wall at a rate of 5 m/s. When the base of the ladder is 8 metres from the wall.

128) A police jeep, approaching an orthogonal intersection from the northern direction, is chasing a speeding car that has turned and moving straight east. When the jeep is 0.6 km north of the intersection and the car is 0.8 km to the east. The police determine with a radar that the distance between them and the car is increasing at 20 km/hr. If the jeep is moving at 60 km/hr at the instant of measurement, what is the speed of the car?

129) Find the equation of the tangent and normal to the Lissajous curve given by $x = 2\cos 3t$ and $y = 3\sin 2t$, $t \in R$

130) Find the angle between $y = x^2$ and $y = (x - 3)^2$.

131) Find the angle between the curves $y = x^2$ and $x = y^2$ at their points of intersection (0,0) and (1,1).

132) If the curves $ax^2 + by^2 = 1$ and $cx^2 + dy^2 = 1$ intersect each other orthogonally then, $\frac{1}{a} - \frac{1}{b} = \frac{1}{c} - \frac{1}{d}$

133) Find the equations of the tangents to the curve $y = \frac{x+1}{x-1}$ which are parallel to the line $x + 2y = 6$.

134) Show that the two curves $x^2 - y^2 = r^2$ and $xy = c^2$ where c, r are constants, cut orthogonally

135) Find the intervals of mono tonicities and hence find the local extremum for the following function:

$f(x) = 2x^3 + 3x^2 - 12x$

136) Using the Lagrange's mean value theorem determine the values of x at which the tangent is parallel to the secant line at the end points of the given interval:
$f(x) = x^3 - 3x + 2,\ x \in [-2, 2]$

137) Expand log(1+ x) as a Maclaurin's series upto 4 non-zero terms for $-1 < x \le 1$.

138) Find the dimensions of the rectangle with maximum area that can be inscribed in a circle of radius 10 cm.

139) Prove that among all the rectangles of the given perimeter, the square has the maximum area.

140) Find the dimensions of the largest rectangle that can be inscribed in a semi circle of radius r cm.

141) A manufacturer wants to design an open box having a square base and a surface area of 108 sq. cm. Determine the dimensions of the box for the maximum volume.

142) The volume of a cylinder is given by the formula $V = \pi r^2 h$. Find the greatest and least values of V if r + h = 6.

143) A hollow cone with base radius a cm and , height b em is placed on a table. Show that the volume of the largest cylinder that can be hidden underneath is $\frac{4}{9}$times volume of the cone.

144) Expand sin x in ascending powers $x - \frac{\pi}{4}$ upto three non-zero terms.

145) Evaluate the following limit, if necessary use l'Hôpital Rule
$\lim_{x \to 0^+} x^x$

146) For the function $f(x)=4x^3+3x^2-6x+1$ find the intervals of monotonicity, local extrema, intervals of concavity and points of inflection.

147) Determine the intervals of concavity of the curve $f(x) = (x-1)^3 . (x-5)$, x∈R and, points of inflection if any.

148) Find the local extrema of the function $f(x) = 4x^6 - 6x^4$

149) Find the intervals of concavity and points of inflexion for $f(x)=x^3-15x^2+75x-50$.

150) Find the local maximum and local minimum values for $f(x)=12x^2-2x^2-x^4$.

151) A right circular cylinder has radius r =10 cm. and height h = 20 cm. Suppose that the radius of the cylinder is increased from 10 cm to 10. 1 cm and the height does not

change. Estimate the change in the volume of the cylinder. Also, calculate the relative error and percentage error.

152) The radius of a circular plate is measured as 12.65 cm instead of the actual length 12.5 cm.find the following in calculating the area of the circular plate:

(i) Absolute error

(ii) Relative error

(iii) Percentage error

153) The time T, taken for a complete oscillation of a single pendulum with length l, is given by the equation T = $2\pi\sqrt{\frac{l}{g}}$, where g is a constant. Find the approximate percentage error in the calculated value of T corresponding to an error of 2 percent in the value of 1

154) Let f(x, y) = sin(xy²) + e^{x3+5y} for all ∈ R^2. Calculate $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial^2 f}{\partial y \partial x}$ and $\frac{\partial^2 f}{\partial x \partial y}$

155) Let w(x, y, z) = $\frac{1}{\sqrt{x^2+y^2+z^2}}, (x, y, z) \neq (0, 0, 0)$. Show that $\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2} + \frac{\partial^2 w}{\partial z^2} = 0$

156) If V(x,y) = e^x(x cos y - y siny), then prove that $\frac{\partial^2 V}{\partial x^2} = \frac{\partial^2 V}{\partial y^2} = 0$

157) If w(x, y) = xy + sin (xy), then prove that $\frac{\partial^2 w}{\partial y \partial x} = \frac{\partial^2 w}{\partial x \partial y}$

158) W(x, y, z) = xy + yz + zx, x =u -v, y = uv, z = u + v, u ∈ R. Find $\frac{\partial W}{\partial u}, \frac{\partial W}{\partial v}$, and evaluate them at $\left(\frac{1}{2}, 1\right)$

159)

If u = $\tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$ Prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ sin 2u.

160) Find the approximate value of $\sqrt[3]{1.02} + \sqrt{1.02}$

161)

Using Euler's theorem, prove that $x\frac{\hat{\partial} u}{\hat{\partial} x} + y\frac{\hat{\partial} u}{\partial y} = \frac{1}{2}\tan u$ if $u = \sin^{-1}\left(\frac{x-y}{\sqrt{x}+\sqrt{y}}\right)$

162) If $V = ze^{ax+by}$ and z is a homogeneous function of degree n in x and y prove that $x\frac{\partial V}{\partial x} + \mathbf{y}\frac{\partial V}{\partial y} = (ax + by + n)V$

163)

If u = $\sec^{-1}\left(\frac{x^3-y^3}{x+y}\right)$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial x} = 2\cot u$

164) Show that $\int_0^{\frac{\pi}{2}} \frac{dx}{4+5sinx} = \frac{1}{3}\log_e 2$.

165) Prove that $\int_0^{\frac{\pi}{4}} \log(1+\tan x)dx = \frac{\pi}{8}\log 2$.

166) Show that $\int_0^1 (tan^{-1}x + tan^{-1}(1-x))\,dx = \frac{\pi}{2} - \log_e 2$

167) Evaluate $\int_2^3 \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}dx$.

168) Evaluate the following integrals using properties of integration:

$\int_0^{\pi} \frac{xsinx}{1+sinx}dx$

169) Evaluate the following integrals using properties of integration:

$\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}} \frac{1}{1+\sqrt{tanx}}dx$

170) Find the area of the region bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

171) Find the area of the region bounded between the parabola $x^2 = y$ and the curve $y = |x|$.

172) The region enclosed by the circle $x^2 + y^2 = a^2$ is divided into two segments by the line $x = h$. Find the area of the smaller segment.

173) Find the area of the region in the first quadrant bounded by the parabola $y^2 = 4x$, the line $x + y = 3$ and y-axis.

174) Find, by integration, the area of the region bounded by the lines $5x - 2y = 15$, $x + y + 4 = 0$ and the x-axis

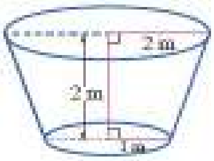
175) Find the area of the region bounded by the line $y = 2x + 5$ and the parabola $y = x^2 - 2x$.

176) Find the area of the region bounded by the parabola $y^2 = x$ and the line $y = x - 2$

177) Find the area of the region common to the circle $x^2 + y^2 = 16$ and the parabola $y^2 = 6x$.

178) Find the volume of the spherical cap of height h cut of from a sphere of radius r.

179) Find, by integration, the volume of the container which is in the shape of a right circular conical frustum.



180) A watermelon has an ellipsoid shape which can be obtained by revolving an ellipse with major-axis 20 cm and minor-axis 10 cm about its major-axis. Find its volume using integration.

181) Solve the following differential equations:

$$\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$$

182) Solve the following differential equations:

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

183) Solve the following differential equations:

$(e^y+1) \cos x\, dx + e^y \sin x\, dy = 0$

184) Solve the following differential equations $2xydx + (x^2 + 2y^2)dy = 0$

185) Solve the differential equation $(y^2-2xy)\, dx = (x^2-2xy)\, dy$

186) Solve the following differential equations

$$\left(1 + 3e^{\frac{y}{x}}\right)dy + 3e^{\frac{y}{x}}\left(1 - \frac{y}{x}\right)dx = 0,$$ given that y = 0- when x=1

187) Solve $(1+x^3)\frac{dy}{dx} + 6x^2y = 1+x^2$.

188) Solve the Linear differential equation:

$$\frac{dy}{dx} + \frac{y}{x\log x} = \frac{\sin 2x}{\log x}$$

189) Solve the Linear differential equation:

$$\frac{dy}{dx} = \frac{\sin^2 x}{1+x^3} - \frac{3x^2}{1+x^3}y$$

190) The growth of a population is proportional to the number present. If the population of a colony doubles in 50 years, in how many years will the population become triple?

191) A radioactive isotope has an initial mass 200mg, which two years later is 50mg . Find the expression for the amount of the isotope remaining at any time. What is its half-life? (half-life means the time taken for the radioactivity of a specified isotope to fall to half its original value).

192) In a murder investigation, a corpse was found by a detective at exactly 8 p.m. Being alert, the detective also measured the body temperature and found it to be 70°F. Two hours later, the detective measured the body temperature again and found it to be 60°F. If the room temperature is 50°F, and assuming that the body temperature of the

person before death was 98.6°F, at what time did the murder occur? [log(2.43) = 0.88789; log(0.5)=-0.69315]

193) Find the population of a city at any time t, given that the rate of increase of population is proportional to the population at that instant and that in a period of 40 years the population increased from 3,00,000 to 4,00,000.

194) Suppose a person deposits 10,000 Indian rupees in a bank account at the rate of 5% per annum compounded continuously. How much money will be in his bank account 18 months later?

195) Assume that the rate at which radioactive nuclei decay is proportional to the number of such nuclei that are present in a given sample. In a certain sample 10% of the original number of radioactive nuclei have undergone disintegration in a period of 100 years. What percentage of the original radioactive nuclei will remain after 1000 years?

196) Water at temperature 100°C cools in 10 minutes to 80°C in a room temperature of 25°C.

Find

(i) The temperature of water after 20 minutes

(ii) The time when the temperature is 40°C

$$\left[\log_e \frac{11}{15} = -0.3101; \log_e 5 = 1.6094\right]$$

197) A pot of boiling water at 100°C is removed from a stove at time t = 0 and left to cool in the kitchen. After 5 minutes, the water temperature has decreased to 80°C , and another 5 minutes later it has dropped to 65°C . Determine the temperature of the kitchen.

198) Two balls are chosen randomly from an urn containing 6 red and 8 black balls. Suppose that we win Rs. 15 for each red ball selected and we lose Rs. 10 for each black ball selected. X denotes the winning amount, then find the values of X and number of points in its inverse images.

199) A six sided die is marked '1' on one face, '3' on two of its faces, and '5' on remaining three faces. The die is thrown twice. If X denotes the total score in two throws, find

(i) the probability mass function

(ii) the cumulative distribution function

(iii) $P(4 \le X < 10)$

(iv) $P(X \ge 6)$

200) Find the probability mass function and cumulative distribution function of number of girl child in families with 4 children, assuming equal probabilities for boys and girls.

201) A random variable X has the following probability mass function.

x	1	2	3	4	5
f(x)	k^2	$2k^2$	$3k^2$	2k	3k

Find

(i) the value of k

(ii) $P(2 \leq X < 5)$

(iii) $P(3 < X)$

202) The probability density function of X is given

$$f(x) = \begin{cases} Ke^{\frac{-x}{3}} & for \quad x > 0 \\ 0 \quad for & x \leq 0 \end{cases}$$

Find

(i) the value of k

(ii) the distribution function.

(iii) $P(X < 3)$

(iv) $P(5 \leq X)$

(v) $P(X \leq 4)$

203) If X is the random variable with probability density functionj{x) given by,

$$f(x) = \begin{cases} x+1 & -1 \leq x < 0 \\ -x+1 & 0 \leq x < 1 \\ 0 & otherwise \end{cases}$$

then find

(i) the distribution function F(x)

(ii) $P(-0.5 \leq X \leq 0.5)$

204) If μ and σ^2 are the mean and variance of the discrete random variable X, and E(X + 3) =10 and $E(X + 3)^2 = 116$, find μ and σ^2

205) Compute P(X = k) for the binomial distribution, B(n, p) where

n = 9, $p = \frac{1}{2}$, k = 7

206) The probability that Mr.Q hits a target at any trial is $\frac{1}{4}$. Suppose he tries at the target 10 times. Find the probability that he hits the target

(i) exactly 4 times

(ii) at least one time.

207) A retailer purchases a certain kind of electronic device from a manufacturer. The manufacturer, indicates that the defective rate of the device is 5%. The inspector of the retailer randomly picks 10 items from a shipment. What is the probability that there will be

(i) at least one defective item

(ii) exactly two defective items.

208) If the probability that a fluorescent light has a useful life of at least 600 hours is 0.9, find the probabilities that among 12 such lights

(i) exactly 10 will have a useful life of at least 600 hours;

(ii) at least 11 will have a useful life of at least 600 hours

(iii) at least 2 will not have a useful life of at least 600 hours.

209) The mean and standard deviation of a binomial variate X are respectively 6 and 2. Find

(i) the probability mass function

(ii) $P(X = 3)$

(iii) $P(X \geq 2)$.

210) Suppose a pair of unbiased dice is rolled once. If X denotes the total score of two dice, write down

(i) the sample space

(ii) the values taken by the random variable X,

(iii) the inverse image of 10, and

(iv) the number of elements in inverse image of X.

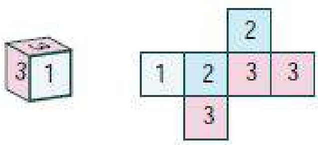
211) A six sided die is marked '1' on one face, '2' on two of its faces, and '3' on remaining three faces. The die is rolled twice. If X denotes the total score in two throws.

(i) Find the probability mass function.

(ii) Find the cumulative distribution function.

(iii) Find $P(3 \leq X < 6)$

(iv) Find $P(X \geq 4)$.



212) A random variable X has the following probability mass function

x	1	2	3	4	5	6
f(x)	k	2k	6k	5k	6k	10k

Find

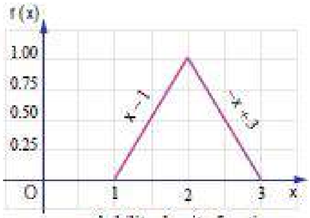
(i) $P(2 < X < 6)$

(ii) $P(2 \leq X < 5)$

(iii) $P(X \leq 4)$

(iv) $P(3 < X)$

213) If X is the random variable with probability density functionf(x)given by,



probability density function

$$f(x) = \begin{cases} x-1 & 1 \leq x < 2 \\ -x+3 & 2 \leq x < 3 \\ 0 & Otherwise \end{cases}$$

find (i) the distribution function F (x)

(ii) $P(1.5 \leq X \leq 2.5)$

214) Let X be a random variable denoting the life time of an electrical equipment having probability density function

$$f(x) = \begin{cases} ke^{-2x} & for x > 0 \\ 0 & for x \leq 0 \end{cases}$$

Find

(i) the value of k

(ii) Distribution function

(iii) $P(X < 2)$

(iv) calculate the probability that X is at least for four unit of time

(v) $P(X = 3)$

215) Suppose that f (x) given below represents a probability mass function

x	1	2	3	4	5	6
f(x)	c^2	$2c^2$	$3c^2$	$4c^2$	c	2c

Find

(i) the value of c

(ii) Mean and variance.

216) On the average, 20% of the products manufactured by ABC Company are found to be defective. If we select 6 of these products at random and X denote the number of defective products find the probability that

(i) two products are defective

(ii) at most one product is defective

(iii) at least two products are defective.

217) A random variable X has the following probability distribution values of X.

x	0	1	2	3	4	5	6	7

f(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

Find

(i) k

(ii) P(X< 6)

(iii) $P(X \geq 6)$

(iv) P(0 < X< 5)

218) Verify

(i) closure property

(ii) commutative property, and

(iii) associative property of the following operation on the given set. (a*b) = a^b;∀a, b∈N (exponentiation property)

219) Verify

(i) closure property

(ii) commutative property

(iii) associative property

(iv) existence of identity, and

(v) existence of inverse for following operation on the given set m*n = m + n - mn; m, n ∈Z

220) Using the equivalence property, show that p ↔ q ≡ (p ∧ q) v (¬p ∧ ¬q)

221) Let p: Jupiter is a planet and q: India is an island be any two simple statements. Give verbal sentence describing each of the following statements.

(i) ¬p

(ii) p ∧ ¬q

(iii) ¬p ∨ q

(iv) p→ ¬q

(v) p↔q

222) Define an operation $*$ on Q as follows: a * b = $\left(\frac{a+b}{2}\right)$; a,b ∈Q. Examine the closure, commutative, and associative properties satisfied by $*$ on Q.

223) Define an operation$*$ on Q as follows: a*b = $\left(\frac{a+b}{2}\right)$; a,b ∈Q. Examine the existence of identity and the existence of inverse for the operation * on Q.

224) Verify whether the following compound propositions are tautologies or contradictions or contingency

(p ∧ q) ∧ ¬ (p ∨ q)

225) Verify whether the following compound propositions are tautologies or contradictions or contingency

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

226) Verify whether the following compound propositions are tautologies or contradictions or contingency

$((p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow (p \rightarrow r)$

227) Let M = $\left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\} \right\}$ and let * be the matrix multiplication. Determine whether M is closed under $*$. If so, examine the commutative and associative properties satisfied by $*$ on M.

228) Let M = $\left\{ \begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\} \right\}$ and let $*$ be the matrix multiplication. Determine whether M is closed under $*$. If so, examine the existence of identity, existence of inverse properties for the operation $*$ on M.

229) Let A be Q\{1}. Define $*$ on A by x*y = x + y − xy. Is $*$ binary on A? If so, examine the commutative and associative properties satisfied by $*$ on A.

230) Let A be Q\{1}. Define $*$ on A by x*y = x + y − xy . Is $*$ binary on A? If so, examine the existence of identity, existence of inverse properties for the operation $*$ on A.

231) Prove $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$ without using truth table.

232) Prove that $p \rightarrow (\neg q \vee r) \equiv \neg p \vee (\neg q \vee r)$ using truth table.

233) Construct the truth table for $(p \wedge q) \vee r$.

234) Verify $(p \wedge \sim p) \wedge (\sim q \wedge p)$ is a tautlogy, contradiction or contingency.

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