Q1. The values of x for which the angle between the vectors $\vec{a} = 2x^2\hat{i} + 5x^2\hat{j} + \hat{k}$ on vector $\vec{b} = 7\hat{i} - 2\hat{j} + x\hat{k}$ is obtuse, is: **1 Marks**

A. 0 or $\frac{1}{2}$

B. $x > \frac{1}{2}$

C. $\left(0, \frac{1}{2}\right)$

D. $\left[0, \frac{1}{2}\right]$

Q2. The matrix $\begin{bmatrix} 0 & 1 & -2 \\ -1 & 0 & -7 \\ 2 & 7 & 0 \end{bmatrix}$ is a: **1 Marks**

A. diagonal matrix

B. symmetric matrix

C. skew symmetric matrix

D. scalar matrix

Q3. If $y = \sin^{-1} x$, then $(1 - x^2)\frac{d^2y}{dx^2}$ is equal to:

A. $x\frac{dy}{dx}$

B. $-x\frac{dy}{dx}$

C. $x^2\frac{dy}{dx}$

D. $-x^2\frac{dy}{dx}$

Q4. The matrix $A = \begin{bmatrix} \sqrt{3} & 0 & 0 \\ 0 & \sqrt{2} & 0 \\ 0 & 0 & \sqrt{5} \end{bmatrix}$ is a/ an:

A. scalar matrix

B. identity matrix

C. null matrix

D. symmetric matrix

Q5. $\int \frac{dx}{\sin^2 x \cos^2 x}$ is equal to: **1 Marks**

A. $\tan x + \cot x + C$

B. $(\tan x + \cot x)^2 + C$

C. $\tan x - \cot x + C$

D. $(\tan x - \cot x)^2 + C$

Q6. Sum of two skew-symmetric matrices of same order is always a/an: **1 Marks**

A. skew-symmetric matrix

B. symmetric matrix

C. null matrix

D. identity matrix

Q7. If $f(x) = \begin{cases} \frac{\sin^2 as}{x^2}, & \text{if } x \neq 0 \\ 1, & \text{if } x = 0 \end{cases}$ is continuous at $x = 0$, then the value of 'a' is: **1 Marks**

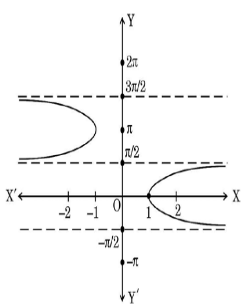
A. ±1

B. -1

C. 0

D. 1

Q8. **1 Marks**



The graph shown below depicts:

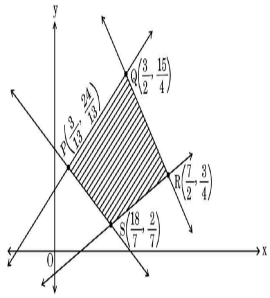
A. $y = \sec^{-1} x$

B. $y = \sec x$

C. $y = \csc^{-1} x$

D. $y = \csc x$

Q9. For a Linear Programming Problem (LPP), the given objective function is $Z = x + 2y$. The feasible region PQRS determined by the set of constraints is shown as a shaded region in the graph. **1 Marks**



$P \equiv \left(\frac{3}{13}, \frac{24}{13}\right)$, $Q \equiv \left(\frac{3}{2}, \frac{15}{4}\right)$, $R \equiv \left(\frac{7}{2}, \frac{3}{4}\right)$, $S \equiv \left(\frac{18}{7}, \frac{2}{7}\right)$ Which of the following statements is correct ?

A. Z is minimum at $\left(\frac{18}{7}, \frac{2}{7}\right)$

B. Z is maximum at $\left(\frac{7}{2}, \frac{3}{4}\right)$

C. (Value of Z at P) > (Value of Z at Q)

D. (Value of Z at Q) < (Value of Z at R)

Q10. $\int e^x(\cos x - \sin x)dx$ is equal to: **1 Marks**

A. $e^x \sin x + C$

B. $-e^x \sin x + C$

C. $-e^x \cos x + C$

D. $e^x \cos x + C$

Q11. If $\begin{bmatrix} 4+X & X-1 \\ -2 & 3 \end{bmatrix}$ is a singular matrix, then the value of x is: **1 Marks**

A. 0

B. 1

C. -2

D. -4

Q12. Let $f'(x) = 3\left(x^2 + 2x\right) - \frac{4}{x^3} + 5$, $f(1) = 0$. Then, f(x) is : **1 Marks**

A. $x^3 + 3x^2 + \frac{2}{x^2} + 5x + 11$

B. $x^3 + 3x^2 + \frac{2}{x^2} + 5x - 11$

C. $x^3 + 3x^2 - \frac{2}{x^2} + 5x - 11$

D. $x^3 - 3x^2 - \frac{2}{x^2} + 5x - 11$

Q13. If $\overrightarrow{PQ} \times \overrightarrow{PR} = 4\hat{i} + 8\hat{j} - 8\hat{k}$, then the area (ΔPQR) is: **1 Marks**

A. 2 sq units

B. 4 sq units

C. 6 sq units

D. 12 squnits

Q14. If $\int \frac{2^{\frac{1}{x}}}{x^2} dx = k\, 2^{\frac{1}{x}} + C$ then K is equal to. **1 Marks**

A. $\frac{-1}{\log 2}$

B. $-\log 2$

C. -1

D. $\frac{1}{2}$

Q15. A Dbox has 4 green, 8 blue and 3 red pens. A student picks up a pen at random, checks its colour and replaces it in the box. He repeats this process 3 times. The probability that at least one pen picked was red is: **1 Marks**

A. $\frac{3}{2}$ sq units

B. $\frac{2}{3}$ sq units

C. 3 sq units

D. $\frac{4}{3}$ sq units

Q16. The value of: $\int_0^1 \frac{dx}{e^x + e^{-x}} dx$ **1 Marks**

A. $-\frac{\pi}{4}$

B. $\frac{\pi}{4}$

C. $\tan^{-1} e - \frac{\pi}{4}$

D. $\tan^{-1} e$

Q17. For a Linear Programming Problem (LPP), the given objective function $Z = 3x + 2y$ is subject to constraints: **1 Marks**

$x + 2y \le 10$

$3x + y \le 15$

$x, y \ge 0$

The correct feasible region is:

A. ABC
B. AOEC
C. CED
D. Open unbounded region BCD

Q18. If M and N are square matrices of order 3 such that det (M) = m and MN = mI, then det (N) is equal to: **1 Marks**

A. -1
B. 1
C. $-m^2$
D. m^2

Q19. The principal branch of $\cos^{-1} x$ is: **1 Marks**

A. $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$
B. $\left[\pi, 2\pi\right]$
C. $[0, \pi]$
D. $[2\pi, 3\pi]$

Q20. The order and degree of the differential equation $\frac{d^2y}{dx^2} + 4\left(\frac{dy}{dx}\right) = x \log\left(\frac{d^2y}{dx^2}\right)$ are respectively: **1 Marks**

A. 0,3
B. 2,1
C. 2, not defined
D. 1, not defined

Q21. Let f(x) = |x|, x ∈ . R. Then, which of the following statements is incorrect? **1 Marks**

A. f has a minimum value at x = 0.
B. f has no maximum value in R.
C. f is continuous at x = 0.
D. f is differentiable at x = 0.

Q22. The solution of the differential equation $\frac{dy}{dx} = \frac{-x}{y}$ represents family of: **1 Marks**

A. parabolas
B. circles
C. ellipses
D. hyperbolas

Q23. The order and degree of the following differential equation are, respectively: $\frac{d^4y}{dx^4} + 2e^{\frac{dy}{dx}} + y^2 = 0$ **1 Marks**

A. -4,1
B. 4, not defined
C. 1,1
D. 4,1

Q24. $\int_{-1}^{1} \frac{|x|}{x} dx$, x # 0 is equal to. **1 Marks**

A. -1
B. 0
C. 1
D. 2

Q25. If A and B are invertible matrices of order 3 × 3 such that det (A) = 4 and det $[(AB)^{-1}] = \frac{1}{20}$, then det (B) is equal to: **1 Marks**

A. $\frac{1}{20}$
B. $\frac{1}{5}$
C. 20
D. 5

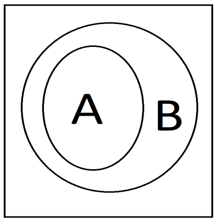
Q26. $\int \sqrt{1 + \sin x}\, dx$ is equal to: **1 Marks**

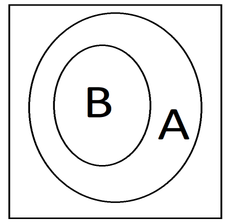
A. $2\left(-\sin\frac{x}{2} + \cos\frac{x}{2}\right) + C$
B. $2\left(\sin\frac{x}{2} - \cos\frac{x}{2}\right) + C$
C. $-2\left(\sin\frac{x}{2} + \cos\frac{x}{2}\right) + C$
D. $2\left(\sin\frac{x}{2} + \cos\frac{x}{2}\right) + C$

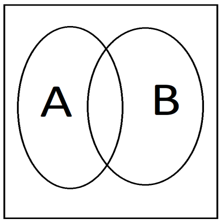
Q27. $\int \frac{e^x}{\sqrt{4 - e^{2x}}} dx$ is equal to: **1 Marks**

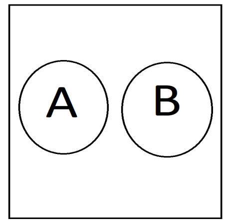
A. $\frac{1}{2}\cos^{-1}(e^x) + C$
B. $\frac{1}{2}\sin^{-1}(e^x) + C$
C. $\frac{e^x}{2} + C$
D. $\sin^{-1}\left(\frac{e^x}{2}\right) + C$

Q28. If A denotes the set of continuous functions and B denotes set of differentiable functions, then which of the following depicts the correct relation between set A and B? **1 Marks**

A.


B.


C.


D.


Q29. If ten^{-1} = $(x^2 - y^{-2})$ = a, where 'a'is a constant, then $\frac{dy}{dx}$is: **rks**

A. $\frac{x}{y}$

B. $\frac{x}{y}$

C. $\frac{a}{x}$

D. $\frac{a}{y}$

Q30. The function f defined by **rks**

$$f(x) = \begin{cases} x & \text{if } x \le 1 \\ 5, & \text{if } x > 1 \end{cases}$$

is not continuous at:

A. x = 0

B. x = 1

C. x = 2

D. x = 5

Q31. $\int_0^{\frac{\pi}{2}} \cos x \cdot e^{\sin x}$ dx is equal to: **1 Marks**

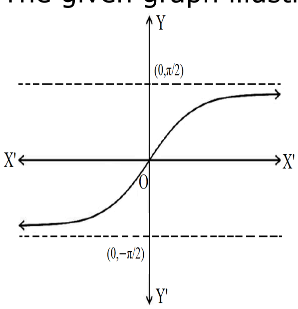
A. 0

B. 1-e

C. e-1

D. e

Q32. The given graph illustrates: **1 Marks**



A. $y = \tan^{-1} x$

B. $y = \text{cosec}^{-1} x$

C. $y = \cot^{-1} x$

D. $y = \sec^{-1} x$

Q33. The solution for the differential equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ is : **1 Marks**

A. $3e^{4y} + 4e^{-3x} + C$

B. $e^{3x+4y} + C = 0$

C. $3e^{-3y} + 4e^{4x} + 12C = 0$

D. $3e^{-4y} + 4e^{3x} + 12C = 0$

Q34. $\int \frac{e^{9\log x} - e^{8\log x}}{e^{6\log x} - e^{5\log x}}$dx is equal to: **1 Marks**

A. x + C

B. $\frac{x^2}{2} + C$

C. $\frac{x^4}{4} + C$

D. $\frac{x^3}{3} + C$

Q35. Let f x^2, $x \in R$ Then, which of the following statements is incorrect? **1 Marks**

A. Minimum value of f does not exist.

B. There is no point of maximum value of fin R.

C. f is continuous at x = 0.

D. fis differentiable at x = 0.

Q36. The absolute maximum value of function f(x) = x3 - 3x + 2 in [0, 2] is: **1 Marks**

A. 0 B. 2 C. 4 D. 5

Q37. $\int \frac{a^x}{\sqrt{1-a^{2x}}} dx$ is equal to: **1 Marks**

A. $\frac{\sin^{-1}(a^x)}{\log_e a} + C$

B. $\log(1-a^{2x}) + C$

C. $\frac{\cos^{-1}(a^x)}{\log_e a} + C$

D. $\frac{\sin^{-1}(a^x)}{a^x} + C$

Q38. If $f(x) = \begin{cases} 1, & \text{if } x \le 3 \\ ax + b, & \text{if } 3 < x < 5 \\ 7, & \text{if } 5 \le x \end{cases}$ is continuous in R, then the values of aandb are: **1 Marks**

A. a = 3, b = -8 B. a = 3, b = 8 C. a = -3, b = -8 D. a = -3, b = 8

Q39. A Dbox has 4 green, 8 blue and 3 red pens. A student picks up a pen at random, checks its colour and replaces it in the box. He repeats this process 3 times. The probability that at least one pen picked was red is: **1 Marks**

A. $\frac{124}{125}$

B. $\frac{1}{125}$

C. $\frac{61}{125}$

D. $\frac{64}{125}$

Q40. IfE and F are two events such that P(E) > 0 and P(F) ≠ 1, then $P\left(\frac{\overline{E}}{\overline{F}}\right)$is: **1 Marks**

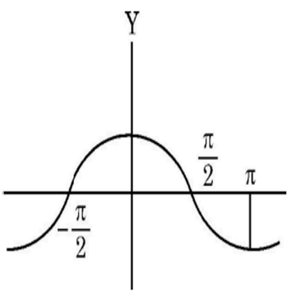
A. $\frac{P(\overline{E})}{P(\overline{F})}$

B. $1 - P\left(\frac{\overline{E}}{F}\right)$

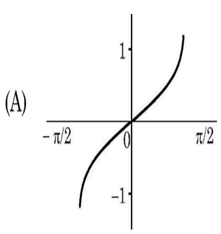
C. $1 - P\left(\frac{E}{F}\right)$

D. $\frac{1 - P(E \cup F)}{P(\overline{F})}$

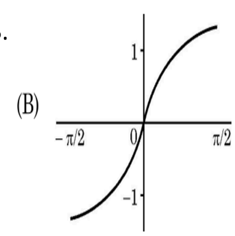
Q41. The graph of a trigonometric function is as shown. Which of the following will represent graph of its inverse? **1 Marks**



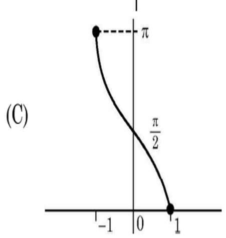
A.



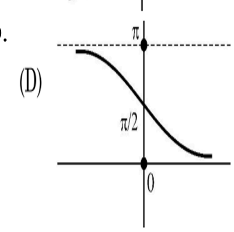
B.



C.



D.



Q42. $\int \frac{e^{-x}}{16 + 9e^{-2x}} dx$ is equal to: **1 Marks**

A. $\frac{16}{9} \tan^{-1}(e^{-x}) + C$

B. $-\frac{1}{12} \tan^{-1}\left(\frac{3e^{-x}}{4}\right) + C$

C. $\tan^{-1}\left(\frac{e^{-x}}{4}\right) + C$

D. $-\frac{1}{3} \tan^{-1}\left(\frac{e^{-x}}{4}\right) + C$

Q43. The integrating factor of the differential equation $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right)\frac{dx}{dy} = 1$ is: **1 Marks**

A. $e^{-1/\sqrt{x}}$
B. $e^{2/\sqrt{x}}$
C. $e^{2\sqrt{x}}$
D. $e^{-2\sqrt{x}}$

Q44. Let P be a skew-symmetric matrix of order 3. If det(P) $= \alpha$ then $(2025)^{\alpha}$ is. **1 Marks**

A. 0
B. 1
C. 2025
D. (2025)3

Q45. In the following probability distribution, the value of p is: **1 Marks**

X	0	1	2	3
P(X)	p	p	0.3	2p

A. $\frac{7}{40}$
B. $\frac{1}{10}$
C. $\frac{9}{35}$
D. $\frac{1}{4}$

Q46. Let $\vec{p}$ and $\vec{q}$ be two unit vectors and α be the angle between them. Then $(\vec{p}+\vec{q})$ will be a unit vector for what value of α? **1 Marks**

A. $\frac{\pi}{4}$
B. $\frac{\pi}{3}$
C. $\frac{\pi}{2}$
D. $\frac{2\pi}{3}$

Q47. If the sides AB and AC of ΔABC are represented by vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ respectively, then the length of the median through A on BC is: **1 Marks**

A. $2\sqrt{2}$units
B. $\sqrt{18}$units
C. $\frac{\sqrt{34}}{2}$units
D. $\frac{\sqrt{48}}{2}$units

Q48. The area of the region enclosed by the curve $x = \sqrt{2}$ and the lines x = 0 and x = 4 and x-axis is: **1 Marks**

A. $\frac{16}{9}$sq. units
B. $\frac{32}{9}$sq. units
C. $\frac{16}{3}$sq. units
D. $\frac{32}{3}$sq. units

Q49. \(\int\dfrac{\cos2\text{x-\cos}2\alpha}{\cos\text{x}-\cos\alpha}\text{dx}\) is equal to: **1 Marks**

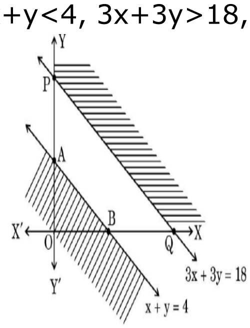
A. $2(\sin x + x\cos\alpha) + C$
B. $2(\sin x - x\cos\alpha) + C$
C. $2(\sin x + 2x\cos\alpha) + C$
D. $2(\sin x + \sin\alpha) + C$

Q50. The principal value of $\sin^{-1}\left(\cos\frac{43\pi}{5}\right)$ is: **1 Marks**

A. $\frac{-7\pi}{5}$
B. $\frac{\pi}{10}$
C. $\frac{-\pi}{10}$
D. $\frac{3\pi}{5}$

Q51. In a Linear Programming Problem (LPP), the objective function Z = 2x + 5y is to be maximised under the following constraints: **1 Marks**

x+y<4, 3x+3y>18, x,y>0 Study the graph and select the correct option.



The solution of the given LPP:

A. lies in the shaded unbounded region.
B. liesin$\triangle$AOB.

C. does not exist.

D. lies in the combined region of △ AOB and unbounded shaded region.

Q52. The value of $\cos\left(\frac{\pi}{6}+\cot^{-1}(-\sqrt{3})\right)$ is: **1 Marks**

A. −1
B. $\frac{-\sqrt{3}}{2}$
C. 0
D. 1

Q53. If $y = a\cos(\log x) + b\sin(\log x)$, then $x^2y_2 + xy_1$ is: **1 Marks**

A. cot(log x)
B. y
C. -y
D. tan(log x)

Q54. If $f(x) = \begin{cases} \frac{1-\sin^3 x}{3\cos^2 x}, & \text{for } x \neq \frac{\pi}{2} \\ k, & \text{for } x = \frac{\pi}{2} \end{cases}$ **1 Marks**

is continuous at $x = \frac{\pi}{2}$, then the value of k is:

A. $\frac{3}{2}$
B. $\frac{1}{6}$
C. $\frac{1}{2}$
D. 1

Q55. If $A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A is a/an: **1 Marks**

A. scalar matrix
B. identity matrix
C. symmetric matrix
D. skew-symmetric matrix

Q56. If f : R → R is defined as $f(x) = 2x - \sin x$, then f is: **1 Marks**

A. a decreasing function
B. an increasing function
C. maximum at $x = \frac{\pi}{2}$
D. maximum at x = 0

Q57. The probability distribution of a random variable X is given by: **1 Marks**

X	0	1	2	3
P(X)	p	p	0.3	2p

Then E(X) of distribution is

A. -1.8
B. -1
C. 1
D. 1.8

Q58. If $y = \sin^{-1} x, -1 \leq x \leq 0$, then the range of y is: **1 Marks**

A. $\left(\frac{-\pi}{2}, 0\right)$
B. $\left[\frac{-\pi}{2}, 0\right]$
C. $\left[\frac{-\pi}{2}, 0\right]$
D. $\left(\frac{-\pi}{2}, 0\right]$

Q59. If $f(x) = \begin{cases} 3ax - b, & x > 1 \\ 11, & x = 1 \\ -5ax - 2b, & x < 1 \end{cases}$ is continuous at x = 1, then the values of a and b are: **1 Marks**

A. a = 3, b = 5
B. a = 8, b = -1
C. a = 1, b = -8
D. a = -3, b = 5

Q60. If $P(A) = \frac{1}{5}, P(B) = \frac{3}{5}$ and $P\left(\frac{A}{B}\right) = \frac{2}{5}$, then $P(A' \cap B')$ is: **1 Marks**

A. $\frac{11}{25}$
B. $\frac{19}{25}$
C. $\frac{8}{25}$
D. $\frac{6}{25}$

Q61. If $\int_0^a dx \leq \frac{a}{2} + 6$ then. **1 Marks**

A. $-4 \le a \le 3$
B. $a \ge 4, a \le -3$
C. $-3 \le a \le 4$
D. $-3 \le a \le 0$

Q62. If a line makes angles of $\frac{3\pi}{4}, \frac{\pi}{3}$ amd θ with the positive directions of x, y and z-axis respectively, then θ is: **1 Marks**

A. $\frac{-\pi}{3}$ only
B. $\frac{\pi}{3}$ only
C. $\frac{\pi}{6}$
D. $\pm\frac{\pi}{3}$

Q63. Domain of $\sin^{-1}(2x^2 - 3)$ is: **1 Marks**

A. $(-1, 0) \cup (1, \sqrt{2})$
B. $(-1, -\sqrt{2}) \cup (0, 1)$
C. $(\sqrt{2}, -1) \cup (1, \sqrt{2})$
D. $(-\sqrt{2}, -1) \cup (1, \sqrt{2})$

Q64. Chances that three persons A, B, and C go to the market are 30%, 60% and 50% respectively. The probability that at least one will go to the market is: **1 Marks**

A. $\frac{14}{10}$
B. $\frac{43}{50}$
C. $\frac{9}{100}$
D. $\frac{7}{50}$

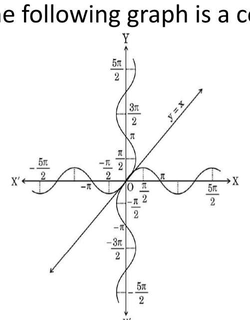
Q65. The corner points of the feasible region of a Linear Programming Problem are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). If Z = ax + by; (a, b > 0) be the objective function, and maximum value of Z is obtained at (0, 2) and (3, 0), then the relation between a and b is: **1 Marks**

A. a = b
B. a = 3b
C. b = 6a
D. 3a = 2b

Q66. If E and F are two independent events such that $P(E) = \frac{2}{3}, P(F) = \frac{3}{7}$, then $P(E/\overline{F})$ is equal to: **1 Marks**

A. $\frac{1}{6}$
B. $\frac{1}{2}$
C. $\frac{2}{3}$
D. $\frac{7}{9}$

Q67. The following graph is a combination of: **1 Marks**



A. $y = \sin^{-1} x$ and $y = \cos^{-1} x$
B. $y = \cos^{-1} x$ and $y = \cos x$
C. $y = \sin^{-1} x$ and $y = \sin x$
D. $y = \cos^{-1} x$ and $y = \sin x$

Q68. The coordinates of the foot of the perpendicular drawn from the point A(-2, 8, 5) on the y-axis is: **1 Marks**

A. (0, 0, 5)
B. (0, 3, 0)
C. (-2, 0, 5)
D. (-2, 0, 5)

Q69. For a function f(x), which of the following holds true? **1 Marks**

A. $\int_a^b f(x)\,dx \int_a^b f(a+b-x)dx$
B. $\int_{-a}^{a} f(x)\,dx = 0$, if f is an even function
C. $\int_{-a}^{a} f(x)\,dx = 2\int_0^a f(x)\,dx$, if fis an odd function
D. $\int_0^{2a} f(x)\,dx = \int_0^a f(x)\,dx - \int_0^a f(2a+x)\,dx$

Q70. The order and degree of the differential equation $\left(\frac{d^2y}{dx}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x \sin\left(\frac{dy}{dx}\right)$ are: **1 Marks**

A. order 2, degree 2
B. order 2, degree 1
C. order 2, degree not defined
D. order 1, degree not defined

Q71. A spherical ball has a variable diameter $\frac{5}{3}(3x + 1)$. The rate of change of its volume w.r.t. x, when x = 1, is: **1 Marks**

A. 225π B. 300π C. 375π D. 125π

Q72. Solve for x, **2 Marks**

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

Q73. The diagonals of a parallelogram are given by $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - \hat{k}$ Find the area of the parallelogram. **2 Marks**

Q74. Find the domain of $\sin^{-1}(x^2 - 3)$. **2 Marks**

Q75. Let f : A → B be defined by $f(x) = \frac{x-2}{x-3}$, where A = R - {3} and B = R - {1}. **2 Marks**

Discuss the bijectivity of the function.

Q76. If $\vec{a}$ and $\vec{b}$ are two non-collinear vectors, then find x, such that $\vec{\alpha} = (x-2)\vec{a} + \vec{b}$ and $\vec{\beta} = (3+2x)\vec{a} - 2\vec{b}$ are collinear. **2 Marks**

Q77. Determine if the lines $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(3\hat{i} - \hat{j})$ and $\vec{r} = (4\hat{i} - \hat{k}) + \mu(2\hat{i} + 3\hat{k})$ intersect with each other. **2 Marks**

Q78. Find the angle at which the given lines are inclined to each other: **2 Marks**

$l_1 : \frac{x-5}{2} = \frac{y+3}{1} = \frac{z-1}{-3}$

$l_2 : \frac{x}{3} = \frac{y-1}{2} = \frac{z+5}{-1}$

Q79. Find the domain of $f(x) = \sin^{-1}(-x^2)$. **2 Marks**

Q80. **2 Marks**

Evaluate: $\int_0^{\pi} \frac{\sin(2px)}{\sin x}\,dx, p \in \mathbb{N}$.

Q81. **2 Marks**

Find the intervals in which function $f(x) = 5x^{\frac{3}{2}} - 3x^{\frac{5}{2}}$ is (i) increasing (ii) decreasing.

Q82. A man needs to hang two lanterns on a straight wire whose end points have coordinates A (4, 1, -2) and B (6, 2, -3). Find the coordinates of the points where he hangs the lanterns such that these points trisect the wire AB. **2 Marks**

Q83. Find the domain of $\sec^{-1}(2x + 1)$. **2 Marks**

Q84. Find the value of A if the following lines are perpendicular to each other: **2 Marks**

$l_1 : \frac{1-x}{-3} = \frac{3y-2}{2\lambda} = \frac{z-3}{3}$

$l_2 : \frac{x-1}{3\lambda} = \frac{1-y}{1} = \frac{2z-5}{3}$

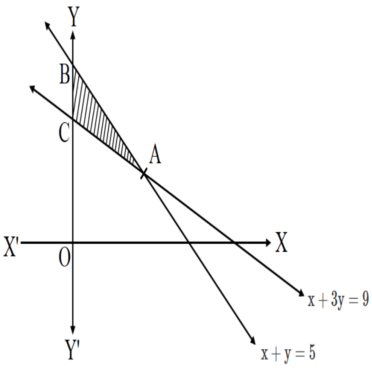
Q85. The radius of a cylinder is decreasing at a rate of 2 cm/s and the altitude is increasing at the rate of 3 cm/s. Find the rate of change of volume of this cylinder when its radius is 4 cm and altitude is 6 cm. **2 Marks**

Q86. Find the values of 'a' for which $f(x) = \sin x - ax + b$ is increasing on R. **2 Marks**

Q87. In a Linear Programming Problem, the objective function Z = 5x + 4y needs to be maximised under constraints 3x + y ≤ 6, x ≤ 1, x, y ≥ 0. Express the LPP on the graph and shade the feasible region and mark the corner points. **2 Marks**

Q88. Find the values of 'a' for which $f(x) = \sqrt{3}\sin x - \cos x - 2ax + b$ is decreasing on IR. **2 Marks**

Q89. For a Linear Programming Problem, find min Z = 5x + 3y (where Z is the objective function) for the feasible region shaded in the given figure. **2 Marks**



Q90. Calculate the area of the region bounded by the curve $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and the x-axis using integration. **2 Marks**

Q91. Let the volume of a metallic hollow sphere be constant. If the inner radius increases at the rate of 2cm/s, find the rate of increase of the outer radius when the radii are 2cm and 4cm respectively. **2 Marks**

Q92. In a linear Programming Program (LPP) for objective function Z = 14x - 10y subject to constraints **2 Marks**

X + y ≤ 8

3x - 2y ≥ -6

X, y ≥ 20

shade the feasible region and mark the corner points in a neatly drawn graph.

Q93. Find the domain of the function $f(x) = \cos^{-1}(x^2 - 4)$. **2 Marks**

Q94. For the curve $y = 5x - 2x^3$, if x increases at the rate of 2 units/ s, then how fast is the slope of the curve changing when x = 2? **2 Marks**

Q95. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 5 \end{bmatrix}$, then find the value of K if $A^2 - 6A + KI_2$, where I_2 is an identity matrix. **2 Marks**

Q96. If $|\vec{a}| = 2, |\vec{b}| = 3$ and $\vec{a}.\vec{b} = 4$, then evaluate $|\vec{a} + \vec{b}|$. **2 Marks**

Q97. Let $\vec{p} = 2\hat{i} - 3\hat{j} - \hat{k}, \vec{q} = -3\hat{i} + 4\hat{j} + \hat{k}$ and $\vec{r} = \hat{i} + \hat{j} + 2\hat{k}$ Express $\vec{r}$in the form of $\vec{x} = \gamma\vec{p} + \mu\vec{q}$and hence find the values of γ and μ. **2 Marks**

Q98. Find the values of 'a' for which $f(x) = x^2 - 2ax + b$ is an increasing function for x > 0. **2 Marks**

Q99. Evaluate: **2 Marks**

$\tan^{-1}\left[2\sin\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$

Q100. Evaluate: **2 Marks**

$\sin^{-1}\left(\sin\frac{3\pi}{5}\right)$

Q101. If $\begin{bmatrix} 3 & -1 \\ 0 & 1 \\ 2 & -3 \end{bmatrix} A = \begin{bmatrix} 2 \\ -5 \\ -17 \end{bmatrix}$, then find matrix A. **2 Marks**

Q102. Surface area of a balloon (spherical), when air is blown into it, increases at a rate of 5 mm^2/s. When the radius of the balloon is 8 mm, find the rate at which the volume of the balloon is increasing. **2 Marks**

Q103. **2 Marks**

Evaluate: $\int 2x^3 e^{x^2} dx$

Q104. Find the local maxima and local minima of the function $f(x) = \frac{8}{3}x^3 - 12x^2 + 18x + 5$. **2 Marks**

Q105. If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, then show that A^2 - 4A + 7I = 0. **2 Marks**

Q106. A cylindrical water container has developed a leak at the bottom. The water is leaking at the rate of $5cm^3$/ s from the leak. If the radius of the container is 15cm, find the rate at which the height of water is decreasing inside the container, when the height of water is 2 metres. **2 Marks**

Q107. **2 Marks**

Evaluate: $\int_0^{\frac{\pi}{4}} \sqrt{1 + \sin 2x}\, dx$

Q108. 10 identical blocks are marked with '0' on two of them, '1' on three of them, '2' on four of them and '3' on one of them and put in a box. If x denotes the number written on the block, then write the probability distribution of X and calculate its mean. **2 Marks**

Q109. Two friends strings of while their flying kites kites crossing - A from each A different locations, find the other. A The — strings A can A be represented by vectors $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + 4\hat{k}$. Determine the angle formed between the kite strings. Assume there is (b) no slack in the strings. **2 Marks**

Q110. If $\vec{\alpha}$ and $\vec{\beta}$are position vectors of two points P and Q respectively, then find the position vector of a point R in QP produced such that $QR = \frac{3}{2}QP$. **2 Marks**

Q111. The probability distribution of a random variable X is given as: **2 Marks**

X	1	2	3	2λ	3λ	4λ
P(X)	$\frac{11}{30}$	$\frac{1}{15}$	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{1}{15}$	$\frac{1}{10}$

Calculate λ if E(X) = 3.2.
Find P (X > 1).

Q112. Consider the experiment of tossing a coin. If the coin shows head, toss it again; but if it shows a tail, then throw a die. Find the conditional probability of the event A: 'the die shows a number greater than 3' given that B : 'there is at least one tail'. **2 Marks**

Q113. If $f(x) = \begin{cases} 2x - 3, & -3 \le x \le -2 \\ x + 1, & -2 \le x \le 0 \end{cases}$ Check the differentiability of f(x) at x = -2. **2 Marks**

Q114. If $x = e^{\frac{x}{y}}$, then prove that $\frac{dy}{dx} = \frac{x - y}{x \log x}$. **2 Marks**

Q115. Differentiate $\left(\frac{5^x}{x^5}\right)$ with respect to x. **2 Marks**

Q116. Check the differentiability of function f(x) = x |x| at x = 0. **2 Marks**

Q117. A vector $\vec{a}$ makes equal angles with all the three axes. If the magnitude of the vector is $5\sqrt{3}$ units, then find $\vec{a}$ **2 Marks**

Q118. If $-2x^2 - 5xy + y^3 = 76$, then find $\frac{dy}{dx}$. **2 Marks**

Q119. If y = 5 cos x-3 sin x, prove that $\frac{d^2y}{dx^2} + y = 0$. **2 Marks**

Q120. In a village of 8000 people, 3000 go out of the village to work and 4000 are women. It is noted that 30% of women go out of the village to work. What is the probability that a randomly chosen individual is either a woman or a person working outside the village? **2 Marks**

Q121. Differentiate $2^{\cos^2 x}$ w.r.t $\cos^2 x$ **2 Marks**

Q122. Let $\vec{a}$, $\vec{b}$, and $\vec{c}$ be three vectors such that $\vec{a}.\vec{b} = \vec{a}.\vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$, $\vec{a} \ne 0$. Show that $\vec{b}, \vec{c}$, **2 Marks**

Q123. Two friends while flying kites from different locations, find the strings of their kites crossing each other. The strings can be represented by vectors $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + 4\hat{k}$. Determine the angle formed between the kite strings. Assume there is no slack in the strings. **2 Marks**

Q124. Find a vector of magnitude 21 units in the direction opposite to that - of $\overrightarrow{AB}$ where A and B are the points A(2, 1, 3) and B(8, -1, 0) respectively. **2 Marks**

Q125. A coin is tossed twice. Let X be a random variable defined as number of heads minus number of tails. Obtain the probability distribution of X and also find its mean. **2 Marks**

Q126. The probability distribution of a random variable X is given by: **2 Marks**

X	0	1	2	3
P(X)	P	$\frac{P}{3}$	$\frac{P}{6}$	$\frac{P}{12}$

i. Determine the value of p.

ii. Calculate $P(X \geq 1)$.

iii. Calculate expectation of X, i.e. E(X).

Q127. In a city, a survey was conducted among residents about their preferred mode of commuting. It was found that 50% people preferred using public transport, 35% preferred using a bicycle and 20% use both public transport and a bicycle. If a person is selected at random, find the probability that: **2 Marks**

i. The person uses only public transport.

ii. The person uses a bicycle, given that they also use the public transport.

iii. The person uses neither public transport nor a bicycle.

Q128. Find the probability distribution of the number of boys in families having three children, assuming equal probability for a boy and a girl. **2 Marks**

Q129. Find k so that **2 Marks**

$f(x) = \begin{cases} \frac{x^2 - 2x - 3}{x + 1} & x \neq -1 \\ k, & x = -1 \end{cases}$

is continuous at x = -1.

Q130. A $\vec{a}$ vector a makes equal angles with all the three axes. If the magnitude of the vector is $5\sqrt{3}$ units, then find $\vec{a}$. **2 Marks**

Q131. If $\vec{\alpha}$ and $\vec{\beta}$ are position vectors of two points P and Q respectively, then find the position vector of a point R in QP produced such that $QR = \frac{3}{2}QP$. **2 Marks**

Q132. If f: $R^+ \rightarrow R$ is defined as $f(x) = \log_a x (a > 0 \text{ and } a \neq 1)$, prove that f is a bijection **2 Marks**

(R^+ is a set of all positive real numbers).

Q133. Let A = {1, 2, 3} and B = {4, 5, 6}. A relation R from A to B is defined as $R = (x, y) : x + y = 6, x \epsilon A, y \epsilon B$. **2 Marks**

Q134. Find domain of $\sin^{-1}\sqrt{x - 1}$. **2 Marks**

Q135. Simplify $\sin^{-1}\left(\frac{x}{\sqrt{1 + x^2}}\right)$. **2 Marks**

Q136. If $\tan^{-1}(x^2 + y^2) = a^2$, then find $\frac{dy}{dx}$ **2 Marks**

Q137. Find : $\int \frac{1}{x}\sqrt{\frac{x + a}{x - a}}dx$. **3 Marks**

Q138. Solve the following linear programming problem graphically: **3 Marks**

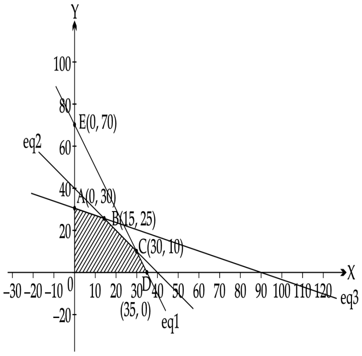
Minimise Z = x - 5y subject to the constraints:

x - y ≥ 0

[-x + 2y ≥ 2

x ≥ 3, y ≤ 4, y ≥ 0

Q139. **3 Marks**



The feasible region along with corner points for a linear programming problem are shown in the graph. Write all the constraints for the given linear programing problem.

Q140. The area of an expanding rectangle is increasing at the rate of 48 cm^2/ s. The length of the rectangle is always square of its breadth. At what rate the length of rectangle increasing at an instant, when breadth = 4.5 cm? **3 Marks**

Q141. In the Linear Programming Problem (LPP), find the point/ points giving maximum value for Z = 5x + 10y **3 Marks**

subject to constraints

$x + 2y \leq 120$

$x + y \geq 60$

$x - 2y \geq 0$

$x, y \geq 0$

Q142. Find: **3 Marks**

$$\int \frac{\sqrt{x}}{1+\sqrt{x^{\frac{3}{2}}}}dx$$

Q143. Solve the following linear programming problem graphically: **3 Marks**

Minimise Z = 2x +y subject to the constraints:

$3x + y \geq 9$

$x + y \geq 7$

$x + 2y \geq 8$

$x, y \geq 0$

Q144. Differentiate $y = \sqrt{\log\left\{\sin\left(\frac{x^3}{2} - 1\right)\right\}}$ with respect to x. **3 Marks**

Q145. Find the interval/intervals in which the function $f(x) = \sin 3x - \cos 3x, \quad 0 < x < \frac{\pi}{2}$ is strictly increasing. **3 Marks**

Q146. Sketch the graph of y = | x + 3 | and find the area of the region enclosed by the curve, x-axis, between x = -6 and x = 0, using integration. **3 Marks**

Q147. Find the value of 'a' for which $f(x) = \sqrt{3}\sin x - \cos x - 2ax + 6$ is decreasing in R. **3 Marks**

Q148. Let A =\(\begin{bmatrix} 1 \4 \-2 \end{bmatrix} \text{And C} = \begin{bmatrix} 3 & 4 & 2 \12 & 16 & 8 \-6 & -8 & -4 \end{bmatrix} \) be two matrices. Then, find the matrix B if AB = C. **3 Marks**

Q149. Show that f (x) = $\tan^{-1}$ (sin x + cos x) is an increasing function in $\left[0, \frac{\pi}{4}\right]$. **3 Marks**

Q150. f and g are continuous functions on interval [a, b]. Given that f(a - x) = f(x) and g(x) + g(a - x) = a, show that $\int_0^a f(x)\,g(x)dx = \frac{a}{2}\int_0^a f(x)dx$ **3 Marks**

Q151. Show that the derivative of $\tan^{-1}(\sec x + \tan x), \left[-\frac{\pi}{2} < x < \frac{\pi}{2}\right]$ with respect to x is equal to $\frac{1}{2}$. **3 Marks**

Q152. Solve the differential equation **3 Marks**
$x\cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x.$

Q153. Find the value of x, if \(\begin{bmatrix} 1 & \text{x} & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \2 & 5 & 1 \15 & 3 & 2 \end{bmatrix}\)\(\begin{bmatrix} 1 \2 \\text{x} \end{bmatrix} = \text{O}.\) **3 Marks**

Q154. Find the distance of the point (-1, -5, -10) from the point of intersection of the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z.$ **3 Marks**

Q155. Consider the Linear Programming Problem, where the objective function Z = (x + 4y) needs to be minimized subject to constraints **3 Marks**

2x + y > 1000

x + 2y > 800

x, y > 0.

Draw a neat graph of the feasible region and find the minimum value of Z.

Q156. Solve the following Linear Programming Problem using graphical method: Maximise Z = 100x + 50y. **3 Marks**

subject to the constraints

a. $3x + y \le 600$
b. $x + y \le 300$
c. $y \le x + 200$
d. $y \ge 0, y \ge 0$

Q157. Solve the following linear programming problem graphically: **3 Marks**

Maximise Z = x + 2y

Subject to the constraints:

$x - y \ge 0$

$x - 2y \ge -2$

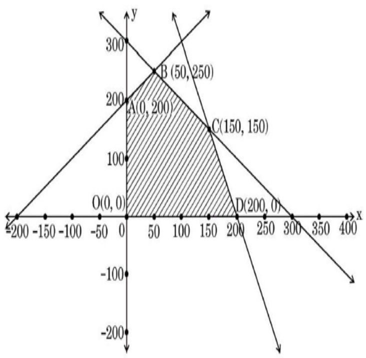
$x \ge 0, y \ge 0$

Q158. Amongst all pairs of positive integers with product as 289, find which of the two numbers add up to the least. **3 Marks**

Q159. Find dimensions of a rectangle of perimeter 12cm which will generate maximum volume when swept along a circular rotation keeping the shorter side fixed as the axis. **3 Marks**

Q160. A spherical medicine ball when dropped in water dissolves in such a way that the rate of decrease of volume at any instant is proportional to its surface area. Calculate the rate of decrease of its radius. **3 Marks**

Q161. **3 Marks**



For the given graph of a Linear Programming Problem, write all the constraints satisfying the given feasible region.

Q162. A coin is biased so that the head is 3 times as likely to occur as tail. If the coin is tossed three times, find the probability distribution of number of tails. Hence, find the mean of the distribution. **3 Marks**

Q163. Find the particular solution of the differential equation **3 Marks**

$\frac{dy}{dx} - \frac{y}{x} + \csc\left(\frac{y}{x}\right) = 0;$ given that $y = 0$, when $x = 1$.

Q164. If $\int_a^b x^3 dx = 0$ and $\int_a^b x^3 dx = \frac{2}{3}$, then find the values of a and b. **3 Marks**

Q165. Let R be a relation on set of real numbers IR defined as $(x, y) : x - y + \sqrt{3}$ is an irrational number, $x, y \in \mathbb{R}$ Verify R for reflexivity, symmetry and transitivity. **3 Marks**

Q166. Bag I contains 4 white and 5 black balls. Bag II contains 6 white and 7 black balls. A ball drawn randomly by from bag I is transferred to bag II and then a ball is drawn randomly from bag II. Find the probability that the ball drawn is white. **3 Marks**

Q167. Show that of all the rectangles with a fixed perimeter, the square has the greatest area. **3 Marks**

Q168. Prove that f : N → N defined as f(x) = ax + b (a, b ∈ N) is one-one but not onto. **3 Marks**

Q169. The side of an equilateral triangle is increasing at the rate of 3 cm/s. At what rate its area increasing when the side of the triangle is 15 cm? **3 Marks**

Q170. Find: **3 Marks**

$\int \left(\frac{\cos x\, dx}{1 + \cos x + \sin x}\right)$

Q171. A person is Head of two independent selection committees I and II. If the probability of making a wrong selection in committee I is 0-03 and that in committee II is 0-01, then find the probability that the person makes the correct decision of selection: **3 Marks**

i. in both committees
ii. in only one committee

Q172. Solve the following Linear Programming Problem graphically: **3 Marks**

Minimise Z = 3x + 5y
subject to the constraints

a. $x + 2y \geq 10$
b. $x + y \geq 6$
c. $3x + y \geq 8$
d. $x, y \geq 0.$

Q173. Differentiate $\log(x^x + \text{cosec}^2 x)$ with respect to x. **3 Marks**

Q174. In the Linear Programming Problem for objective function Z = 18x + 10y subject to constraints **3 Marks**

4x + y ≥ 20

2x + 3y ≥ 30

x, y ≥ 0

find the minimum value of Z.

Q175. Let R be a relation defined over N, where N is set of natural numbers, defined as "mRn if and only if m is a multiple of n, m, n ∈ N." Find whether R is reflexive, symmetric and transitive or not. **3 Marks**

Q176. \(\text {bf} { 26.} \text{ If} \text{ A} = \begin{bmatrix} 1 & -1 & 0 \end{bmatrix}, \quad \text{B} = \begin{bmatrix} 2 & 0 & 1 \-1 & 3 & 4 \0 & 5 & 1 \end{bmatrix}, \quad \text{and} \quad C = \begin{bmatrix} 2 \3 \4 \end{bmatrix},\)re three matrices, then find ABC. **3 Marks**

Q177. Find the particular solution of the differential equation **3 Marks**

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

given that $= \frac{\pi}{4}$, when x = 1.

Q178. Evaluate: **ks**

$\int_{\frac{\pi}{2}}^{\pi} e^x \left(\frac{1 - \sin x}{1 - \cos x}\right) dx.$

Q179. The probability that a student buys a colouring book is 0-7 and that she buys a box of colours is 0-2. The probability that she buys a colouring book, given that she buys a box of colours, is 0-3. Find the probability that the student: **3 Marks**

i. Buys both the colouring book and the box of colours.
ii. Buys a box of colours given that she buys the colouring book.

Q180. Verify that lines given by? $\vec{r} = (1 - \lambda)\hat{i} + (\lambda - 2)\hat{j} + (3 - 2\lambda)\hat{k}$ and $\vec{r} = (\mu + 1)\hat{i} + (2\mu - 1)\hat{j} - (2\mu + 1)\hat{k}$ are skew lines. Hence, find shortest distance between the lines. **3 Marks**

Q181. A student wants to pair up natural numbers in such a way that they satisfy the equation 2x + y = 41, $x, y \in n$. Find the domain and range of the relation. Check if the relation thus formed is reflexive, symmetric and transitive. Hence, state whether it is an equivalence relation or not. **3 Marks**

Q182. Show that the function f: N — N, where N is a set of natural numbers, given by $f(n) = \begin{cases} n - 1, & \text{if n is even} \\ n + 1, & \text{if n is odd} \end{cases}$ is a bijection. **3 Marks**

Q183. If $\vec{a}$ and $\vec{b}$ are unit vectors inclined with each other at an angle θ then prove that $\frac{1}{2}\left|\vec{a} - \vec{b}\right| = \sin\frac{\theta}{2}$. **3 Marks**

Q184. Differentiate $y = \sin^{-1}(3x - 4x^3)$ w.r.t.x, if $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$. **3 Marks**

Q185. Evaluate: **3 Marks**

$\int_1^4 (|x - 2| + |x - 4|)\, dx$

Q186. Solve the differential equation $2(y+3 - xy\frac{dy}{dx} = 0$; given y(1) = -2. **3 Marks**

Q187. Evaluate: **3 Marks**

$$\int_0^{\frac{\pi}{4}} \frac{dx}{\cos^3 x\sqrt{2\sin 2x}}$$

Q188. If $x\sqrt{1+y} + y\sqrt{1+x} = 0,\ -1 < x < 1,\ x \neq y$, then prove that $\frac{dy}{dx} = \frac{-1}{(1+x)^2}$. **3 Marks**

Q189. Two dice are thrown. Defined are the following two events A and B : A = {(x, y) : x + y = 9}, B = {(x, y) : x ≠ 3}, where (x, y) denote a point in the sample space. **3 Marks**
Check if events A and B are independent or mutually exclusive.

Q190. Let R be a relation defined on a set N of natural numbers such that R = {(x, y) : xy is a square of a natural number, x, y ∈ N}. Determine if the relation R is an equivalence relation. **3 Marks**

Q191. The probability distribution for the number of students being absent in X a class on a Saturday is as follows: **3 Marks**

X	0	2	4	5
P(X)	p	2p	3p	p

Where X is the number of students absent.

- Calculate p.
- Calculate the mean of the number of absent students on Saturday.

Q192. A die with number 1 to 6 is biased such that $P(2) = \frac{3}{10}$ and probability of other numbers is equal. Find the mean of the number of times number 2 appears on the dice, if the dice is thrown twice. **3 Marks**

Q193. Solve the following differential equation:

$$(1+x^2)\frac{dy}{dx} + 2xy = 4x^2$$

Q194. If $y = \log\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$, then show that $x(x + 1)^2\ y_2$, + $(x + 1)^2\ y_1$, = 2.

Q195. Show that the function f : R → R defined by $f(x) = 4x^3 - 5$, ∀ x ∈ R is one-one and onto. **3 Marks**

Q196. For the vacancy advertised in the newspaper, 3000 candidates submitted their applications. From the data it was revealed that two third of the total applicants were females and other were males. The selection for the job was done through a writteb test. The performance of the applicants indicates that the probability of a male getting a distinction in written test is 0.4 and that a female getting a distinction is 0.35. Find the probability that the candidate chosen at random will have a distinction in the written test. **3 Marks**

Q197. Evaluate: **3 Marks**

$$\int_0^{\frac{\pi}{2}} \frac{5\sin x + 3\cos x}{\sin x + \cos x}dx$$

Q198. The scalar product of the vector $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ with a unit vector along sum of vectors $\vec{b} = 2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c} = \lambda\hat{i} - 2\hat{j} - 3\hat{k}$ is equal to 1. Find the value of λ. **3 Marks**

Q199. A person has a fruit box that contains 6 apples and 4 oranges. He picks out a fruit three times, one after the other, after replacing the previous one in the box. Find: **3 Marks**

i. The probability distribution of the number of oranges he draws.
ii. The expectation of the random variable (number of oranges).

Q200. Evaluate: $\int_0^5 (|x-1| + |x-2| + |x-5|)dx$ **3 Marks**

Q201. During a cricket match, the position of the bowler, the wicket keeper and the leg slip fielder are in line given by $\vec{B} = 2\hat{i} + 8\hat{j}$, $\vec{W} = 6\hat{i} + 12\hat{j}$ and $\vec{F} = 12\hat{i} + 18\hat{j}$ respectively. Calculate the ratio which the wicketkeeper divides the line segment joining the in bowler and the leg slip fielder. **3 Marks**

Q202. Let 2x + 5y - 1 = 0 and 3x + 2y - 7 = 0 represent the equations of two lines on which the ants are moving on the ground. Using matrix method, find a point common to the paths of the ants. **3 Marks**

Q203. A shopkeeper sells 50 Chemistry, 60 Physics and 35 Maths books on day I and sells 40 Chemistry, 45 Physics and 50 Maths books on day II. If the selling price for each such subject book is ₹ 150 (Chemistry), ₹ 175 (Physics) and ₹ 180 (Maths), then find his total sale in two days, using matrix method. If cost price of all the books together is ₹ 35,000, what profit did he earn after the sale of two days? **3 Marks**

Q204. Find the distance of the point P(2, 4, -1) from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$ **3 Marks**

Q205. Let the position vectors of the points A, B and C be $3\hat{i} - \hat{j} - 2\hat{k}, \hat{i} + 2\hat{j} - \hat{k}$ and $\hat{i} + 5\hat{j} + 3\hat{k}$ respectively. Find the vector and cartesian equations of the line passing through A and parallel to line BC. **3 Marks**

Q206. Differentiate $y = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ with respect to x, when $x \in (0, 1)$. **3 Marks**

Q207. Find the shortest distance between the lines : **3 Marks**

$\vec{r} = (2\hat{i} - \hat{j} + 3\hat{k}) + \lambda(\hat{i} - 2\hat{j} + 3\hat{k})$

$\vec{r} = (\hat{i} + 4\hat{k}) + \mu(3\hat{i} - 6\hat{j} + 9\hat{k})$.

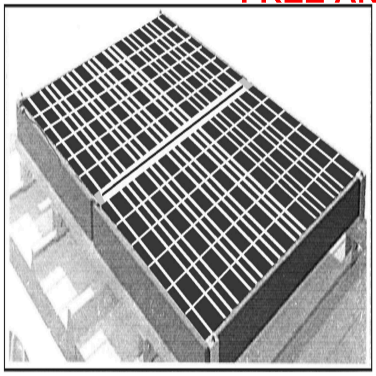
Q208. A gardener wanted to plant vegetables in his garden. Hence he bought 10 seeds of brinjal plant, 12 seeds of cabbage plant and 8 seeds of radish plant. The shopkeeper assured him of germination probabilities of brinjal, cabbage and radish to be 25%, 35% and 40% respectively. But before he could plant the seeds, they got mixed up in the bag and he had to sow them randomly. **4 Marks**

Radish Cabbage Brinjal

Based upon the above information, answer the following questions:

i. Calculate the probability of a randomly chosen seed to germinate.
ii. What is the probability that it is a cabbage seed, given that the chosen seed germinates?

Q209. **4 Marks**



A technical company is designing a rectangular solar panel installation on roof using 300 metres of boundary material. The design includes a partition running parallel to one of the sides dividing the area (roof) into two sections. Let the length of the side perpendicular to the partition be x metres and with parallel to the partition be y metres.

Based on this information, answer the following questions:

i. A Write the equation for the total boundary material used in the boundary and parallel to the partition in terms of x and y.

ii. Write the area of the solar panel as a function of x.

iii. Find the critical points of the area function. use second derivative test to determine critical points at the maximum area. Also, find the maximum area.

OR

iii. Using first derivative test, calculate the maximum area the company can enclose with the 300 metres of boundary material, considering the parallel partition.

Q210. Based upon the results of regular medical check-ups in a hospital, it was found that out of 1000 people, 700 were very healthy, 200 maintained average health and 100 had a poor health record. **4 Marks**

Let A_1 : People with good health,

A_2 : People with average health,

and A_3 : People with poor health.

During a pandemic, the data expressed that the chances of people contracting the disease from category A_1, A_2 and A_3 are 25%, 35% and 50%, respectively.

Based upon the above information, answer the following questions:

i. A person was tested randomly. What is the probability that he/she has contracted the disease?

ii. Given that the person has not contracted the disease, what is the probability that the person is from category A2?

Q211. A carpenter needs to make a wooden cuboidal box, closed from all sides, which has a square base and fixed volume. Since he is short of the paint required to paint the box on completion, he wants the surface area to be minimum. **4 Marks**

On the basis of the above information, answer the following questions:

i. Taking length = breadth = x m and height = y m, express the surface area (S) of the box in terms of x and its volume (V), which is constant.

ii. Find $\frac{dS}{dx}$

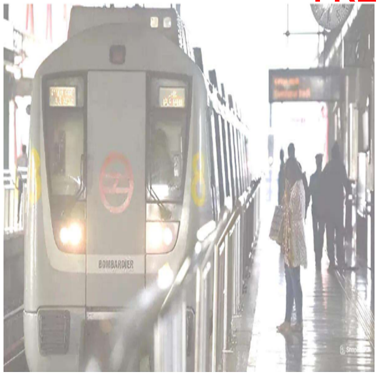
iii. (a) Find a relation between x and y such that the surface area (S) is minimum.

OR

iii. (b) If x minimum. OR surface area (S) is constant, the volume $(V) = \frac{1}{4}(Sx - 2x^3)$, x being the edge of base.

Show that volume (V) is maximum for $x = \sqrt{\frac{S}{6}}$.

Q212. An engineer is designing a new metro rail network in a city. **4 Marks**



Initially, two metro lines, Line A and Line B, each consisting of multiple stations are designed. The track for Line A is represented by $l_1 : \frac{x-2}{3} = \frac{y+1}{-2} = \frac{z-3}{4}$, while the track for Line B is represented by $l_2 : \frac{x-1}{2} = \frac{y-3}{1} = \frac{z+2}{-3}$.

Based on the above information, answer the following questions:

i. Find whether the two metro tracks are parallel.

ii. Solar panels are to be installed on the rooftop of the metro stations. Determine the equation of the line representing the placement of solar panels on the rooftop of Line A's stations, given that panels are to be positioned parallel to Line A's track (l_1) and pass through the point (1, -2, -3).

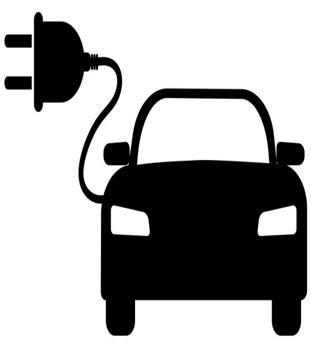
iii.

a. To connect the stations, a pedestrian pathway perpendicular to the two metro lines is to be constructed which passes through point (3, 2, 1). Determine the equation of the pedestrian walkway.

OR

b. Find the shortest distance between Line A and Line B.

Q213. Three persons viz. Amber, Bonzi and Comet are manufacturing cars which run on petrol and on battery as well. Their production share in the market is 60%, 30% and 10% respectively. Of their respective production capacities, 20%, 10% and 5% cars respectively are electric (or battery operated). Based on the above, answer the following: **4 Marks**



i. (a) What is the probability that a randomly selected car is an electric car?

OR

ii. (b) What is the probability that a randomly selected car is a petrol car?

iii. A car is Selected at random and is found to be electric. What is the probability that it was manufactured by Comet?

iv. A car is selected at random and is found to be electric. What is the probability that it was manufactured by Amber or Bonzi?

Q214. A shop selling electronic items sells smartphones of only three reputed companies A, B and C because chances of their manufacturing a defective smartphone are only 5%, 4% and 2% respectively. In his inventory he has 25% smartphones from company A, 35% smartphones from company B and 40% smartphones from company C. **4 Marks**

A person buys a smartphone from this shop.

i. Find the probability that it was defective.

ii. What is the probability that this defective smartphone was manufactured by company B?

Q215. Three students, Neha, Rani and Sam go to a market to purchase stationery items. Neha buys 4 pens, 3 notepads and 2 erasers and ₹ 60. Rani buys 2 pens, 4 notepads and 6 erasers for ₹ 90. Sam pays ₹ 70 for 6 pens, 2 note pads and 3 erasers. **4 Marks**

Based upon the above information, answer the following questions:

i. Form the equations required to solve the problem of finding the price of each item, and express it in the matrix form AX = B.

ii. Find |A| and confirm if it is possible to find A^{-1}

iii. (a) Find A^{-1}, if possible, and write the formula to find X.

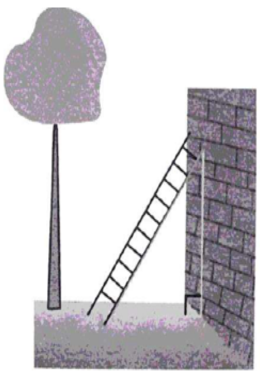
OR

(b) Find $A^2 - 8I$, where I is an identity matrix.

Q216. Find: **4 Marks**

$\int \sin^{-1}\sqrt{\dfrac{x}{a+x}}dx.$

Q217. **4 Marks**



A ladder of fixed length ‘h’ is to be placed along the wall such that it is free to move along the height of the wall.

Based upon the above information, answer the following questions:

i. Express the distance (y) between the wall and foot of the ladder in terms of ‘h’ and height (x) on the wall at a certain instant. Also, write an expression in terms of h and x for the area (A) of the right triangle, as seen from the side by an observer.

ii. Find the derivative of the area (A) with respect to the height on the wall (x), and find its critical point.

iii. (a) Show that the area (A) of the right triangle is maximum at the critical point.

OR

iii. (b) If the foot of the ladder whose length is 5 m, is being pulled towards the wall such that the rate of decrease of distance (y) is 2 m/s, then at what rate is the height on the wall (x) increasing, when the foot of the ladder is 3 m away from the wall?

Q218. A school is organizing a debate competition with participants as speakers S = 1{S_1, S_2, S_3, S_4} and these are judged by judges J = {J_1, J_2, J_3}. Each speaker can be assigned one judge. Let R be a relation from set S to J defined as R = {(x, y) : speaker x is judged by judge $y, x \in S, y \in J$} **4 Marks**

i. Based on the above, answer the following:

ii. How many relations can be there from S to J?

iii. A student identifies a function from S to J as f = {(S;, J;), (S,, Jy), (Sg, Jy), (S, I3} Check if it is bijective.

iv. (a) How many one-one functions can be there from set S to set J?

OR

iv. Another student considers a relation $R_1 = \{(S_1, S_2), \{S_2, S_4\}$ in set S. Write minimum ordered pairs to be included in R_1 so that R_1 is reflexive but not symmetric.

Q219. Camphor is a waxy, colourless solid with strong aroma that evaporates through the process of sublimation, if left in the open at room temperature. **4 Marks**


(Cylindrical-shaped Camphor tablets)

A cylindrical camphor tablet whose height is equal to its radius (r) evaporates when exposed to air such that the rate of reduction of its volume is proportional to its total surface area. Thus, $\frac{dV}{dt} = kS$ is the differential equation, where V is the volume, S is the surface area and t is the time in hours.

Based upon the above information, answer the following questions:

i. Write the order and degree of the given differential equation.

ii. Substituting $V = \pi r^3$ and $S = 2\pi r^2$, we get the differential equation $\frac{dr}{dt} = \frac{2}{3}k$. Solve it, given that r(0) = 5mm.

iii. (a) If it is given that r = 3mm when t = 1 hour, find the value of k. Hence, find t for r = 0mm.

OR

iii. (b) If it is given that r = 1mm when t = 1 hour, find the value of k. Hence, find t for r = 0mm.

Q220. A class-room teacher is keen to assess the learning of her students the concept of "relations" taught to them. She writes the following five relations each defined on the set A = {1, 2, 3} **4 Marks**

R_1 = {(2, 3), (3, 2)}

R_2 = {(1,2), (1,3), (3, 2)}

R_3 = {(1,2), (2,1), (1,1)}

R_4 = {(1 1), (1,2), (3,3), (2,2)}

R_5 = {(1,1), (1,2), (3,3), (2,2), (2,1), (2,3), (3, 2)}

The students are asked to answer the following questions about the above relations:

i. Identify the relation which is reflexive, and symmetric but not symmetric.

ii. Identify transitive the relation which is reflexive and symmetric but not transitive.

iii. Identify the relations which are symmetric but neither reflexive nor transitive.

OR

iii. What pairs should be added to the relation R, to make it an equivalence relation?

Q221. Let A be the set of 30 students of class XII in a school. Let f: A — N, N is a set of natural numbers such that function f(x) = Roll Number of student x .On the basis of the given information, answer the following: **4 Marks**

i. Is f a bijective function?

ii. Give reasons to support your answer to (i).

iii. (a) Let R be a relation defined by the teacher to plan the seating arrangement of students in pairs, where R = {(x, y) : X, y are Roll Numbers of students such that y = 3 x}. List the elements of R. Is the relation R reflexive, symmetric and transitive? Justify your answer.

OR

iii. (b) Let R be a relation defined by

R = {(x, y) : X, y are Roll Numbers of students such that $y = x^3$}. List the elements of R. Is R a function? Justify your answer.

Q222. Some students are having a misconception while comparing decimals. For example, a student may mention that 78:56 > 789 as 7856 > 789. In order to assess this concept, a decimal comparison test was administered to the students of class VI through the following question In the recently held Sports Day in the school, 5 students participated in a javelin throw competition. The distances to which they have thrown the javelin are shown below in the table: **4 Marks**

Name of student	Distance of javelin (in meters)
Ajay	47.7
Bijoy	47.07
Kartik	43.09
Dinesh	43.9
Devesh	45.2

The students were asked to identify who has thrown the javelin the farthest. Based on the test attempted by the students, the teacher concludes that 40% of the students have the misconception in the concept of decimal comparison and the rest do not have the misconception. 80% of the students having misconception answered Bijoy as the correct answer in the paper. 90% of the students who are identified with not having misconception, did not answer Bijoy as their answer.

On the basis of the above information, answer the following questions:

i. What is the probability of a student not having misconception but still answers Bijoy in the test?
ii. What is the probability that a randomly selected student answers Bijoy as his answer in the test?
iii.
a. What is the probability that a student who answered as Bijoy is having misconception?

OR

b. What is the probability that a student who answered as Bijoy is amongst students who do not have the misconception ?

Q223. **4 Marks**

A bank offers loan to its customers on different types of interest namely, fixed rate, floating rate and variable rate. From the past data with the bank, it is known that a customer avails loan on fixed rate, floating rate or variable rate with probabilities 10%, 20% and 70% respectively. A customer after availing loan can pay the loan or default on loan repayment. The bank data suggests that the probability that a person defaults on loan after availing it at fixed rate, floating rate and variable rate is 5%, 3% and 1% respectively. Based on the above information, answer the following:

i. What is the probability that a customer after availing the loan will default on the loan repayment?
ii. A customer after availing the loan, defaults on loan repayment. What is the probability that he availed the loan at a variable rate of interest?

Q224. A school wants to allocate students into three clubs : Sports, Music and Drama, under following conditions: **4 Marks**

- The number of students in Sports club should be equal to the sum of the number of students in Music and Drama club.
- The number of students in Music club should be 20 more than half the number of students in Sports club.
- The total number of students to be allocated in all three clubs are 180.

Find the number of students allocated to different clubs, using matrix method.

Q225. A Small town is analyzing the pattern of a new street light installation. The lights are set up in such a way that the intensity of light at any point x metres from the start of the street can be modelled by $f(x) = e^x \sin x$ where x is in metres. **4 Marks**

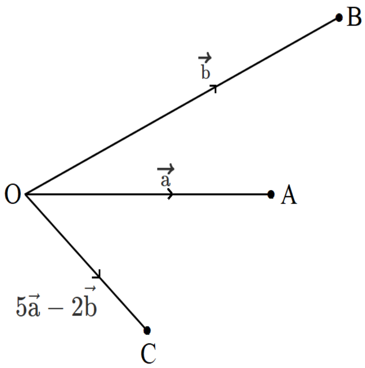
Based on the above, answer the following:

i. Find the intervals on which the f(x) is increasing or decreasing, $x \in [0, \pi]$.

ii. Verify, whether each critical point when $x \in [0, \pi]$. is a point of local maximum or local minimum or a point of inflexion.

Q226. Find the absolute maximum and absolute minimum of function $f(x) = 2x^3 - 15x^2 + 36x + 1$ on [1, 5]. **4 Marks**

Q227. Three friends A, B and C move out from the same location O at the same time in three different directions to reach their destinations. They move out on straight paths and decide that A and B after reaching their destinations will meet up with C at his predecided destination, following straight paths from A to C and B to C in such a way that $\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = \vec{b}$ and $\overrightarrow{OC} = 5\vec{a} - 2\vec{b}$ respectively. **4 Marks**



Based upon the above information, answer the following questions:

i. Complete the given figure to explain their entire movement plan along the respective vectors.

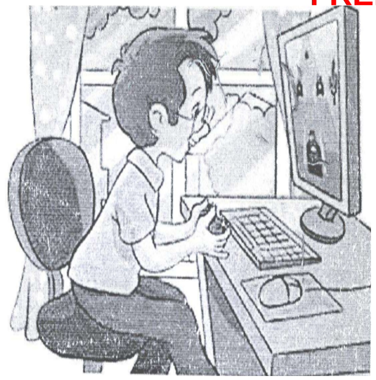
ii. Find vectors $\overrightarrow{AC}$ and $\overrightarrow{BC}$.

iii. (a) If $\vec{a} \cdot \vec{b} = 1,$ distance of O to A is 1km and that from O to B is 2km, then find the angle between $\overrightarrow{OA}$ and $\overrightarrow{OB}$. Also, find $|\vec{a} \times \vec{b}|$.

OR

iii. (b) If $\vec{a} = 2\hat{i} - \hat{j} + 4\hat{k}$ and $\vec{b} = \hat{j} + \hat{k}$, then find a unit vector perpendicular to $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$.

Q228. During a heavy gaming session, the temperature of a student's laptop processor increases significantly. After the session, the processor begins to cool down, and the rate of cooling is proportional to the difference between the processor's temperature and the room temperature (25°C). Initially the processor's temperature is 85°C. The rate of cooling is defined by the equation $\frac{d}{dt}(T(t)) = -k(T(t - 25))$. where T(t) represents the temperature of the processor at time t (in minutes) and k is a constant. **4 Marks**



Based on the above information, answer the following questions:

i. Find the expression for temperature of processor, T(t) given that T(0) = 85°C.
ii. How long will it take for the processor's temperature to reach 40°C ? Given that k = 0-03, log, 4 = 1-3863.

Q229. Find $\frac{dy}{dx}$, if $y = x^{\tan x} + \frac{\sqrt{x^2+1}}{2}$. **4 Marks**

Q230. Differentiate $\tan^{-1}\frac{\sqrt{1-x^2}}{x}$ w.r.t. $\cos^{-1}(2x\sqrt{1-x^2}), x\epsilon\left(\frac{1}{\sqrt{2}}, 1\right)$ **4 Marks**

Q231. Find the image A of the point A(2, 1, 2) the line A2, 1, 2) in the line $l : \vec{r} = 4\hat{i} + 2\hat{j} + 2\hat{k} + \lambda\left(\hat{i} - \hat{j} - \hat{k}\right)$ Also, find the equation of line joining AA'. Find the foot of perpendicular from point A on the line l. **4 Marks**

Q232. If $x = a\left(\cos\theta + \log\tan\frac{\theta}{2}\right)$ and $y = \sin\theta$, then find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{4}$. **4 Marks**

Q233. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x - y)$, then prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$. **4 Marks**

Q234. Find the image A' of the point A(1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$. Also, find the equation of the line joining A and A'. **4 Marks**

Q235. Find the shortest distance between the lines: $\frac{x+1}{2} = \frac{y-1}{1} = \frac{z-9}{-3}$ and $\frac{x-3}{2} = \frac{y+15}{-7} = \frac{z-9}{5}$. **4 Marks**

Q236. Find: **4 Marks**

$$\int \frac{\sqrt{x^2+1}\left[\log(x^2+1) - 2\log x\right]}{x^2}dx$$

Q237. Given $A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ find AB. Hence, solve the system of linear equations: **4 Marks**

x - y + z = 4
x - 2y - 2z = 9
2x + y + 3z = 1.

Q238. Evaluate: **4 Marks**

$$\int_0^{\pi} \frac{dx}{a^2\cos^2 x + b^2\sin^2 x}$$

Q239. Find: **4 Marks**

$\int \frac{\cos x}{(4 + \sin^2 x)(5 - 4\cos^2 x)} dx$

Q240. **4 Marks**

Evaluate:

$\int_0^{\frac{3}{2}} |x \cos \pi x| dx$

Q241. **Find:** **4 Marks**

$\int \frac{dx}{\sin^2 x + \sin 2x}$

Q242. Show that the area of a parallelogram whose diagonals a represented by $\vec{a}$ and $\vec{b}$ is given by $\frac{1}{2}|\vec{a} \times \vec{b}|$.Also find the A area of a parallelogram whose diagonals are $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 3\hat{j} - \hat{k}$. **4 Marks**

Q243. Find the equation of a line in vector and cartesian form which passes through the point (1, 2, -4) and is perpendicular to the lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$, and $\vec{r} = 15\hat{i} + 29\hat{j} + 5\hat{k} + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})$. **4 Marks**

Q244. If $A = \begin{bmatrix} 1 & 2 & 0 \\ -2 & -1 & -2 \\ 0 & -1 & 1 \end{bmatrix}$ then find A^{-1}. **4 Marks**

Hence, solve the system of linear equations:

x - 2y = 10

2x - y - z = 8

-2y + z = 17

Q245. Find a point P on the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$. such that its distance from point Q(2, 4, -1) is 7 units. Also find the equation of line joining P and Q. **4 Marks**

Q246. The relation between the height of the plant (y cm) with respect to exposure to sunlight is governed by the equation $y = 4x - \frac{1}{2}x^2$, where x is the number of days exposed to sunlight. **5 Marks**

i. Find the rate of growth of the plant with respect to sunlight.
ii. In how many days will the plant attain its maximum height? What is the maximum height?

Q247. Solve the differential equation $\frac{dy}{dx} = \cos x - 2y$. **5 Marks**

Q248. Solve the differential equation $(x - \sin y)dy + (\tan y)dx = 0$, given y(0) = 0. **5 Marks**

Q249. Find : $\int \left(\sqrt{\tan x} + \sqrt{\cot x}\right) dx$. **5 Marks**

Q250. A furniture workshop produces three types of furniture - chairs, tables and beds each day. On a particular day the total number of furniture pieces produced is 45. It was also found that production of beds exceeds that of chairs by 8, while the total production of beds and chairs together is twice the production of tables. Determine the units produced of each type of furniture, using matrix method. **5 Marks**

Q251. Solve the differential equation $(x^2 + y^2)dx + xy\,dy = 0$, y(1) = 1. **5 Marks**

Q252. An amount of ₹10,000 is put into three investments at the rate of 10%, 12% and 15% per annum. The combined annual income of all three investments is ₹1,310, however the combined annual income of the first and the second investments is ₹190 short of the income from the third. Use matrix method and find the investment amount in each at the beginning of the year. **5 Marks**

Q253. Show that the line passing through the points A (0, -1, -1) and B (4, 5, 1) intersects the line joining points C (3, 9, 4) and D (-4, 4, 4). **5 Marks**

Q254. Use integration to find the area of the region enclosed by curve $y = — x^2$ and the straight lines $x = —3$, $x = 2$ and $y = 0$. Sketch a rough figure to illustrate the bounded region. **5 Marks**

Q255. In a rough sketch, mark the region bounded by $y = 1 + |x+1|$, $x = -2$, $x = 2$ and $y = 0$. Using integration, find the area of the marked region. **5 Marks**

Q256. Find the foot of the perpendicular drawn from point (2, -1, 5) to the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11}$ Also, find the length of the perpendicular. **5 Marks**

Q257. If A is a 3 × 3 invertible matrix, show that for any scalar $k \neq 0, (kA)^{-1} = \frac{1}{k}A^{-1}$. Hence calculate $(3A)^{-1}$, where: **5 Marks**

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

Q258. Draw a rough sketch for the curve $y = 2 + |x + 1|$. Using integration, findthe area of the region bounded by the curve $y = 2 + |x + 1|$, $x = -4$, $x = 3$ andy $= 0$. **5 Marks**

Q259. Using integration, find the area of the region bounded by the line $y = 5x + 2$, the x - axis and the ordinates $x = -2$ and $x = 2$. **5 Marks**

Q260. A woman discovered a scratch along a straight line on a circular table top of radius 8 cm. She divided the table top into 4 equal quadrants and discovered the scratch passing through the origin inclined at an angle $\frac{\pi}{4}$ anticlockwise along the positive direction of x-axis. Find the area of the region enclosed by the x-axis, the scratch and the circular table top in the first quadrant, using integration. **5 Marks**

Q261. Sketch a graph of $y = x^2$. Using integration, find the area of the region bounded by $y = 9$, $x = 0$ and $y = x^2$. **5 Marks**

Q262. Three students run on a racing track such that their speeds add up to 6 km/h. However, double the speed of the third runner added to the speed of the first results in 7 km/h. If thrice the speed of the first runner is added to the original speeds of the other two, the result is 12 km/h. Using matrix method, find the original speed of each runner. **5 Marks**

Q263. Draw a rough sketch of the curve $y = \sqrt{x}$ Using integration, find the area of the region bounded by the curve $y = \sqrt{x}$, $x = 4$ and x-axis, in the first quadrant. **5 Marks**

Q264. Let the polished side of the mirror be along the line $\frac{x}{1} = \frac{1-y}{-2} = \frac{2z-4}{6}$ A point P(1, 6, 3), some distance awaymfrom the mirror, has its image formed behind the mirror. Find the coordinates of the image point and the distance between the point P and its image. **5 Marks**

Q265. Find : **5 Marks**

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

Q266. Using integration, find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ bounded between the lines $x = -\frac{a}{2}$ to $x = \frac{a}{2}$. **5 Marks**

Q267. **5 Marks**

Evaluate:

$$\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$$

Q268. Find: **5 Marks**

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

Q269. Solve the differential equation $(1 + x^2)\frac{dy}{dx} + 2xy - 4x^2 = 0$ subject to initial condition y(0) = 0.

Q270. Find the image of the point (-1, 5, 2) in the line $\frac{2x-4}{2} = \frac{y}{2} = \frac{2-z}{3}$. Find the length of the line segment joining the points (given point and the image point).

Q271. Find the point Q on the line $\frac{2x+4}{6} = \frac{y+1}{2} = \frac{-2z+6}{-4}$ at a distance of $3\sqrt{2}$ from the point P(1, 2, 3).

Q272. Solve the differential equation: $x^2y\,dx - (x^3 + y^3)\,dy = 0$.