1. **Assertion (A):** The vectors

$$\vec{a} = 6\hat{i} + 2\hat{j} - 8\hat{k}$$
$$\vec{b} = 10\hat{i} - 2\hat{j} - 6\hat{k}$$
$$\vec{c} = 4\hat{i} - 4\hat{j} + 2\hat{k}$$

represent the sides of a right angled triangle.

Reason (R): Three non-zero vectors of which none of two are collinear form a triangle if their resultant is zero vector or sum of any two vectors is equal to the third.

2. Simplify: $\cos^{-1} x + \cos^{-1}\left[\frac{x}{2}\frac{\sqrt{3-3x^2}}{2}\right]; -\frac{1}{2} \leq x \leq 1$

3. Find: $\int \cos^3 x e^{\log \sin x} dx$

4. Find: $\int \frac{1}{5+4x-x^2} dx$

5. The surface area of a cube increases at the rate of72cm$^2/sec$. find the rate of change of its volume, when the edge of the cube measures 3cm.

6. Find the vector equation of the line passing through the point (2, 3, -5) and making equal angles with the coordinate axes.

7. Verify whether the function f defined by

$$f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$$

is continuous at $x = 0$ or not.

8. Check for differentiability of the function f defined by $f(x) = |x - 5|$ at the point $x = 5$.

9. Evaluate : $\int_0^\pi \frac{e^{\cos x}}{e^{\cos x} + e^{-\cos x}} dx$

10. Find : $\int \frac{2x+1}{(x+1)^2(x-1)} dx$

11. If $y = (\tan^{-1} x)^2$, show that $(x^2+1)^2 \frac{d^2y}{dx^2} + 2x(x^2+1)\frac{dy}{dx} = 2$.

12. Find the particular solution of the differential equation
$\frac{dy}{dx} - 2xy = 3x^2 e^{x^2}; \quad y(0) = 5.$

13. Solve the following differential equation :
$x^2 dy + y(x+y)dx = 0$

14. Find $\frac{dy}{dx}$, if $(\cos x)^y = (\cos y)^x$.

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

16. Find the projection of vector $(\vec{b}+\vec{c})$ on vector $\vec{a}$, where $\vec{a} = 2\hat{\imath}+2\hat{\jmath}+\hat{k}, \vec{b}=\hat{\imath}+3\hat{\jmath}+\hat{k}$, and $\vec{c}=\hat{\imath}+\hat{k}$.

17. An urn contains 3 red and 2 white marbles. Two marbles are drawn one by one with replacement from the urn. Find the probability distribution of the number of white balls. Also, find the mean of the number of white balls drawn.

18. Find the area of the region bounded by the curve $4x^2+y^2=36$ using integration.

19. Find the coordinates of the foot of the perpendicular drawn from the point $(2,3,-8)$ to the line $\frac{4-x}{2}=\frac{y}{6}=\frac{1-z}{3}$.

    Also, find the perpendicular distance of the given point from the line.

20. Find the shortest distance between the lines L_1 & L_2 given below: L_1: The line passing through (2,-1, 1) and parallel to $\frac{x}{1}=\frac{y}{1}=\frac{z}{3}$
    L_2: $\vec{r}=\hat{\imath}+(2\mu+1)\hat{\jmath}-(\mu+2)\hat{k}$.

21. If $A=\begin{bmatrix}1 & 2 & -3\\ 2 & 0 & -3\\ 1 & 2 & 0\end{bmatrix}$ then findA^{-1}hence solve the following system of equations
    $x+2y-3z=1$
    $2x-3Z=2$
    $x+2y=3$

22. Find the product of the matrices $\begin{bmatrix}1 & 2 & -3\\ 2 & 3 & 2\\ 3 & -3 & -4\end{bmatrix}\begin{bmatrix}-6 & 17 & 13\\ 14 & 5 & -8\\ -15 & 9 & -1\end{bmatrix}$ and hence solve the system of linear equations:

    $x+2y-3z=-4$
    $2x+3y+2z=2$
    $3x-3y-4z=11$

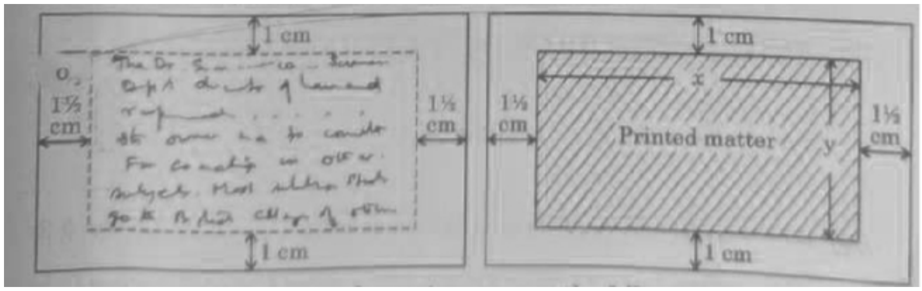
23. Solve the following L.P.P. graphically:

    Minimise $Z=6x+3y$

    Subject to constraints

$$\begin{aligned} 4x+y &\geq 80\\ x+5y &\geq 115\\ 3x+2y &\leq 150\\ x,y &\geq 0 \end{aligned}$$

24. A rectangular visiting card is to contain $24 sq.cm.$of printed matter. The margins at the top and bottom of the card are to be 7cm and the margins on the left and right are to be$1\frac{1}{2}$ cm as shown below:



On the basis of the above information, answer the following questions: (i) Write the expression for the area of the visiting card in terms of x. (ii) Obtain the dimensions of the card of minimum area. i

25. A departmental store sends bills to charge its customers once a month Past experience shows that 70% of its customers pay their first month bill in time. The store also found that the customer who pays the bill in time has the probability of 0.8 of paying in time next month and the customer who doesn't pay in time has the probability of 0.4 of paying in time the next month.

    Based on the above information, answer the following question:

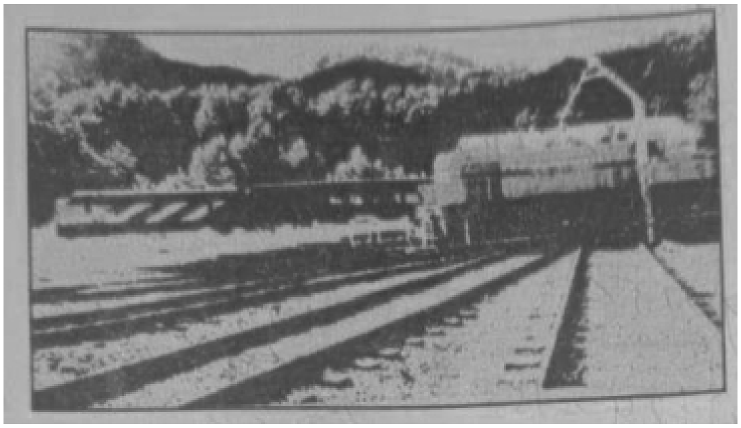
    (i) Let E_1 and E_2 respectively denote the event of customer paying or not paying the first month bill in time
    Find $P(E_1), P(E_2)$.

    (ii) Let A denotes the event of customer paving some month's bill in time, then find $P(A|E_1)$ and $P(A|E_2)$.

    (iii) Find the probability of customer paying second month's bill in time.

26. Find the probability of customer paying first month's bill in time if it is found that customer has paid the second month's bill in time

27. Students of a school are taken to railway museum to learn about railways heritage and its history



An exhibit in the museum depicted many rail lines on the track near the railway station. Last L. be the set of all rail lines on the railway track and R be the relation on L defined by
$R = \{(l_1, l_2) : l_1 \text{is parallel to } l_2\}$

On the basis of the shove information, answer the following questions

(i) Find whether the relation R is symmetric or not.

(ii) Find whether the relation R is transitive or not.

(iii) If one of the rail lines on the railway track is represented by the equation $y = 3x + 2$, then find the set of rail lines in R related to it.

28. the Let S be the relation defined by $S = \{(l_1, l_2)\text{perpendicular to} l_2\}$ check whether the relation S is symmetric and transitive.