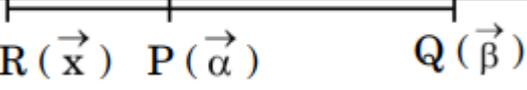


4.	<p>If $A = \begin{bmatrix} 1 & 12 & 4y \\ 6x & 5 & 2x \\ 8x & 4 & 6 \end{bmatrix}$ is a symmetric matrix, then $(2x + y)$ is</p> <p>(A) -8 (B) 0 (C) 6 (D) 8</p>	
Ans	(D) 8	1
5.	<p>If $y = \sin^{-1}x$, $-1 \leq x \leq 0$, then the range of y is</p> <p>(A) $\left(\frac{-\pi}{2}, 0\right)$ (B) $\left[\frac{-\pi}{2}, 0\right]$ (C) $\left[\frac{-\pi}{2}, 0\right)$ (D) $\left(\frac{-\pi}{2}, 0\right]$</p>	
Ans	(B) $\left[-\frac{\pi}{2}, 0\right]$	1
6.	<p>If a line makes angles of $\frac{3\pi}{4}, \frac{\pi}{3}$ and θ with the positive directions of x, y and z-axis respectively, then θ is</p> <p>(A) $\frac{-\pi}{3}$ only (B) $\frac{\pi}{3}$ only (C) $\frac{\pi}{6}$ (D) $\pm\frac{\pi}{3}$</p>	
Ans	No option is correct. Full marks may be awarded for attempting the question.	1
7.	<p>If E and F are two events such that $P(E) > 0$ and $P(F) \neq 1$, then $P(\overline{E}/\overline{F})$ is</p> <p>(A) $\frac{P(\overline{E})}{P(\overline{F})}$ (B) $1 - P(\overline{E}/F)$ (C) $1 - P(E/F)$ (D) $\frac{1 - P(E \cup F)}{P(\overline{F})}$</p>	
Ans	(D) $\frac{1 - P(E \cup F)}{P(\overline{F})}$	1
8.	<p>Which of the following can be both a symmetric and skew-symmetric matrix ?</p> <p>(A) Unit Matrix (B) Diagonal Matrix (C) Null Matrix (D) Row Matrix</p>	
Ans	(C) Null Matrix	1

16.	<p>A factory produces two products X and Y. The profit earned by selling X and Y is represented by the objective function $Z = 5x + 7y$, where x and y are the number of units of X and Y respectively sold. Which of the following statement is correct ?</p> <p>(A) The objective function maximizes the difference of the profit earned from products X and Y.</p> <p>(B) The objective function measures the total production of products X and Y.</p> <p>(C) The objective function maximizes the combined profit earned from selling X and Y.</p> <p>(D) The objective function ensures the company produces more of product X than product Y.</p>	
Ans	(C) The objective function maximizes the combined profit earned from selling X and Y	1
17.	<p>If A and B are square matrices of order m such that $A^2 - B^2 = (A - B)(A + B)$, then which of the following is always correct ?</p> <p>(A) $A = B$ (B) $AB = BA$</p> <p>(C) $A = 0$ or $B = 0$ (D) $A = I$ or $B = I$</p>	
Ans	(B) $AB = BA$	1
18.	<p>If p and q are respectively the order and degree of the differential equation $\frac{d}{dx} \left(\frac{dy}{dx} \right)^3 = 0$, then $(p - q)$ is</p> <p>(A) 0 (B) 1</p> <p>(C) 2 (D) 3</p>	
Ans	(B) 1	1
	<p><i>Questions number 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below.</i></p> <p>(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).</p> <p>(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).</p> <p>(C) Assertion (A) is true, but Reason (R) is false.</p> <p>(D) Assertion (A) is false, but Reason (R) is true.</p>	

19.	<p>Assertion (A) : $A = \text{diag} [3 \ 5 \ 2]$ is a scalar matrix of order 3×3.</p> <p>Reason (R) : If a diagonal matrix has all non-zero elements equal, it is known as a scalar matrix.</p>	
Ans	(D) Assertion (A) is false and Reason (R) is true.	1
20.	<p>Assertion (A) : Every point of the feasible region of a Linear Programming Problem is an optimal solution.</p> <p>Reason (R) : The optimal solution for a Linear Programming Problem exists only at one or more corner point(s) of the feasible region.</p>	
Ans	(D) Assertion (A) is false and Reason (R) is true.	1
SECTION-B		
This section comprises 5 Very Short Answer (VSA) type questions of 2 marks each.		
21	<p>(a) 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}.</p> <p style="text-align: center;">OR</p> <p>(b) 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 $QR = \frac{3}{2}QP$.</p>	
21 (a) Ans	<p>Let α be the angle which the vector \vec{a} makes with all the three axes.</p> <p>Then $3\cos^2\alpha = 1$</p> <p>$\Rightarrow \cos\alpha = \frac{1}{\sqrt{3}}$</p> <p>The unit vector along the vector $\vec{a} = \frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$</p> <p>$\vec{a} = 5(\hat{i} + \hat{j} + \hat{k})$</p> <p style="text-align: center;">OR</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
21 (b) Ans	 <p>$\vec{R}(\vec{x}) \quad \vec{P}(\vec{\alpha}) \quad \vec{Q}(\vec{\beta})$</p> <p>$\frac{QR}{QP} = \frac{3}{2}$</p>	

	Hence, R divides PQ, externally, in the ratio 1:3. The Position vector of R = $\vec{x} = \frac{\vec{\beta}-3\vec{\alpha}}{1-3} = \frac{3\vec{\alpha}-\vec{\beta}}{2}$	1 1
22.	Evaluate : $\int_0^{\frac{\pi}{4}} \sqrt{1 + \sin 2x} \, dx$	
Ans	Given definite integral = $\int_0^{\frac{\pi}{4}} \sqrt{(\sin x + \cos x)^2} dx$ $= \int_0^{\frac{\pi}{4}} (\sin x + \cos x) dx$ $= [-\cos x + \sin x]_0^{\frac{\pi}{4}}$ $= 1$	1 1
23.	Find the values of 'a' for which $f(x) = \sin x - ax + b$ is increasing on R.	
Ans	$f'(x) = \cos x - a$ For $f(x)$ to be increasing, $f'(x) \geq 0$ <i>i. e.</i> , $\cos x \geq a$ Since, $-1 \leq \cos x \leq 1$ $\Rightarrow a \leq -1$ Hence, $a \in (-\infty, -1]$. (Also, accept $a \in (-\infty, -1)$)	1 1
24.	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.	
Ans	$\vec{\alpha}$ and $\vec{\beta}$ are collinear $\Rightarrow \frac{x - 2}{3 + 2x} = \frac{1}{-2}$	1½

	Therefore, the function is not differentiable at -2. Note: (1) If a student finds only RHD and concludes the result, full marks may be awarded. (2) If a student proves that the function is discontinuous at -2 and hence not differentiable at -2, full marks may be awarded.	1
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SECTION-C

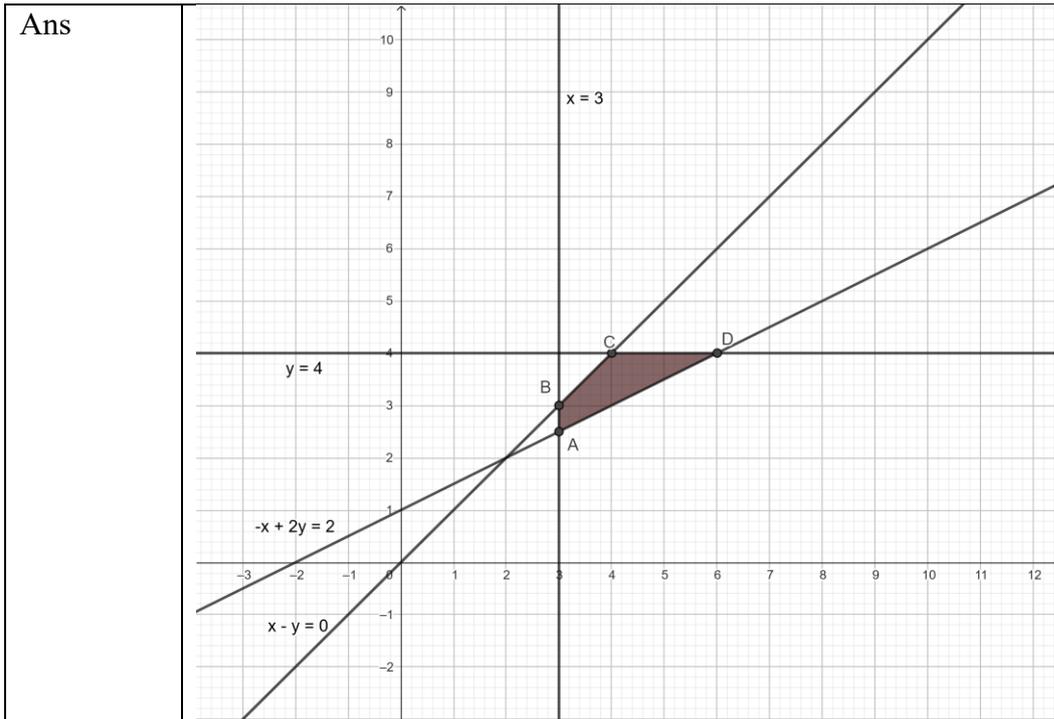
This section comprises 6 Short Answer (SA) type questions of 3 marks each.

26	(a) Solve the differential equation $2(y + 3) - xy \frac{dy}{dx} = 0$; given $y(1) = -2$. OR (b) Solve the following differential equation : $(1 + x^2) \frac{dy}{dx} + 2xy = 4x^2.$	
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26(a) Ans	Given differential equation can be written as $\frac{y}{y+3} dy = \frac{2}{x} dx$ $\Rightarrow \int \left(1 - \frac{3}{y+3}\right) dy = 2 \int \frac{1}{x} dx$ $\Rightarrow y - 3 \log y + 3 = 2 \log x + C$ $y = -2, \text{ when } x = 1 \Rightarrow C = -2$ Hence, the required particular solution is $\Rightarrow y - 3 \log y + 3 = 2 \log x - 2$ <p style="text-align: center;">OR</p>	1 1½ ½
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26(b) Ans	Given differential equation can be written as $\frac{dy}{dx} + \frac{2x}{1+x^2} y = \frac{4x^2}{1+x^2}, \text{ which is linear in } y.$ I.F. = $e^{\int \frac{2x}{1+x^2} dx} = e^{\log(1+x^2)} = 1 + x^2$ The solution is given by $y(1 + x^2) = \int 4x^2 dx$ $\Rightarrow y(1 + x^2) = \frac{4}{3} x^3 + C$ or $y = \frac{4x^3}{3(1+x^2)} + C \frac{1}{(1+x^2)}$, which is the required general solution	1 1 1
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27.	<p>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, $m, n \in N$.” Find whether R is reflexive, symmetric and transitive or not.</p>	
Ans	<p>Let $x \in N$. Then we know that x is a multiple of itself. $\Rightarrow xRx$ Hence, R is reflexive.</p> <p>We have $2, 8 \in N$ such that 8 is a multiple of 2 $\Rightarrow 8R2$</p> <p>But, 2 is not a multiple of 8. Hence, 2 is not R-related to 8. Therefore, R is not symmetric.</p> <p>Let $x, y, z \in N$ such that xRy, yRz Then $x = my, y = nz$ for some $m, n \in N$ $\Rightarrow x = mnz \Rightarrow x = pz$, where $p = mn \in N$. Hence, xRz Therefore, R is transitive.</p>	<p>1</p> <p>1</p> <p>1</p>
28.	<p>Solve the following linear programming problem graphically :</p> <p>Minimise $Z = x - 5y$ subject to the constraints :</p> $x - y \geq 0$ $-x + 2y \geq 2$ $x \geq 3, y \leq 4, y \geq 0$	



Corner point	Value of $Z = x - 5y$
A (3, 2.5)	-9.5
B (3, 3)	-12
C (4, 4)	-16
D (6, 4)	-14

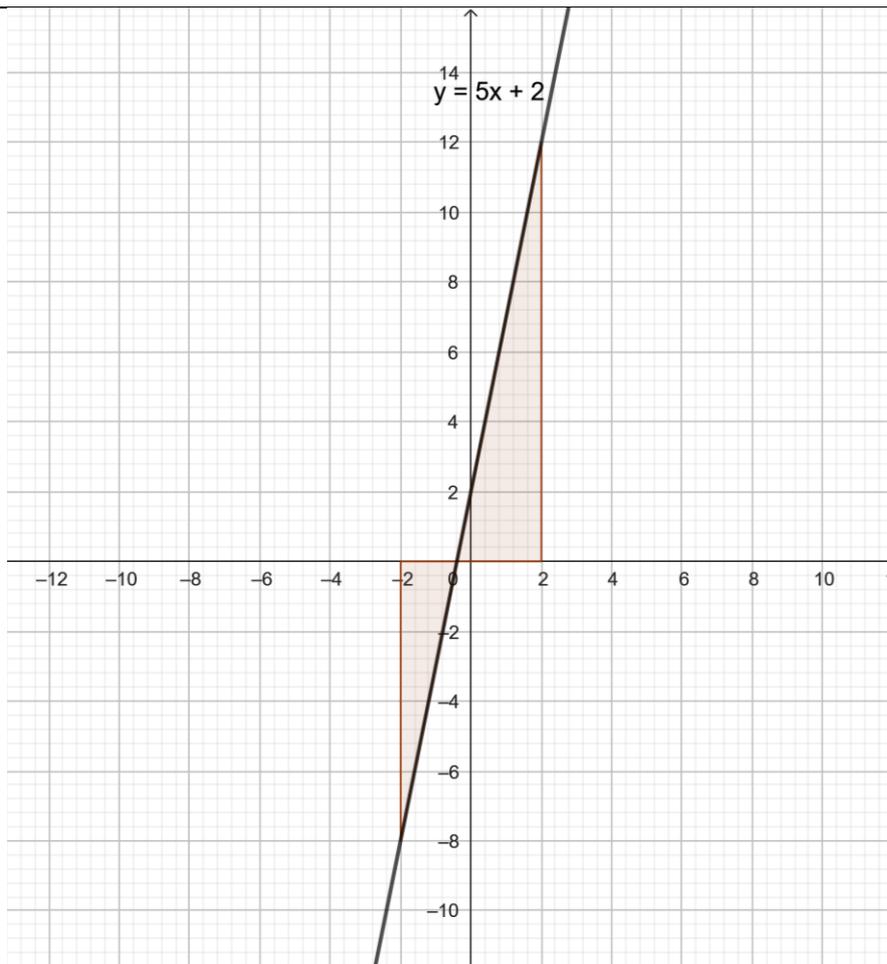
The minimum value of Z is -16, which is attained at $x = 4, y = 4$.

Ans		Correct graph and shading 1½
		1
		½

29	<p>(a) If $y = \log \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2$, then show that $x(x+1)^2 y_2 + (x+1)^2 y_1 = 2$.</p> <p style="text-align: center;">OR</p> <p>(b) If $x\sqrt{1+y} + y\sqrt{1+x} = 0, -1 < x < 1, x \neq y$, then prove that $\frac{dy}{dx} = \frac{-1}{(1+x)^2}$.</p>	
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29(a)	<p>The given function can be written as</p> $y = 2 \log(x+1) - \log x$ $\Rightarrow y_1 = \frac{2}{x+1} - \frac{1}{x} = \frac{x-1}{x(x+1)}$ $\Rightarrow (x+1)y_1 = \frac{x-1}{x} = 1 - \frac{1}{x}$	
Ans		1

	<p>The probability distribution is</p> <table border="1"> <thead> <tr> <th>X</th> <th>P(X)</th> <th>XP(X)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>$\frac{7}{10} \times \frac{7}{10} = \frac{49}{100}$</td> <td>0</td> </tr> <tr> <td>1</td> <td>$\frac{3}{10} \times \frac{7}{10} \times 2 = \frac{42}{100}$</td> <td>$\frac{42}{100}$</td> </tr> <tr> <td>2</td> <td>$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$</td> <td>$\frac{18}{100}$</td> </tr> </tbody> </table> <p>Mean = $\sum XP(X) = \frac{60}{100} = 0.6$</p> <p style="text-align: center;">OR</p>	X	P(X)	XP(X)	0	$\frac{7}{10} \times \frac{7}{10} = \frac{49}{100}$	0	1	$\frac{3}{10} \times \frac{7}{10} \times 2 = \frac{42}{100}$	$\frac{42}{100}$	2	$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$	$\frac{18}{100}$	<p>1½</p> <p>½</p>
X	P(X)	XP(X)												
0	$\frac{7}{10} \times \frac{7}{10} = \frac{49}{100}$	0												
1	$\frac{3}{10} \times \frac{7}{10} \times 2 = \frac{42}{100}$	$\frac{42}{100}$												
2	$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$	$\frac{18}{100}$												
30(b)	<p>$A = \{(3,6), (4,5), (5,4), (6,3)\}$</p> <p>Ans $P(A) = \frac{4}{36} = \frac{1}{9}, P(B) = \frac{30}{36} = \frac{5}{6}$</p> <p>$P(A \cap B) = \frac{3}{36} = \frac{1}{12}$</p> <p>$P(A) \times P(B) = \frac{5}{54} \neq P(A \cap B)$</p> <p>Therefore, A and B are not independent.</p> <p>A and B are not mutually exclusive as $A \cap B \neq \emptyset$</p>	<p>1</p> <p>½</p> <p>1</p> <p>½</p>												
31.	<p>Find : $\int \frac{1}{x} \sqrt{\frac{x+a}{x-a}} dx.$</p>													
Ans	<p>$I = \int \frac{1}{x} \frac{x+a}{\sqrt{x^2-a^2}} dx = \int \frac{1}{\sqrt{x^2-a^2}} dx + a \int \frac{1}{x\sqrt{x^2-a^2}} dx$</p> <p>$= \log x + \sqrt{x^2-a^2} + \sec^{-1} \left(\frac{x}{a} \right) + C$</p>	<p>1</p> <p>1+1</p>												
	<p>SECTION-D</p> <p>This section comprises 4 Long Answer (LA) type questions of 5 marks each.</p>													
32.	<p>Using integration, find the area of the region bounded by the line $y = 5x + 2$, the x-axis and the ordinates $x = -2$ and $x = 2$.</p>													
Ans														



Correct sketch and shading

2

The required area

$$= \left| \int_{-2}^{-\frac{2}{5}} (5x + 2) dx \right| + \int_{-\frac{2}{5}}^2 (5x + 2) dx$$

$$= \left| \left[\frac{(5x + 2)^2}{10} \right]_{-2}^{-\frac{2}{5}} \right| + \left[\frac{(5x + 2)^2}{10} \right]_{-\frac{2}{5}}^2$$

$$= \frac{64}{10} + \frac{144}{10} = \frac{104}{5}$$

1

1

1

33.

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

Ans

$$\frac{x^2 + x + 1}{(x + 2)(x^2 + 1)} = \frac{A}{x + 2} + \frac{Bx + c}{x^2 + 1}$$

Getting $A = \frac{3}{5}, B = \frac{2}{5}, C = \frac{1}{5}$

Given integral = $\frac{3}{5} \int \frac{1}{x+2} dx + \frac{1}{5} \int \frac{2x}{x^2+1} dx + \frac{1}{5} \int \frac{1}{x^2+1} dx$

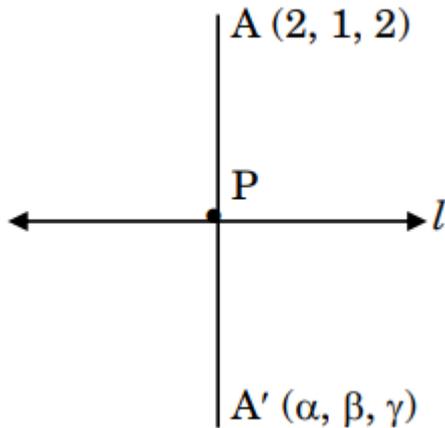
2

1½

	$= \frac{3}{5} \log x+2 + \frac{1}{5} \log(x^2+1) + \frac{1}{5} \tan^{-1}x + C$	1½
34	<p>(a) Find the shortest distance between the lines :</p> $\frac{x+1}{2} = \frac{y-1}{1} = \frac{z-9}{-3} \text{ and}$ $\frac{x-3}{2} = \frac{y+15}{-7} = \frac{z-9}{5}.$ <p style="text-align: center;">OR</p> <p>(b) Find the image A' of the point A(2, 1, 2) in the line $l : \vec{r} = 4\hat{i} + 2\hat{j} + 2\hat{k} + \lambda (\hat{i} - \hat{j} - \hat{k})$. Also, find the equation of line joining AA'. Find the foot of perpendicular from point A on the line l.</p>	
34(a) Ans	<p>The vector equations of the lines are</p> $\vec{r} = -\hat{i} + \hat{j} + 9\hat{k} + \lambda(2\hat{i} + \hat{j} - 3\hat{k})$ $\vec{r} = 3\hat{i} - 15\hat{j} + 9\hat{k} + \mu(2\hat{i} - 7\hat{j} + 5\hat{k})$ $\vec{a}_1 = -\hat{i} + \hat{j} + 9\hat{k}, \vec{a}_2 = 3\hat{i} - 15\hat{j} + 9\hat{k}$ $\vec{b}_1 = 2\hat{i} + \hat{j} - 3\hat{k}, \vec{b}_2 = 2\hat{i} - 7\hat{j} + 5\hat{k}$ $\vec{a}_2 - \vec{a}_1 = 4\hat{i} - 16\hat{j}$ $\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & -3 \\ 2 & -7 & 5 \end{vmatrix} = -16\hat{i} - 16\hat{j} - 16\hat{k}$ $\text{S.D.} = \frac{ (\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2) }{ \vec{b}_1 \times \vec{b}_2 } = \frac{12}{\sqrt{3}} = 4\sqrt{3}$ <p style="text-align: center;">OR</p>	1 1 2 1

34(b)

Ans



Let the image of A in the line be $A'(\alpha, \beta, \gamma)$

The point P, which is the point of intersection of the lines l and AA' , will have coordinates $(\lambda + 4, -\lambda + 2, -\lambda + 2)$ for some λ .

Drs of AP are $\langle \lambda + 2, -\lambda + 1, -\lambda \rangle$

$AP \perp l$

$$(\lambda + 2) - (-\lambda + 1) - (-\lambda) = 0$$

$$\Rightarrow \lambda = -\frac{1}{3}$$

Therefore, the coordinates of P are $(\frac{11}{3}, \frac{7}{3}, \frac{7}{3})$

P is the mid-point of AA'

$$\Rightarrow \frac{2 + \alpha}{2} = \frac{11}{3}, \frac{1 + \beta}{2} = \frac{7}{3}, \frac{2 + \gamma}{2} = \frac{7}{3}$$

$$\Rightarrow \alpha = \frac{16}{3}, \beta = \frac{11}{3}, \gamma = \frac{8}{3}$$

The coordinates of the image are $(\frac{16}{3}, \frac{11}{3}, \frac{8}{3})$

The equation of AA' is

$$\frac{x - 2}{\frac{10}{3}} = \frac{y - 1}{\frac{8}{3}} = \frac{z - 2}{\frac{2}{3}}$$

or,

$$\frac{3(x - 2)}{5} = \frac{3(y - 1)}{4} = \frac{3(z - 2)}{1}$$

 $\frac{1}{2}$ $\frac{1}{2}$

1

 $\frac{1}{2}$ $1\frac{1}{2}$

1

$$A^{-1} = \frac{1}{|A|} \text{adj}A = \begin{bmatrix} -3 & -2 & -4 \\ 2 & 1 & 2 \\ 2 & 1 & 3 \end{bmatrix}$$

The given system of equations is equivalent to the matrix equation

$$A^T X = B, \text{ where } B = \begin{bmatrix} 10 \\ 8 \\ 7 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

$$\Rightarrow X = (A^T)^{-1} B$$

$$\Rightarrow X = (A^{-1})^T B$$

$$\Rightarrow X = \begin{bmatrix} -3 & 2 & 2 \\ -2 & 1 & 1 \\ -4 & 2 & 3 \end{bmatrix} \begin{bmatrix} 10 \\ 8 \\ 7 \end{bmatrix} = \begin{bmatrix} 0 \\ -5 \\ -3 \end{bmatrix}$$

$$\therefore x = 0, y = -5, z = -3$$

½

½

1½

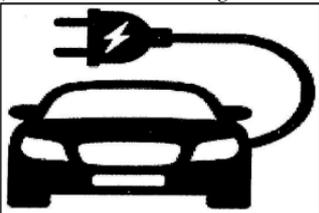
SECTION-E

This section comprises 3 case study based questions of 4 marks each

36.

A school is organizing a debate competition with participants as speakers $S = \{S_1, S_2, S_3, S_4\}$ 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 $R = \{(x, y) : \text{speaker } x \text{ is judged by judge } y, x \in S, y \in J\}$.



	<p>Based on the above, answer the following :</p> <p>(i) How many relations can be there from S to J ? 1</p> <p>(ii) A student identifies a function from S to J as $f = \{(S_1, J_1), (S_2, J_2), (S_3, J_2), (S_4, J_3)\}$ Check if it is bijective. 1</p> <p>(iii) (a) How many one-one functions can be there from set S to set J ? 2</p> <p style="text-align: center;">OR</p> <p>(iii) (b) 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. 2</p>	
36 Ans (i)	The number of relations = $2^{4 \times 3} = 2^{12}$	1
36 Ans (ii)	Since, S_2 and S_3 have been assigned the same judge J_2 , the function is not one-one. Hence, it is not bijective.	1
36 (iii) (a)	There cannot exist any one-one function from S to J as $n(S) > n(J)$. Hence, the number of one-one functions from S to J is 0. OR	2
36 (iii) (b)	To make R_1 reflexive and not symmetric we need to add the following ordered pairs: $(S_1, S_1), (S_2, S_2), (S_3, S_3), (S_4, S_4)$	2
37.	<p>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 :</p> <div style="text-align: center;">  </div> <p>(i) (a) What is the probability that a randomly selected car is an electric car ? 2</p> <p style="text-align: center;">OR</p> <p>(i) (b) What is the probability that a randomly selected car is a petrol car ? 2</p> <p>(ii) A car is selected at random and is found to be electric. What is the probability that it was manufactured by Comet ? 1</p> <p>(iii) A car is selected at random and is found to be electric. What is the probability that it was manufactured by Amber or Bonzi ? 1</p>	

<p>37(i) (a)</p> <p>Ans</p>	<p>Let A = Amber manufactures the car</p> <p>B = Bonzi manufactures the car</p> <p>C = Comet manufactures the car</p> <p>E = The selected car is electric</p> $P(A) = \frac{60}{100}, P(B) = \frac{30}{100}, P(C) = \frac{10}{100}$ $P(E) = P(A) \times P\left(\frac{E}{A}\right) + P(B) \times P\left(\frac{E}{B}\right) + P(C) \times P\left(\frac{E}{C}\right)$ $= \frac{60}{100} \times \frac{20}{100} + \frac{30}{100} \times \frac{10}{100} + \frac{10}{100} \times \frac{5}{100}$ $= \frac{155}{1000} \text{ or } \frac{31}{200}$ <p style="text-align: center;">OR</p>	<p style="text-align: center;">½</p> <p style="text-align: center;">1</p> <p style="text-align: center;">½</p>
<p>37(i)(b)</p> <p>Ans</p>	<p>Let A = Amber manufactures the car</p> <p>B = Bonzi manufactures the car</p> <p>C = Comet manufactures the car</p> <p>E = The selected car is a petrol car</p> $P(A) = \frac{60}{100}, P(B) = \frac{30}{100}, P(C) = \frac{10}{100}$ $P(E) = P(A) \times P\left(\frac{E}{A}\right) + P(B) \times P\left(\frac{E}{B}\right) + P(C) \times P\left(\frac{E}{C}\right)$ $= \frac{60}{100} \times \frac{80}{100} + \frac{30}{100} \times \frac{90}{100} + \frac{10}{100} \times \frac{95}{100}$ $= \frac{845}{1000} \text{ or } \frac{169}{200}$	<p style="text-align: center;">½</p> <p style="text-align: center;">1</p> <p style="text-align: center;">½</p>
<p>37(ii) Ans</p>	$P\left(\frac{C}{E}\right) = \frac{P(C) \times P\left(\frac{E}{C}\right)}{P(E)}$ $= \frac{\frac{10}{100} \times \frac{5}{100}}{\frac{60}{100} \times \frac{20}{100} + \frac{30}{100} \times \frac{10}{100} + \frac{10}{100} \times \frac{5}{100}}$ $= \frac{50}{\frac{10000}{1550}} = \frac{1}{31}$	<p style="text-align: center;">1</p>

37(iii) Ans	$P\left(\frac{A \text{ or } B}{E}\right) = 1 - P\left(\frac{C}{E}\right) = 1 - \frac{1}{31} = \frac{30}{31}$	1
38.	 <p>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.</p> <p>Based on the above, answer the following :</p> <p>(i) Find the intervals on which the $f(x)$ is increasing or decreasing, $x \in [0, \pi]$. 2</p> <p>(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. 2</p>	
(i) Ans	$f'(x) = e^x(\cos x + \sin x)$ <p>For critical points, $f'(x) = 0$</p> $\Rightarrow \cos x + \sin x = 0$ $\Rightarrow \cos x = -\sin x$ <p>For x to be a critical point $x \in (0, \pi)$, hence, $x = \frac{3\pi}{4}$</p> <p>For all $x \in \left[0, \frac{3\pi}{4}\right], f'(x) \geq 0$</p> <p>Hence, f is increasing in $\left[0, \frac{3\pi}{4}\right]$</p> <p>Note: If a student concludes the answer in any of the following intervals, full marks may be awarded:</p> $\left(0, \frac{3\pi}{4}\right) \text{ or } \left[0, \frac{3\pi}{4}\right) \text{ or } \left(0, \frac{3\pi}{4}\right]$ <p>For all $x \in \left[\frac{3\pi}{4}, \pi\right], f'(x) \leq 0$</p> <p>Hence, f is decreasing in $\left[\frac{3\pi}{4}, \pi\right]$</p> <p>Note: If a student concludes the answer in any of the following intervals, full marks may be awarded:</p> $\left(\frac{3\pi}{4}, \pi\right) \text{ or } \left(\frac{3\pi}{4}, \pi\right] \text{ or } \left[\frac{3\pi}{4}, \pi\right)$	<p style="text-align: right;">½</p> <p style="text-align: right;">½</p> <p style="text-align: right;">½</p> <p style="text-align: right;">½</p>

(ii) Ans	<p>$x = \frac{3\pi}{4}$ is a critical point</p> $f''(x) = e^x(\cos x - \sin x) + e^x(\cos x + \sin x)$ $= 2e^x \cos x$ $f''\left(\frac{3\pi}{4}\right) = -ve$ <p>Hence, $\frac{3\pi}{4}$ is a point of local maximum.</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>

