INDIAN SCHOOL AL WADI AL KABIR

Pre-Board Examination 2

MATHEMATICS - 041

QP. Code: 65/1/1

	SET – 1
1	a) -1
2	c) R
3	a) $\begin{bmatrix} 5 & 14 \\ 0 & -7 \end{bmatrix}$
4	d) 49y
5	c) $\frac{(1+\log x)^3}{3} + c$
6	a) $\frac{\pi}{6}$
7	d) $\frac{5\vec{a}}{4}$
8	a) x = 12, y = 6
9	c) 3
10	b) 4
11	c) $\frac{2}{1+x^2}$
12	c) Feasible solution
13	d) 90^0
14	b) (3, 2)
15	d) $\frac{1}{16}$
16	d) 8π sq units
17	a) $0, \frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$
18	d) 16
19	(d) A is False but R is true.
20	(a) Both A and R are true and R is the correct explanation of A.

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$V = \frac{4}{3}\pi r^3$ and $S = 4\pi r^2$

$\frac{dV}{dr} = 4\pi r^2$ and $\frac{dS}{dr} = 8\pi r$

$\frac{dV}{dS} = \frac{4\pi r^2}{8\pi r} = \frac{1}{2}r$

$\left.\frac{dV}{dS}\right|_{r=2cm} = \frac{2}{2} = 1\ \text{cm}^3/1\text{cm}^2$

22

Ans: a = $\sin^{-1}\left(\frac{\sqrt{2}}{2}\right) + \cos^{-1}\left(-\frac{1}{2}\right)$

$= \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + \cos^{-1}\left(-\frac{1}{2}\right) = \frac{\pi}{4} + \frac{2\pi}{3} = \frac{11\pi}{12}$

b = $\tan^{-1}(\sqrt{3}) - \cot^{-1}\left(-\frac{1}{\sqrt{3}}\right) = \frac{\pi}{3} - \frac{2\pi}{3} = \frac{-\pi}{3}$

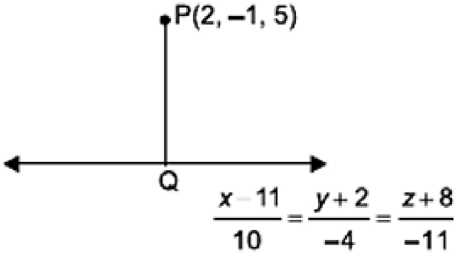
Now a + b $= \frac{11\pi}{12} - \frac{\pi}{3} = \frac{11\pi - 4\pi}{12} = \frac{7\pi}{12}$

- OR -

Ans: Given that $\sin^{-1}\left[k\tan\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right] = \frac{\pi}{3}$

$\Rightarrow k\tan\left(2\cos^{-1}\left(\cos\frac{\pi}{6}\right)\right) = \sin\frac{\pi}{3}$

$\Rightarrow k\tan\frac{\pi}{3} = \frac{\sqrt{3}}{2} \Rightarrow k\sqrt{3} = \frac{\sqrt{3}}{2} \Rightarrow k = \frac{1}{2}$

23	$\cos\theta = \frac{\overline{PQ}.\overline{PR}}{\lvert\overline{PQ}\rvert\lvert\overline{PR}\rvert}$ $\cos\theta = \frac{15+8+16}{\sqrt{9+16+16}\sqrt{25+4+16}}$ $\cos\theta = \frac{39}{\sqrt{41}\sqrt{45}}$ $\theta = \cos^{-1}\left(\frac{39}{3\sqrt{205}}\right) = \cos^{-1}\left(\frac{13}{\sqrt{205}}\right)$	- OR - $\frac{\overline{PQ}+\overline{PR}}{2} = \frac{(-3i+4j+4k)+(-5i+2j+4k)}{2}$ $\frac{-8i+6j+8k}{2} = 4i+3j+4k$ The length of median = $\lvert 4i+3j+4k\rvert = \sqrt{41}$
24	Ans. General point on the line $\frac{x-11}{10} = \frac{y+2}{-4} = \frac{z+8}{-11} = \lambda$ is $Q(10\lambda + 11, -4\lambda - 2, -11\lambda - 8)$ ...(*i*)  Direction ratios of PQ are $10\lambda + 11 - 2, -4\lambda - 2 + 1, -11\lambda - 8 - 5$ i.e. $10\lambda + 9, -4\lambda - 1, -11\lambda - 13$ If PQ is perpendicular to the given line, then $10(10\lambda + 9) - 4(-4\lambda - 1) - 11(-11\lambda - 13) = 0$ $\Rightarrow 237\lambda = -237 \quad \lambda = -1$ Substituting in (i), we get the foot of perpendicular as Q(1, 2, 3). Length of perpendicular PQ = $\sqrt{(2-1)^2+(-1-2)^2+(5-3)^2} = \sqrt{1+9+4} = \sqrt{14}$	
25	$\Rightarrow x\sin(a+y) = -\sin a\cos(a+y)$ $\Rightarrow x = \frac{-\sin a\cos(a+y)}{\sin(a+y)} \Rightarrow x = -\sin a.\cot(a+y)$ Differentiating with respect to y, we get $\frac{dx}{dy} = -\sin a\left[-\operatorname{cosec}^2(a+y)\right].\frac{d}{dy}(a+y)$ $= -\sin a\left[-\operatorname{cosec}^2(a+y)\right].(0+1) = \frac{\sin a}{\sin^2(a+y)}$ $\qquad \Rightarrow \frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$ - OR – Let $I = \int_0^{\pi/2}\frac{dx}{1+\sqrt{\tan x}} = \int_0^{\pi/2}\frac{dx}{1+\sqrt{\frac{\sin x}{\cos x}}} = \int_0^{\pi/2}\frac{\sqrt{\cos x}}{\sqrt{\cos x}+\sqrt{\sin x}}dx$ ...(i) By the property, $\int_0^a f(x)dx = \int_0^a f(a-x)dx$, we get $I = \int_0^{\pi/2}\frac{\sqrt{\cos\left(\frac{\pi}{2}-x\right)}}{\sqrt{\cos\left(\frac{\pi}{2}-x\right)}+\sqrt{\sin\left(\frac{\pi}{2}-x\right)}}dx = \int_0^{\pi/2}\frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx$ ...(ii) Adding (i) and (ii), we get	

	$2I = \int_0^{\pi/2}\left[\frac{\sqrt{\cos x}}{\sqrt{\sin x}+\sqrt{\cos x}} + \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}\right]dx$	$= \int_0^{\pi/2} 1\cdot dx = [x]_0^{\pi/2} = \frac{\pi}{2} \Rightarrow I = \frac{\pi}{4}$
26	$\lvert x+2\rvert = \begin{cases} x+2, & x \geq -2 \\ -(x+2), & x < -2 \end{cases}$ $\int_{-5}^{5}\lvert x+2\rvert dx = \int_{-5}^{-2} -(x+2)dx + \int_{-2}^{5}(x+2)dx$ $= -\left(\frac{x^2}{2}+2x\right)_{-5}^{-2} + \left(\frac{x^2}{2}+2x\right)_{-2}^{5}$ $-\left(\frac{4}{2}-4-\frac{25}{2}+10\right)+\left(\frac{25}{2}+10-\frac{4}{2}+4\right)$	$= -\left(\frac{4-8-25+20}{2}\right)+\left(\frac{25+20-4+8}{2}\right)=$ $\frac{9}{2}+\frac{49}{2}=29$
27	$S = \{BB, BG, GB, GG\}$ (*i*) *A*: at least one of the children is a boy = *BB, BG, GB* *B*: both are boys = *BB* $A \cap B$: *BB* both boys when at least one of the children is a boy $P(B/A) = \frac{P(A\cap B)}{P(A)} = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{3}$	(*ii*) *A*: the elder child is a boy = *BB, BG* *B*: both are boys = *BB* $A \cap B$: *BB* Probability of the elder child is a boy. $P(B/A) = \frac{P(A\cap B)}{P(A)} = \frac{\frac{1}{4}}{\frac{2}{4}} = \frac{1}{2}$ - OR -
	Ans: Bag *I*: 3 red + 4 black, Bag *II*: 4 red + 5 black **Case I** : when ball transferred is black. $P(B/I) = \frac{4}{7}$ Total balls in bag *II* are 4 red + 6 black; $P(R/II) = \frac{4}{10}$ Probability in this case = $\frac{4}{7}\times\frac{4}{10}$.	**Case II**: When ball transferred is red. $P(R/I) = \frac{3}{7}$ Total balls in bag *II* are 5 red + 5 black, $P(R/II) = \frac{5}{10}$ Probability in this case = $\frac{3}{7}\times\frac{5}{10}$ Using Bayes' Theorem, probability that the ball transferred is black $= \frac{\frac{4}{7}\times\frac{4}{10}}{\frac{4}{7}\times\frac{4}{10}+\frac{3}{7}\times\frac{5}{10}} = \frac{16}{16+15} = \frac{16}{31}$
28	$\int\frac{1}{9x^2+6x+5}dx = \frac{1}{9}\int\frac{1}{x^2+\frac{6}{9}x+\frac{5}{9}}dx$ $=\frac{1}{9}\int\frac{1}{x^2+\frac{2}{3}x+\frac{5}{9}+\left(\frac{1}{3}\right)^2-\left(\frac{1}{3}\right)^2}dx = \frac{1}{9}\int\frac{1}{\left(x+\frac{1}{3}\right)^2+\left(\frac{2}{3}\right)^2}dx$, putting $x+\frac{1}{3}=t \Rightarrow dx = dt$ $=\frac{1}{9}\int\frac{1}{t^2+\left(\frac{2}{3}\right)^2}dt = \frac{1}{9}\cdot\frac{1}{\frac{2}{3}}\tan^{-1}\left(\frac{t}{2/3}\right)+C = \frac{1}{6}\tan^{-1}\left[\frac{3\left(x+\frac{1}{3}\right)}{2}\right]+C = \frac{1}{6}\tan^{-1}\left(\frac{3x+1}{2}\right)+C$	

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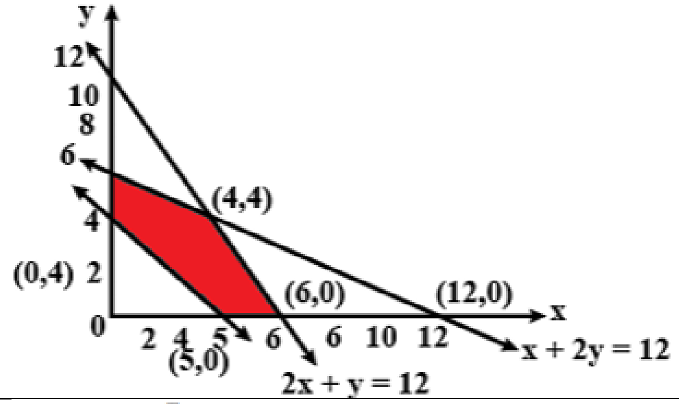

Corner points	Z = 600x + 400y
(0,4)	1600 minimum
(0.6)	2400
(4,4)	4000 maximum
(6,0)	3600
(5,0)	3000

30

Let $I = \int_0^{\frac{\pi}{2}} \sin 2x \tan^{-1}(\sin x)\, dx$

$= \int_0^{\frac{\pi}{2}} 2 \sin x \cos x \tan^{-1}(\sin x)\, dx$

let $\sin x = t \quad \Rightarrow \cos x\, dx = dt$

When $x = 0, t = 0$, when $x = \frac{\pi}{2}, t = 1$

$\Rightarrow I = 2\int_0^1 t \tan^{-1}(t)\, dt$ ...(i)

$\int t \cdot \tan^{-1} t\, dt =$

$= \tan^{-1} t \cdot \int t\, dt - \int \left\{\frac{d}{dt}(\tan^{-1} t) \int t\, dt\right\} dt$

$= \tan^{-1} t \cdot \frac{t^2}{2} - \int \frac{1}{1+t^2} \cdot \frac{t^2}{2} dt$

$= \frac{t^2 \tan^{-1} t}{2} - \frac{1}{2}\int \frac{t^2+1-1}{1+t^2} dt$

$= \frac{t^2 \tan^{-1} t}{2} - \frac{1}{2}\int 1\, dt + \frac{1}{2}\int \frac{1}{1+t^2} dt$

$= \frac{t^2 \tan^{-1} t}{2} - \frac{1}{2} \cdot t + \frac{1}{2}\tan^{-1} t$

$\Rightarrow \int_0^1 t \cdot \tan^{-1} t\, dt = \left[\frac{t^2 \cdot \tan^{-1} t}{2} - \frac{t}{2} + \frac{1}{2}\tan^{-1} t\right]_0^1$

$= \frac{1}{2}\left[\frac{\pi}{4} - 1 + \frac{\pi}{4}\right] = \frac{1}{2}\left[\frac{\pi}{2} - 1\right] = \frac{\pi}{4} - \frac{1}{2}$

$I = 2\left[\frac{\pi}{4} - \frac{1}{2}\right] = \frac{\pi}{2} - 1$

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We have, $(1 + e^{2x})\, dy + (1 + y^2)\, e^x\, dx = 0$ and given that $y = 1$, when $x = 0$

$\therefore \quad \frac{dy}{dx} = \frac{-(1+y^2)e^x}{1+e^{2x}} \qquad \Rightarrow \frac{dy}{-(1+y^2)} = \frac{e^x dx}{1+e^{2x}}$

Integrating both sides, we get

$-\int \frac{dy}{1+y^2} = \int \frac{e^x dx}{1+e^{2x}} \qquad \Rightarrow -\tan^{-1} y = \int \frac{e^x dx}{1+(e^x)^2}$

$\Rightarrow -\tan^{-1} y = \int \frac{dt}{1+t^2} \qquad$ [Putting $e^x = t \Rightarrow e^x dx = dt$]

$\Rightarrow -\tan^{-1} y = \tan^{-1}(t) + C \quad \Rightarrow -\tan^{-1} y = \tan^{-1}(e^x) + C$

Put $x = 0, y = 1$ in (i), we get

$-\tan^{-1} 1 = \tan^{-1}(e^0) + C \qquad \Rightarrow -\frac{\pi}{4} = \frac{\pi}{4} + C \Rightarrow C = -\frac{\pi}{2}$

Putting the value of C in (i), we get

$-\tan^{-1} y = \tan^{-1}(e^x) - \frac{\pi}{2} \qquad \Rightarrow \frac{\pi}{2} = \tan^{-1}(e^x) + \tan^{-1} y$

Hence, $\tan^{-1}(e^x) + \tan^{-1} y = \frac{\pi}{2}$ is the required solution.

- OR -

Comparing it with $\frac{dy}{dx} + Py = Q$, we get $P = 2\tan x, Q = \sin x$

$\therefore \quad IF = e^{\int 2\tan x dx} = e^{2\log\sec x} = e^{\log\sec^2 x} = \sec^2 x \qquad [\because e^{\log z} = z]$

Hence, general solution is $y.\sec^2 x = \int \sin x.\sec^2 x dx + C$.

$y.\sec^2 x = \int \sec x.\tan x\, dx + C \Rightarrow y.\sec^2 x = \sec x + C \Rightarrow y = \cos x + C\cos^2 x$

Putting $y = 0$ and $x = \frac{\pi}{3}$, we get $0 = \cos\frac{\pi}{3} + C.\cos^2\frac{\pi}{3}$

$\Rightarrow 0 = \frac{1}{2} + \frac{C}{4} \quad \Rightarrow \quad C = -2$

$\therefore$ Required solution is $y = \cos x - 2\cos^2 x$.

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$x + y + z = 6$

$y + 3z = 11$

$x + z = 2y$ or $x - 2y + z = 0$

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \ \& \ B = \begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$$

$A = 1(1 + 6) - 0 + 1(3 - 1) = 9$

$$\text{Hence, } adj(A) = \begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}$$

$$\text{Thus, } A^{-1} = \frac{1}{|A|} adj(A) = \frac{1}{9}\begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}$$

$\therefore X = A^{-1}B$

$$\Rightarrow X = \frac{1}{9}\begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}\begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{9}\begin{bmatrix} 9 \\ 18 \\ 27 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \Rightarrow x = 1, y = 2, z = 3$$

\- OR -

$$|A| = \begin{vmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{vmatrix}$$

$= 1(2 - 2) - 2(3 + 4) - 3(-3 - 4)$

$= -14 + 21 = 7$

$$\therefore \quad \text{adj } A = \begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}$$

$$\Rightarrow A^{-1} = \frac{1}{|A|}\text{adj } A = \frac{1}{7}\begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}$$

The given system of equations is $x + 2y - 3z = 6$

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

$2x - y + z = 2$

The system of equations can be written as $AX = B$

$$\text{where } A = \begin{bmatrix} 1 & 2 & -3 \\ 3 & 2 & -2 \\ 2 & -1 & 1 \end{bmatrix}; X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, B = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}$$

$\because \ A^{-1}$ exists, so system of equations has a unique solution given by $X = A^{-1}B$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{7}\begin{bmatrix} 0 & 1 & 2 \\ -7 & 7 & -7 \\ -7 & 5 & -4 \end{bmatrix}\begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix} = \frac{1}{7}\begin{bmatrix} 7 \\ -35 \\ -35 \end{bmatrix} = \begin{bmatrix} 1 \\ -5 \\ -5 \end{bmatrix}$$

$\Rightarrow x = 1, y = -5, z = -5$

33

Ans: Given: $y^2 = 2x$

$y = x - 4$

Required area is OABCO

from (1) and (2), $(x - 4)^2 = 2x$

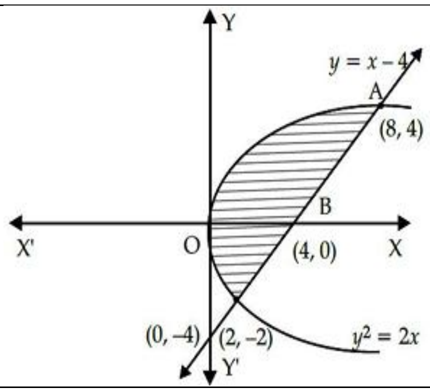
$\Rightarrow x^2 - 10x + 16 = 0$

$\Rightarrow (x - 8)(x - 2) = 0$

$\Rightarrow x = 8$ and $x = 2$

$\therefore$ Intersection points (2, – 2) and (8, 4)

$$\text{Area} = \left[\frac{y^2}{2} + 4y - \frac{y^3}{6}\right]_{-2}^{4} = \left(8 + 16 - \frac{32}{3} - 2 + 8 - \frac{4}{3}\right) = 30 - 12 = 18 \text{ unit}^2$$



34 Ans: Relation R on $N \times N$ is given by

$(a, b)\ R(c, d) \Leftrightarrow ad(b + c) = bc(a + d)$

For reflexive:

For $(a, b) \in N \times N$

$(a, b)\ R(a, b) \Rightarrow ab(b + a) = ba(a + b)$

true in N

Hence, reflexive

For symmetric:

For $(a, b), (c, d) \in N \times N$

$(a, b)\ R(c, d) \Rightarrow ad(b + c) = bc(a + d)$

$\Rightarrow cb(d + a) = da(c + b)$ (×

$\Rightarrow (c, d)\ R(a, b)\ \forall\ (a, b), (c, d) \in N \times N.$

Hence, symmetric

For transitive:

For $(a, b), (c, d), (e, f) \in N \times N$

Let $(a, b)\ R(c, d)$ and $(c, d)\ R(e, f)$

$\Rightarrow ad(b + c) = bc(a + d)$

$\Rightarrow \frac{1}{c} + \frac{1}{b} = \frac{1}{d} + \frac{1}{a}$

and $cf(d + e) = de(c + f)$

$\frac{1}{e} + \frac{1}{d} = \frac{1}{f} + \frac{1}{c}$

$\Rightarrow \frac{1}{c} + \frac{1}{b} + \frac{1}{e} + \frac{1}{d} = \frac{1}{d} + \frac{1}{a} + \frac{1}{f} + \frac{1}{c}$

$\Rightarrow \frac{1}{b} + \frac{1}{e} = \frac{1}{a} + \frac{1}{f}$

$af(e + b) = be(f + a)$

$\Rightarrow af(b + e) = be(a + f)$

$\Rightarrow (a, b)\ R(e, f)$

As $(a, b)\ R(c, d)$, $(c, d)\ R(e, f)$

$\Rightarrow (a, b)\ R(e, f)$ Hence, transitive.

As relation R is reflexive, symmetric and transitive. Hence, R is an equivalence relation.

35 i) $\overline{a_1} = i + 2j + 3k$; $\overline{b} = i - 3j + 2k$

$\overline{a_2} = 4i + 5j + 6k$ Both lines are parallel.

$$\overline{a_2} - \overline{a_1} = 3i + 3j + 3k$$

$$\overline{b} \times (\overline{a_2} - \overline{a_1}) = \begin{vmatrix} i & j & k \\ 1 & -3 & 2 \\ 3 & 3 & 3 \end{vmatrix}$$

$$= i(-9 - 6) - j(3 - 6) + k(3 - (-9))$$

$$= -15i + 3j + 12k$$

Shortest distance = $\left| \frac{|\overline{b} \times (\overline{a_1} - \overline{a_2})|}{|\overline{b}|} \right|$

$$= \left| \frac{|-15i + 3j + 12k|}{|i - 3j + 2k|} \right|$$

$$= \left| \frac{\sqrt{225 + 9 + 144}}{\sqrt{1 + 9 + 4}} \right| = \frac{\sqrt{378}}{\sqrt{14}}$$

$$= \frac{3\sqrt{3}\sqrt{14}}{\sqrt{14}} = 3\sqrt{3}$$

- OR

(i)

Ans: Given that $\vec{a} = \hat{i} - \hat{j} + 7\hat{k}$ and $\vec{b} = 5\hat{i} - \hat{j} + \lambda\hat{k}$

$\therefore\ \vec{a} + \vec{b} = \hat{i} - \hat{j} + 7\hat{k} + 5\hat{i} - \hat{j} + \lambda\hat{k} = 6\hat{i} - 2\hat{j} + (7 + \lambda)\hat{k}$

and $\vec{a} - \vec{b} = \hat{i} - \hat{j} + 7\hat{k} - 5\hat{i} + \hat{j} - \lambda\hat{k} = -4\hat{i} + (7 - \lambda)\hat{k}$

Now, $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular vectors

$\Rightarrow (\vec{a} + \vec{b}).(\vec{a} - \vec{b}) = 0$

$\Rightarrow (6\hat{i} - 2\hat{j} + (7 + \lambda)\hat{k}).(-4\hat{i} + (7 - \lambda)\hat{k} = 0$

$\Rightarrow -24 + 0 + (7 + \lambda)(7 - \lambda) = 0$

$\Rightarrow -24 + 49 - \lambda^2 = 0 \Rightarrow \lambda^2 = 25 \Rightarrow \lambda = \pm 5$

(ii)

$\overrightarrow{AB} = (\hat{i} - 3\hat{j} - 5\hat{k}) - (2\hat{i} - \hat{j} + \hat{k}) = -\hat{i} - 2\hat{j} - 6\hat{k}$

$\Rightarrow |\overrightarrow{AB}| = \sqrt{1 + 4 + 36} = \sqrt{41}$

$\overrightarrow{BC} = (3\hat{i} - 4\hat{j} - 4\hat{k}) - (\hat{i} - 3\hat{j} - 5\hat{k}) = 2\hat{i} - \hat{j} + \hat{k}$

$\Rightarrow |\overrightarrow{BC}| = \sqrt{4 + 1 + 1} = \sqrt{6}$

and $\overrightarrow{AC} = (3\hat{i} - 4\hat{j} - 4\hat{k}) - (2\hat{i} - \hat{j} + \hat{k}) = \hat{i} - 3\hat{j} - 5\hat{k}$

$\Rightarrow |\overrightarrow{AC}| = \sqrt{1 + 9 + 25} = \sqrt{35}$

$\therefore |\overrightarrow{AB}|^2 = |\overrightarrow{AC}|^2 + |\overrightarrow{BC}|^2$

Hence, ABC is a right angled triangle.

36 Ans: (i) Since, $\sum P(x) = 1$

$\therefore$ k + 2k + 3k + 0 = 1

$\Rightarrow$ 6k = 1 $\Rightarrow$ k = 1/6

(ii) From (i), k = 1/6

$\therefore$ P(x = 2) = 3k = 3/6 = 1/2

(iii) If a students has study time at least 1 hr then either he/she has studies for 1 hour or 2 hour.

$\therefore$ Required Probability = P(x = 1) + P(x = 2) = 2k + 3k = 5k = $\frac{5}{6}$

Mean = $\sum xP(x) = 0 \times \frac{1}{6} + 1 \times \frac{2}{6} + 2 \times \frac{3}{6} = 0 + \frac{2}{6} + 1 = \frac{1}{3} + 1 = \frac{4}{3}$

37	Ans: (a) $V(t)=\frac{1}{5}t^3-\frac{5}{2}t^2+25t-2$ $\because$ For 2000, t = 0 $\therefore$ V(0) = 0 – 0 + 0 – 2 Since, number of vehicles cannot be negative. Therefore, the given function cannot be used to estimate number of vehicles in the year 2000. (b) $V(t)=\frac{1}{5}t^3-\frac{5}{2}t^2+25t-2$ $V'(t)=\frac{3}{5}t^2-5t+25=\frac{3}{5}\left[t^2-\frac{25}{3}t+\frac{125}{3}\right]$ $=\frac{3}{5}\left[\left(t-\frac{25}{6}\right)^2-\frac{625}{36}+\frac{125}{3}\right]=\frac{3}{5}\left[\left(t-\frac{25}{6}\right)^2+\frac{875}{36}\right]$ $V'(t)>0$ for any value of t. $\therefore$ The given function $V(t)$ is an increasing function.
38	Ans: (i) Required relation is given by 2x + y = 200. (ii) Area of garden as a function of x can be represented as A(x) = xy = x(200 – 2x) = 200x – $2x^2$ (iii) A(x) = 200x – $2x^2$ $\Rightarrow$ A′(x) = 200 – 4x For the area to be maximum A′(x) = 0 $\Rightarrow$ 200 – 4x = 0 $\Rightarrow$ x = 50 ft. **OR** (iii) Maximum area of the garden = $200(50)-2(50)^2$ = 10000 – 5000 = 5000 sq. ft