Reg. No. : ....

Name : ....

Code No. 2018

Second Year – JUNE 2016
SAY / IMPROVEMENT

Time : 2½ Hours
Cool-off time : 15 Minutes

Part – III

MATHEMATICS (SCIENCE)

Maximum : 80 Scores

General Instructions to Candidates :

- There is a 'cool-off time' of 15 minutes in addition to the writing time of 2½ hrs.
- You are not allowed to write your answers nor to discuss anything with others during the 'cool-off time'.
- Use the 'cool-off time' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- All questions are compulsory and only internal choice is allowed.
- When you select a question, all the sub-questions must be answered from the same question itself.
- Calculations, figures and graphs should be shown in the answer sheet itself.
- Malayalam version of the questions is also provided.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the Examination Hall.

നിർദ്ദേശങ്ങൾ :

- നിർദ്ദിഷ്ട സമയത്തിന് പുറമെ 15 മിനിറ്റ് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും. ഈ സമയത്ത് ചോദ്യങ്ങൾക്ക് ഉത്തരം എഴുതാനോ, മറ്റുള്ളവരുമായി ആശയവിനിമയം നടത്താനോ പാടില്ല.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതണം.
- ഒരു ചോദ്യനമ്പർ ഉത്തരമെഴുതാൻ തെരഞ്ഞെടുത്തു കഴിഞ്ഞാൽ ഉപചോദ്യങ്ങളും അതേ ചോദ്യനമ്പരിൽ നിന്ന് തന്നെ തെരഞ്ഞെടുക്കേണ്ടതാണ്.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നൽകിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

1. (a) If the matrix A is both symmetric and skew-symmetric, then A is a

(i) diagonal matrix (ii) zero matrix

(iii) square matrix (iv) scalar matrix **(Score : 1)**

(b) If $A = \begin{bmatrix} 1 & 3 \\ -2 & 4 \end{bmatrix}$, then show that $A^2 - 5A + 10I = 0$ **(Scores : 3)**

(c) Hence find A^{-1}. **(Scores : 2)**

2. (a) The value of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 1 & 1 & -1 \end{vmatrix}$ is

(i) -4 (ii) 0

(iii) 1 (iv) 4 **(Score : 1)**

(b) Using matrix method, solve the system of

linear equations, $x + y + 2z = 4$

$2x - y + 3z = 9$

$3x - y - z = 2$ **(Scores : 4)**

3. (a) If $f : R \to R$ and $g : R \to R$ defined by $f(x) = x^2$ and $g(x) = x + 1$, then $gof\,(x)$ is

(i) $(x + 1)^2$ (ii) $x^3 + 1$

(iii) $x^2 + 1$ (iv) $x + 1$ **(Score : 1)**

(b) Consider the function $f : N \to N$, given by $f(x) = x^3$. Show that the function f is injective but not surjective. **(Scores : 2)**

(c) The given table shows an operation $*$ on $A = \{p, q\}$

*	p	q
p	p	q
q	p	q

(i) Is $*$ a binary operation on A ?

(ii) Is $*$ commutative ? Give reason. **(Scores : 2)**

4. (a) The principal value of $\tan^{-1}(-\sqrt{3})$ is

(i) $\frac{\pi}{3}$ (ii) $\frac{-\pi}{3}$

(iii) $\frac{\pi}{4}$ (iv) $\frac{-\pi}{6}$ **(Score : 1)**

(b) Show that $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{2}{11} = \tan^{-1}\frac{3}{4}$ **(Scores : 3)**

5. (a) Find $\frac{dy}{dx}$, if $x = a\cos^2\theta$, $y = b\sin^2\theta$. **(Scores : 3)**

(b) Find the second derivative of the function

$y = e^x \sin x$ **(Scores : 3)**

6. (a) The slope of the normal to the curve, $y = x^3 - x^2$ at $(1, -1)$ is

(i) 1 (ii) -1

(iii) 2 (iv) 0 **(Score : 1)**

(b) Find the intervals in which the function $f(x) = 2x^3 - 24x + 25$ is increasing or decreasing. **(Scores : 4)**

OR

(a) The rate of change of the area of a circle with respect to radius r, when r = 5 cm

(i) 25π cm^2/cm (ii) 25 cm^2/cm

(iii) 10π cm^2/cm (iv) 10 cm^2/cm **(Score : 1)**

(b) Show that of all rectangles with a given area, the square has the least perimeter.

(Scores : 4)

7. Find the following :

(a) $\int \cot x \log \sin x \, dx$ **(Scores : 2)**

(b) $\int \frac{1}{x^2 + 2x + 2} dx$ **(Scores : 2)**

(c) $\int x e^{9x} dx$ **(Scores : 2)**

8. (a) The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \cos\left(\frac{dy}{dx}\right) = 0$ is

(i) 2 (ii) 1

(iii) 0 (iv) Not defined **(Score : 1)**

(b) Solve $\frac{dy}{dx} + 2y \tan x = \sin x$, $y = 0$, when $x = \frac{\pi}{3}$. **(Scores : 5)**

9. (a) The projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$ is

(i) 1 (ii) 0

(iii) 2 (iv) –1 **(Score : 1)**

(b) Find the area of the parallelogram whose adjacent sides are given by the vectors $\vec{a} = 3\hat{i} + \hat{j} + 4\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ **(Scores : 2)**

10. Find $\int_0^{\pi} \frac{x}{1 + \sin x} dx$. **(Scores : 4)**

OR

Find $\int_0^{2} e^x dx$ as the limit of a sum. **(Scores : 4)**

11. (a) The area bounded by the curve $y = 2 \cos x$, the x-axis from $x = 0$ to $x = \frac{\pi}{2}$ is

(i) 0 (ii) 1

(iii) 2 (iv) –1 **(Score : 1)**

(b) Find the area of the region bounded by the curves $y^2 = 4ax$ and $x^2 = 4ay$, $a > 0$.

(Scores : 5)

12. (a) $(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b})$ is equal to

(i) $\vec{0}$ (ii) $|\vec{a}|^2 - |\vec{b}|^2$

(iii) $\vec{a} \times \vec{b}$ (iv) $2(\vec{a} \times \vec{b})$ **(Score : 1)**

(b) If $\vec{a}$ and $\vec{b}$ are any two vectors, then prove that $(\vec{a} \times \vec{b})^2 = \begin{vmatrix} \vec{a} \cdot \vec{a} & \vec{a} \cdot \vec{b} \\ \vec{a} \cdot \vec{b} & \vec{b} \cdot \vec{b} \end{vmatrix}$

(Scores : 2)

(c) Using vectors, show that the points

A(1, 2, 7), B(2, 6, 3) and C(3, 10, –1) are collinear. **(Scores : 2)**

13. (a) The equation of the line which passes through the point (1, 2, 3) and parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$ is

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

(ii) $2\hat{i} - 5\hat{k} + \lambda(3\hat{i} + 2\hat{j} - 2\hat{k})$

(iii) $\hat{i} + 2\hat{j} + 3\hat{k} + \lambda(-2\hat{i} + 4\hat{j} - 2\hat{k})$

(iv) $\hat{i} + 2\hat{j} + 3\hat{k} + \lambda(3\hat{i} + 2\hat{j} - 2\hat{k})$ **(Score : 1)**

(b) Find the angle between the pair of lines

$\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda(3\hat{i} + 2\hat{j} + 6\hat{k})$ and

$\vec{r} = 7\hat{i} - 6\hat{k} + \mu(\hat{i} + 2\hat{j} + 2\hat{k})$ **(Scores : 3)**

14. (a) The distance of the plane $x + y + z + 1 = 0$ from the point (1, 1, 1) is

(i) 4 units (ii) $\frac{1}{\sqrt{3}}$ units

(iii) $\frac{4}{\sqrt{3}}$ units (iv) $\frac{1}{4\sqrt{3}}$ units **(Score : 1)**

(b) Find the equation of the plane passing through (1, 0, –2) and perpendicular to each of the planes $2x + y - z = 2$ and $x - y - z = 3$. **(Scores : 3)**

15. Consider the following L.P.P.

Maximise, $Z = 3x + 9y$

Subject to the constraints $x + 3y \leq 60$

$x + y \geq 10$

$x \leq y$

$x \geq 0, y \geq 0$

(a) Draw its feasible region. **(Scores : 3)**

(b) Find the corner points of the feasible region. **(Scores : 3)**

16. (a) If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$ then P(A/B) is

(i) $\frac{9}{4}$ (ii) $\frac{16}{13}$

(iii) $\frac{4}{9}$ (iv) $\frac{11}{13}$ **(Score : 1)**

(b) Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, then

(i) Find the probability that the problem is solved. **(Scores : 2)**

(ii) Find the probability that exactly one of them solves the problem. **(Scores : 2)**

OR

A die is thrown 6 times. If getting an odd number is a success

(i) Find probability of success and failure **(Score : 1)**

(ii) Find the probability of 5 success. **(Scores : 2)**

(iii) Find the probability of atleast 5 successes. **(Scores : 2)**

SECOND YEAR HIGHER SECONDARY SAY/IMP. EXAMINATION, JUNE 2016.
(Finalised Scheme of Valuation)

Subject: Mathematics (Science) **Code No: 2018**

Qn.No		Scoring Indicators	Split Score	Total Score
1.	(a)	(ii) Zero matrix	1	1
	(b)	$A^2 = A \times A$	1/2	
		$A^2 = \begin{bmatrix} -5 & 15 \\ -10 & 10 \end{bmatrix}$	1/2	
		$A^2 - 5A + 10I = \begin{bmatrix} -5 & 15 \\ -10 & 10 \end{bmatrix} - \begin{bmatrix} 5 & 15 \\ -10 & 20 \end{bmatrix} + \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$	1	3
		$= \begin{bmatrix} -10 & 0 \\ 0 & -10 \end{bmatrix} + \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$		
		$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = 0$	1	
	(c)	multiplying by A^{-1} with the given matrix equation		
		we get, $A^2A^{-1} - 5AA^{-1} + 10IA^{-1} = 0$		
		$A \cdot A \cdot A^{-1} - 5I + 10A^{-1} = 0$	1/2	
		$A - 5I + 10A^{-1} = 0$		2
		$10A^{-1} = 5I - A$	1/2	
		$A^{-1} = \frac{5I - A}{10}$		
		$A^{-1} = \frac{1}{10}\begin{bmatrix} 4 & -3 \\ 2 & 1 \end{bmatrix}$	1	
		Remark:-		
		Any other method give 1 1/2 Score		

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Qn.No		Scoring Indicators	Split Score	Total Score
2	(a)	(iv) 4	1	1
	(b)	Express in the matrix form $AX=B$	$\frac{1}{2}$	
		where $A=\begin{bmatrix}1&1&2\\2&-1&3\\3&-1&-1\end{bmatrix}$, $X=\begin{bmatrix}x\\y\\z\end{bmatrix}$, $B=\begin{bmatrix}4\\9\\2\end{bmatrix}$	$\frac{1}{2}$	
		$\lvert A\rvert=\begin{vmatrix}1&1&2\\2&-1&3\\3&-1&-1\end{vmatrix}=17$	1	
		$\operatorname{adj}A=\begin{bmatrix}4&-1&5\\11&-7&1\\1&4&-3\end{bmatrix}$	1	4
		$X=A^{-1}B$ $=\frac{1}{17}\begin{bmatrix}17\\-17\\34\end{bmatrix}=\begin{bmatrix}1\\-1\\2\end{bmatrix}$	$\frac{1}{2}$	
		$\Rightarrow x=1,\ y=-1,\ z=2$	$\frac{1}{2}$	
3	(a)	(iii) x^2+1	1	1
	(b)	$f: N\to N$, given by $f(x)=x^3$ for $x,y\in N$ $f(x)=f(y)$ $\Rightarrow x^3=y^3$ $\Rightarrow x=y$ $\therefore f$ is injective	1	2
		Now $2\in N$, But there doesnot exists any element x in domain N such that $f(x)=x^3=2$ $\therefore f$ is not surjective	1	
		<u>Remark</u> Any other method give full score		

(5)

Qn.No		Scoring Indicators	Split Score	Total Score
	(c)	(i) Yes	1	
		(ii) No, because $p * q = q$ $q * p = p$ $\Rightarrow p * q \neq q * p$ $\therefore *$ is not Commutative	1	2
4	(a)	(ii) $\frac{-\pi}{3}$	1	1
	(b)	$\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right)$	1	
		$\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{2}{11} = \tan^{-1}\left(\frac{\frac{1}{2}+\frac{2}{11}}{1-\frac{1}{2}\times\frac{2}{11}}\right)$	1	3
		$= \tan^{-1}\left(\frac{15}{20}\right) = \tan^{-1}\left(\frac{3}{4}\right)$	1	
5	(a)	$\frac{dx}{d\theta} = -2a\cos\theta\cdot\sin\theta$	1	
		$\frac{dy}{d\theta} = 2b\sin\theta\cos\theta$	1	
		$\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$	1/2	3
		$= \frac{2b\sin\theta\cos\theta}{-2a\cos\theta\sin\theta}$ $= \frac{-b}{a}$	1/2	
	(b)	$y = e^x \sin x$		
		$\frac{dy}{dx} = e^x\cdot\cos x + \sin x\cdot e^x = e^x[\cos x+\sin x]$	1	
		$\frac{d^2y}{dx^2} = e^x[-\sin x+\cos x]+[\cos x+\sin x]e^x$ $= e^x[-\sin x+\cos x+\cos x+\sin x]$ $= e^x[2\cos x] = 2\cdot e^x\cos x$	2	3

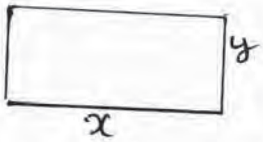
5

4

6

Remark

formula give 1 score

Qn.No		Scoring Indicators	Split Score	Total Score
6	(a)	(ii) -1	1	1
	(b)	$f(x) = 2x^3 - 24x + 25$		
		$f'(x) = 6x^2 - 24$	1	
		$f'(x) = 0$	½	
		$x^2 = 4 \Rightarrow x = \pm 2$	½	4
		∴ The intervals are $(-\infty, -2), (-2, 2), (2, \infty)$	1	
		∴ $f(x)$ is increasing in $(-\infty, -2) \cup (2, \infty)$	½	
		$f(x)$ is decreasing in $(-2, 2)$	½	
		OR		
	(a)	(iii) $10\pi \text{ cm}^2/\text{cm}$	1	1
	(b)			
		Area $A = xy$	½	
		$\therefore y = \frac{A}{x}$		
		Perimeter $P = 2x + 2y$	½	
		$P = 2x + 2\frac{A}{x}$		
		$\frac{dP}{dx} = 2 - \frac{2A}{x^2}$	½	
		$\frac{dP}{dx} = 0$	½	
		$\Rightarrow x^2 = A \therefore x = \pm\sqrt{A}$	½	
		$\frac{d^2P}{dx^2} = \frac{4A}{x^3}$	½	

5

OR

Qn.No		Scoring Indicators	Split Score	Total Score
		at $x=\sqrt{A}$, $\frac{d^2P}{dx^2}$ is +ve	1/2	4
		$\therefore$ the perimeter of the rectangle is least when $x=y=\sqrt{A}$	1/2	
		Hence the perimeter of the rectangle is least when it is a square		
7	(a)	$\int \cot x \log \sin x \, dx$		
		Let $\log \sin x = t$	1/2	
		$\frac{1}{\sin x} \cos x = \frac{dt}{dx}$	1/2	2
		$dt = \cot x \, dx$		
		$\int \cot x \cdot \log \sin x \, dx = \int t \cdot dt = \frac{t^2}{2} + c$ $= \frac{(\log \sin x)^2}{2} + c$	1	
		<u>Remark</u> Any other method give full score		
	(b)	$\int \frac{1}{x^2+2x+2} dx = \int \frac{1}{(x+1)^2+1^2} dx$	1	2
		$= \tan^{-1}(x+1) + C$	1	
		<u>Remark</u> formula geve 1 score		

(5)

Qn.No		Scoring Indicators	Split Score	Total Score	
	(c)	$\int x \cdot e^{9x} dx = x \cdot \frac{e^{9x}}{9} - \int 1 \cdot \frac{e^{9x}}{9} dx$	1	2	6
		$= \frac{x e^{9x}}{9} - \frac{1}{81} e^{9x} + C$	1		
		$= \frac{1}{81} e^{9x} (9x-1) + C$			
		Remark Formula give 1/2 Score			
8	(a)	(iv) Not defined	1	1	6
	(b)	$\frac{dy}{dx} + 2y\tan x = \sin x$			
		$\frac{dy}{dx} + Py = Q$ where $P = 2\tan x, Q = \sin x$	1		
		$I \cdot F = e^{\int P dx}$	1/2		
		$= e^{\int 2\tan x\, dx} = \sec^2 x$	1/2	5	
		General Solution $y(IF) = \int Q(IF) dx + C$	1		
		$y \sec^2 x = \int \sin x \cdot \frac{1}{\cos x} dx + C$			
		$y \sec^2 x = \sec x + C$.	1		
		Put $y = 0$ and $x = \frac{\pi}{3}$, Then $c = -2$	1		
		$y = \cos x - 2\cos^2 x$			
9	(a)	(ii) 0	1	1	3
	(b)	$\vec{a} \times \vec{b} = 5\hat{i} + \hat{j} - 4\hat{k}$	1	2	
		Area of parallelogram $= \lvert \vec{a} \times \vec{b} \rvert$	1/2		
		$\lvert \vec{a} \times \vec{b} \rvert = \sqrt{42}$	1/2		

SECOND YEAR HIGHER SECONDARY SAY/IMP. EXAMINATION, JUNE 2016.
(Finalised Scheme of Valuation)

Subject: Computer Science

Code No: 2019

Qn.No		Scoring Indicators	Split Score	Total Score
10		Let $I = \int_0^{\pi} \frac{x}{1+\sin x} dx \longrightarrow ①$		
		Also $I = \int_0^{\pi} \frac{\pi - x}{1+\sin(\pi - x)} = \int_0^{\pi} \frac{\pi - x}{1+\sin x} dx \to ②$	1	
		①+② $2I = \int_0^{\pi} \frac{\pi}{1+\sin x} dx = \pi \int_0^{\pi} \frac{1}{1+\sin x} dx$	1	
		$2I = \pi \int_0^{\pi} \frac{(1-\sin x)}{(1+\sin x)(1-\sin x)} dx = \pi \int_0^{\pi} \frac{1-\sin x}{1-\sin^2 x} dx$		4
		$= \pi \int_0^{\pi} \sec^2 x\, dx - \pi \int_0^{\pi} \sec x \tan x\, dx$	1	
		$2I = [\pi \tan x - \pi \sec x]_0^{\pi}$	1	
		$2I = \pi [\tan x - \sec x]_0^{\pi}$		
		$2I = 2\pi$		
		$\therefore I = \pi$		
		Remark write $\int_0^a f(x) dx = \int_0^a f(a-x) dx$ give one score		
		OR		OR
		$\int_a^b f(x) dx = (b-a) \lim_{n\to\infty} \frac{1}{n}[f(a) + f(a+h) + \dots + f(a+(n-1)h)]$	1	
		$\int_0^2 e^x dx = (2-0) \lim_{n\to\infty} \frac{1}{n}[f(0) + f(h) + f(2h) + \dots + f[(n-1)h]]$	1/2	

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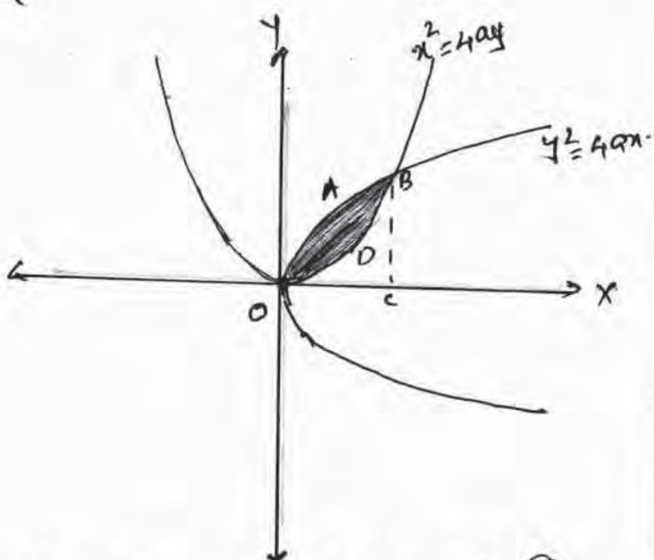
Qn.No		Scoring Indicators	Split Score	Total Score
		$= 2 \lim_{n \to \infty} \frac{1}{n}\left[1 + e^{h} + e^{2h} + \cdots + e^{(n-1)h}\right]$		
		$= 2 \lim_{n \to \infty} \frac{1}{n}\left[\frac{(e^{h})^{n} - 1}{e^{h} - 1}\right]$		
		$= 2 \lim_{n \to \infty} \frac{1}{n}\left[\frac{e^{nh} - 1}{e^{h} - 1}\right]$	1	4
		$= 2(e^{2} - 1) \lim_{h \to 0} \frac{h}{2(e^{h} - 1)}$		
		$= (e^{2} - 1) \lim_{h \to 0} \frac{1}{\left(\frac{e^{h} - 1}{h}\right)}$	1	
		$= (e^{2} - 1) \times 1 = e^{2} - 1$	1/2	
		Remark Direct method give one score		
11	(a)	(iii) 2	1	1
			1	
		$x^2 = 4ay \rightarrow ①$ $y^2 = 4ax \rightarrow ②$		
		from ① $y = \frac{x^2}{4a}$ ② $\Rightarrow \frac{x^4}{16a^2} = 4ax$	1	

(4)

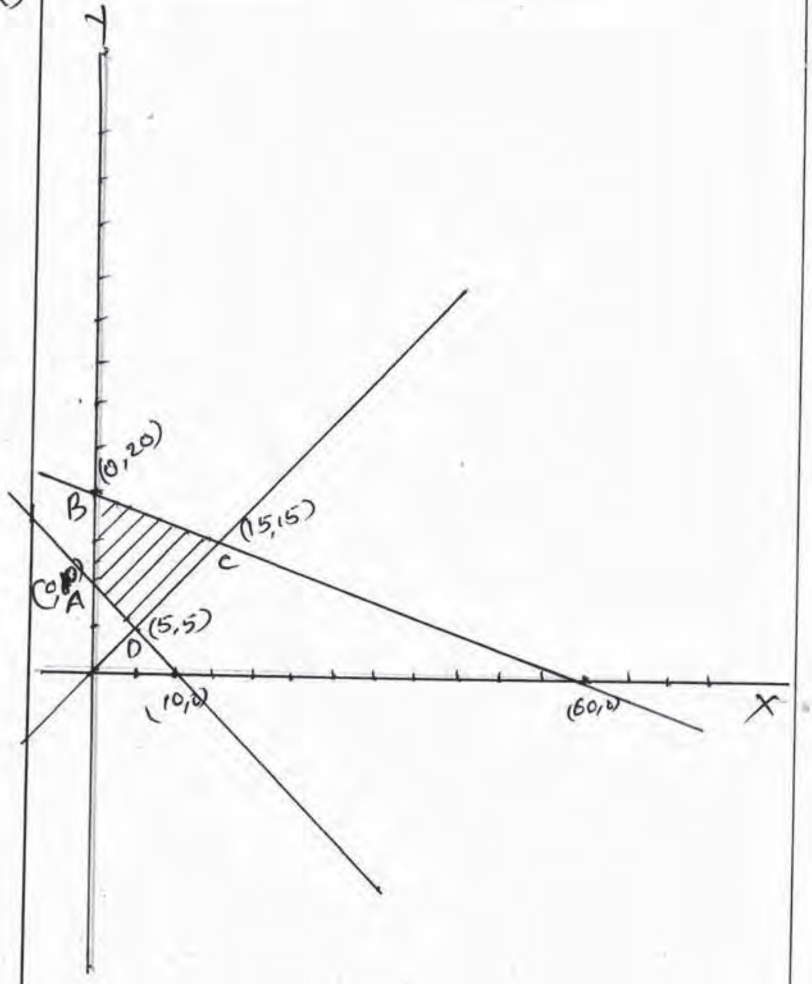
$\Rightarrow x = 0$ or $x = 4a$

Qn.No		Scoring Indicators	Split Score	Total Score
		when $x=0, y=0$ when $x=4a, y=4a$ Required area = Area under the region OAB from $x=0$ to $x=4a$ — Area under the region ODB	1	
		$= \int_0^{4a} 2\sqrt{a}\sqrt{x}\,dx - \int_0^{4a} \frac{x^2}{4a}\,dx$	1	5
		$= \frac{4}{3}\sqrt{a}\left[(4a)^{3/2} - 0\right] - \frac{1}{12a}\left[(4a)^3 - 0\right]$	½	
		$= \frac{4}{3}\sqrt{a}\cdot 8a^{3/2} - \frac{1}{12a}\cdot 64a^3$		
		$= \frac{16}{3}a^2$ square unit	½	
12	(a)	(iv) $2(\vec{a}\times\vec{b})$	1	1
	(b)	$(\vec{a}\times\vec{b})^2 = (\vec{a}\times\vec{b})\cdot(\vec{a}\times\vec{b}) = a^2b^2\sin^2\theta$	½	
		$= a^2b^2 - a^2b^2\cos^2\theta$	1	
		$= (\vec{a}\cdot\vec{a})(\vec{b}\cdot\vec{b}) - (\vec{a}\cdot\vec{b})^2$		2
		$= \begin{vmatrix} \vec{a}\cdot\vec{a} & \vec{a}\cdot\vec{b} \\ \vec{a}\cdot\vec{b} & \vec{b}\cdot\vec{b} \end{vmatrix}$	½	
	(c)	$\vec{AB} = \hat{i}+4\hat{j}-4\hat{k}$	½	
		$\vec{AC} = 2\hat{i}+8\hat{j}-8\hat{k} = 2(\hat{i}+4\hat{j}-4\hat{k})$	½	2
		$\vec{AC} = 2\vec{AB}$	½	
		$\Rightarrow$ A, B, C are collinear	½	

(6)

(5)

Qn.No	Scoring Indicators	Split Score	Total Score	
13	(a) (iv) $\hat{i}+2\hat{j}+3\hat{k}+\lambda(3\hat{i}+2\hat{j}-2\hat{k})$	1	1	
	(b) $\cos\theta = \left\lvert \frac{\vec{b_1}\cdot\vec{b_2}}{\lvert\vec{b_1}\rvert\lvert\vec{b_2}\rvert} \right\rvert$	1		
	$\vec{b_1}\cdot\vec{b_2} = 19$	1/2	3	4
	$\lvert\vec{b_1}\rvert = 7$, $\lvert\vec{b_2}\rvert = 3$	1/2		
	$\therefore \cos\theta = \frac{19}{21}$	1		
	$\therefore \theta = \cos^{-1}\left(\frac{19}{21}\right)$			
14	(a) (iii) $\frac{4}{\sqrt{3}}$ units	1	1	
	(b) Eqn. of the plane passing through $(1,0,-2)$ is $a(x-1)+b(y-0)+c(z+2)=0 \rightarrow (1)$	1		
	Plane (1) is $\perp^{er}$ to the given planes $\Rightarrow 2a+b-c=0 \rightarrow (2)$	1/2		
	$a-b-c=0 \rightarrow (3)$	1/2		4
	Solving (2) and (3) we get $\frac{a}{-2} = \frac{b}{1} = \frac{c}{-3} = k$		3	
	$a=-2k$, $b=k$, $c=-3k$	1/2		
	$\therefore (1) \Rightarrow -2x+y-3z-4=0$ $\Rightarrow 2x-y+3z+4=0$	1/2		
	Remark Any other method give full score			

Qn.No		Scoring Indicators	Split Score	Total Score
15	(a)		3	6
	(b)	Corner points are A (0,10), B (0,20), C (15,15) & D (5,5)	3	
		Remark (a) Incorrect fesible region deduct 1/2 score for each line give one score (b) Any correct three corner points give full score		

Qn.No	Scoring Indicators	Split Score	Total Score
16	(a) (iii) $\frac{4}{9}$	1	1
	(b) (i) $P(A)=1/2$ $\quad P(B)=1/3$	1/2	
	$P(A')=1/2$ $\quad P(B')=2/3$	1/2	
	P [the problem is solved]		2
	= 1 − P [none of them solve the problem]	1/2	
	$=1-P[A'\cap B'] = 1-P(A')\cdot P(B')$	1/2	
	$=1-\left(\frac{1}{2}\times\frac{2}{3}\right) = 1-\frac{1}{3} = \frac{2}{3}$		
	(ii) P [exactly one of them solved the problem]		
	$=P(A'\cap B \cup A\cap B') = P(A'\cap B)+P(A\cap B')$	1/2	
	$=P(A')\cdot P(B)+P(A)\cdot P(B')$	1/2	2
	$=\frac{1}{2}\cdot\frac{1}{3}+\frac{1}{2}\cdot\frac{2}{3}$		
	$=\frac{1}{6}+\frac{2}{6}$	1	
	$=\frac{1}{2}$		
	OR		
	(i) $P(\text{success})=\frac{3}{6}=\frac{1}{2}$ $\quad P(\text{failure})=1-1/2=1/2$	1/2 + 1/2	1
	(ii) $P(5 \text{ success}) = nC_x\, p^x q^{n-x}$	1	
	$=6C_1 (1/2)^5 (1/2) = \frac{3}{32}$	1	2
	(iii) $P(\text{at least 5 success}) = P(5\text{ success}) + P(6 \text{ success})$	1/2	
	$=6(1/2)^5(1/2)+1(1/2)^6 = \frac{3}{32}+\frac{1}{64}=\frac{7}{64}$	1 1/2	2

5

OR

5