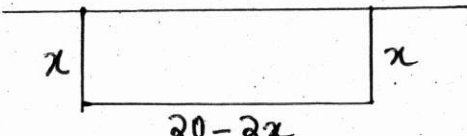


SECOND YEAR HIGHER SECONDARY EXAMINATION JUNE 2018

SUBJECT : MATHEMATICS (SCIENCE)

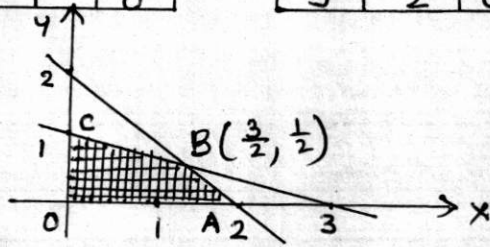
CODE. NO: 2018

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1	a	$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$	$\frac{1}{2} + \frac{1}{2}$	3
	b	$A^2 = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix} \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix} = \begin{bmatrix} 29 & 36 \\ 45 & 56 \end{bmatrix}$	1+1	
		<u>Remarks</u> for any THREE correct entries in A^2 give full score for any A, Correct A^2 give 2 score		
2	a	$2x$	1	3
	b	$\int x e^x dx = x \int e^x dx - \int x dx$ $= x e^x - e^x + c = e^x(x-1) + c$	1 1	
		<u>Remarks</u> formula give $\frac{1}{2}$ score		
3	$(x-a)^2 + y^2 = a^2 \quad \text{--- ①}$		1	3
	$x^2 + y^2 = 2ax$		1	
	$2x + 2y \frac{dy}{dx} = 2a \Rightarrow a = x + y \frac{dy}{dx}$		1	
	$\text{①} \Rightarrow y^2 \left(\frac{dy}{dx}\right)^2 + y^2 = \left(x + y \frac{dy}{dx}\right)^2$ $\Rightarrow \frac{dy}{dx} = \frac{y^2 - x^2}{2xy}$		1	
		<u>Remarks</u> for $(x-a)^2 + (y-b)^2 = r^2$ give $\frac{1}{2}$ score		
4	not reflexive, $(2, 2) \notin R$		1	3
	Symmetric $(x, y) \in R, \Rightarrow (y, x) \in R$ $xy = yx$		1	
	not transitive $(3, 2) \in R$ and $(2, 3) \in R$ but $(3, 3) \notin R$		1	
		<u>Remarks</u> def. for reflexive, symmetric, transitive give $\frac{1}{2}$ score each		
5	$A = \int_0^{\frac{\pi}{2}} \cos x dx + \left \int_{\frac{\pi}{2}}^{\pi} \cos x dx \right $		1	
	$= [\sin x]_0^{\frac{\pi}{2}} + \left [\sin x]_{\frac{\pi}{2}}^{\pi} \right $		1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
		$= 1 + 1 = 2$ <p>Remarks find the area using $\int_0^{\pi} \cos x dx$ give $\frac{1}{2}$ score for diagram only give ONE score</p>	1	3
6		 <p>length = $20 - 2x$, breadth = x</p> $A = x(20 - 2x) = 20x - 2x^2$ $A'(x) = 20 - 4x$ $A'(x) = 0 \Rightarrow x = 5$ $A''(x) = -4 < 0 \Rightarrow A \text{ is maximum at } x = 5$ <p>maximum area = $5 \times 10 = 50$</p> <p>Remarks Area = $l \times b$ give $\frac{1}{2}$ score</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	3
7		<p>Max $Z = 25x + 12y$</p> <p>Subject to</p> $2x + 3y \leq 15$ $3x + y \leq 15$ $x, y \geq 0$ <p>Remarks for $2x + 3y \geq 15, 3x + y \geq 15$ give 1 score</p>	<p>1</p> <p>1</p> <p>1</p>	3
8	a	$\frac{dy}{dx} = 3x^2 + 8$ $3x^2 + 8 = 20$ $x = \pm 2$ <p>points $(2, 21), (-2, 21)$</p> <p>Remarks Any one point give FULL score</p>	<p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>	4
	b	<p>No</p> $3x^2 + 8 \geq 0$ <p>Slope of the tangent = $\frac{dy}{dx}$ give $\frac{1}{2}$ score</p>	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
9	a	iii) $f(x) = \begin{cases} \sin \frac{1}{x}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$	1	4
	b	$\lim_{x \rightarrow 3^+} f(x) = 3a + b ; 3a + b = 10$	1	
		$\lim_{x \rightarrow 4^-} f(x) = 4a + b ; 4a + b = 20$	1	
		Solving, $a = 10, b = -20$	1	
		<u>Remarks</u> def. of continuity give $\frac{1}{2}$ score		
10	a	$2x - 3y + z = k$	1	4
		passing through $(1, 1, 3)$	1	
		$2 - 3 + 3 = k \Rightarrow k = 2$		
	$2x - 3y + z = 2$			
		<u>Remarks</u> for $a(x-x_1) + b(y-y_1) + c(z-z_1) = 0$ give $\frac{1}{2}$ score		
b	Distance between planes = Distance of the point $(1, 1, 3)$ from the plane	1	$\frac{1}{2} + \frac{1}{2}$	
	$= \left \frac{2 \times 1 - 3 \times 1 + 3 - 5}{\sqrt{4 + 9 + 1}} \right = \frac{3}{\sqrt{14}}$			
		<u>Remarks</u> for formula give $\frac{1}{2}$ score Alternate method give full score		
11	a	Projection $\frac{\vec{a} \cdot \vec{b}}{ \vec{b} }$	1	4
	b	$\vec{a} \cdot \vec{b} = 3, \vec{b} = \sqrt{18}$	$\frac{1}{2} + \frac{1}{2}$	
		projection = $\frac{3}{\sqrt{18}}$ or $\frac{1}{\sqrt{2}}$		
c	$\vec{d} = \vec{a}$, or any vector parallel to \vec{a}	1		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
12	a	$\vec{AC} = \vec{AB} + \vec{AD} = 4\hat{i} + 4\hat{j}$ $\vec{DB} = \vec{AB} - \vec{AD} = 2\hat{i} - 2\hat{j}$	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$	4
	b	<p>Let $\vec{c} = \vec{a} + \vec{b}$ and $\vec{d} = \vec{a} - \vec{b}$</p> $\vec{c} \times \vec{d} = (\vec{a} + \vec{b}) \times (\vec{a} - \vec{b}) = -2(\vec{a} \times \vec{b})$ $ \vec{c} \times \vec{d} = 2 \vec{a} \times \vec{b} $ <p><u>Remarks</u> Verify the result using any vectors give FULL score</p>	 1 $\frac{1}{2}$ $\frac{1}{2}$	
13		$4x + 7 = A(2x + 4) + B$ $A = 2, B = -1$ $I = 2 \int (2x + 4) \sqrt{x^2 + 4x + 13} dx - \int \sqrt{x^2 + 4x + 13} dx$ $= 2I_1 - I_2$ $I_1 = \int \sqrt{t} dt = \frac{2}{3} t^{3/2} + C, \frac{2}{3} (x^2 + 4x + 13)^{3/2} + C_1$ $I_2 = \int \sqrt{x^2 + 4x + 13} dx = \int \sqrt{(x+2)^2 + 9} dx$ $= \frac{x+2}{2} \sqrt{(x+2)^2 + 9} + \frac{9}{2} \log (x+2) + \sqrt{(x+2)^2 + 9} + C_2$ $I = 2I_1 - I_2$	 1 1 1	4
14	a	$IF = e^{\int \frac{1}{x} dx} = e^{\log x} = x$	$\frac{1}{2} + \frac{1}{2}$	4
	b	$\frac{dy}{dx} = 2x$ $y = x^2 + C$ $4 = 1 + C \Rightarrow C = 3$ <p>equation $y = x^2 + 3$</p>	 1 1 1	

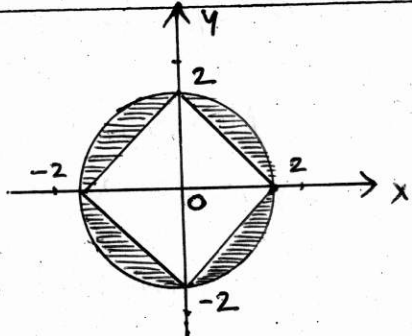
Qn. No	Sub Qns	Answer Key/Value Points	Score	Total																										
15		<div style="display: flex; justify-content: space-around;"> <table border="1" style="border-collapse: collapse;"> <tr><td colspan="3" style="text-align: center;">$x+3y=3$</td></tr> <tr><td style="text-align: center;">x</td><td style="text-align: center;">0</td><td style="text-align: center;">3</td></tr> <tr><td style="text-align: center;">y</td><td style="text-align: center;">1</td><td style="text-align: center;">0</td></tr> </table> <table border="1" style="border-collapse: collapse;"> <tr><td colspan="3" style="text-align: center;">$x+y=2$</td></tr> <tr><td style="text-align: center;">x</td><td style="text-align: center;">0</td><td style="text-align: center;">2</td></tr> <tr><td style="text-align: center;">y</td><td style="text-align: center;">2</td><td style="text-align: center;">0</td></tr> </table> </div>  <p>Corner points</p> <table style="margin-left: 20px;"> <tr><td>$O(0,0)$</td><td>$Z=3x+5y$</td></tr> <tr><td>$A(2,0)$</td><td>6</td></tr> <tr><td>$B(\frac{3}{2}, \frac{1}{2})$</td><td>$7$</td></tr> <tr><td>$C(0,1)$</td><td>$5$</td></tr> </table> <p>Maximum 7 at $B(\frac{3}{2}, \frac{1}{2})$</p> <p><u>Remark</u> Correct graph and incorrect shaded region give $2\frac{1}{2}$ score</p>	$x+3y=3$			x	0	3	y	1	0	$x+y=2$			x	0	2	y	2	0	$O(0,0)$	$Z=3x+5y$	$A(2,0)$	6	$B(\frac{3}{2}, \frac{1}{2})$	7	$C(0,1)$	5	1 2 1	4
$x+3y=3$																														
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$C(0,1)$	5																													
16	a b	<p style="text-align: center;">$x = \frac{5}{12}$</p> $\cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{5}{12}\right)$ $= \tan^{-1}\left(\frac{\frac{3}{4} + \frac{5}{12}}{1 - \frac{3}{4} \cdot \frac{5}{12}}\right)$ $= \tan^{-1}\left(\frac{5b}{33}\right)$ <p><u>Remarks</u> FOR ATTEMPTING AND ANALYSING GIVE FULL SCORE</p>	1 3	4																										
17	a b	<p>$\frac{ab}{4} = \frac{ab}{4}$, * commutative, $a \times b = b \times a$</p> <p>$\frac{abc}{16} = \frac{abc}{16}$, * associative $(a \times b) \times c = a \times (b \times c)$</p> <p>$a \times e = a \Rightarrow \frac{ae}{4} = a$ $\Rightarrow e = 4$</p>	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$																											

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
	c	$5 \times b = 4 \Rightarrow \frac{5b}{4} = 4$ $\Rightarrow b = \frac{16}{5}$ <p>Remark $b = \frac{16}{5}$ give full score</p>	$\frac{1}{2}$ $\frac{1}{2}$	4
18	a	$A = I A$ $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 0 & 4 & 9 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$ $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -4 & 1 \end{bmatrix} A \quad R_3 \rightarrow R_3 - 4R_2$ $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 8 & -2 \\ 0 & 9 & -2 \\ 0 & -4 & 1 \end{bmatrix} A \quad \begin{array}{l} R_1 \rightarrow R_1 - 2R_3 \\ R_2 \rightarrow R_2 - 2R_3 \end{array}$ $A^{-1} = \begin{bmatrix} 1 & 8 & -2 \\ 0 & 9 & -2 \\ 0 & -4 & 1 \end{bmatrix}$ <p>Remark Alternate method, correct A^{-1} give 2 score</p>	1 $\frac{1}{2}$ 1 $\frac{1}{2}$	6
	b	$AX = B$ $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$ $X = A^{-1}B = \begin{bmatrix} 1 & 8 & -2 \\ 0 & 9 & -2 \\ 0 & -4 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$ $= \begin{bmatrix} 4 \\ 3 \\ -1 \end{bmatrix}$ $x = 4, y = 3, z = -1$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2} + 1$ $\frac{1}{2}$	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
19	<p>a</p> <p>b</p>	$\Delta = \begin{vmatrix} 1 & a & bc \\ 0 & b-a & c(a-b) \\ 0 & c-a & b(a-c) \end{vmatrix} \begin{matrix} R_2 \rightarrow R_2 - R_1 \\ R_3 \rightarrow R_3 - R_1 \end{matrix}$ $= (b-a)(c-a) \begin{vmatrix} 1 & a & bc \\ 0 & 1 & -c \\ 0 & 1 & -b \end{vmatrix}$ $= (b-a)(c-a)(c-b)$ $= (a-b)(b-c)(c-a)$ <p>b</p> $ A = -14$ $\text{adj}A = \begin{bmatrix} -1 & -3 \\ -4 & 2 \end{bmatrix}$ $A(\text{Adj}A) = \begin{bmatrix} -14 & 0 \\ 0 & -14 \end{bmatrix} = A I$	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>6</p>
20	<p>a</p> <p>b</p> <p>c</p>	$2 \int_0^a f(x) dx$ $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos x dx = 2 \int_0^{\frac{\pi}{2}} \cos x dx$ $= 2 \left[\sin x \right]_0^{\frac{\pi}{2}}$ $= 2 (\sin \frac{\pi}{2} - \sin 0) = 2$ <p><u>Remark</u> Alternate method give full score</p> $h = \frac{1}{n}, b-a = 1$ $\int_a^b f(x) dx = \lim_{n \rightarrow \infty} \frac{b-a}{n} \left[f(a) + f(a+h) + \dots + f(a+(n-1)h) \right]$ $\int_0^1 (x^2+1) dx = \lim_{n \rightarrow \infty} \frac{1}{n} \left[1 + \left(\frac{1}{n}\right)^2 + 1 + \left(\frac{2}{n}\right)^2 + 1 + \dots + \left(\frac{n-1}{n}\right)^2 + 1 \right]$ $= \lim_{n \rightarrow \infty} \frac{1}{n} \left[(1+1+\dots+1) + \frac{1}{n^2} (1^2+2^2+\dots+(n-1)^2) \right]$	<p>1</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1</p> <p>1</p> <p>1/2</p>	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
		$= \lim_{n \rightarrow \infty} \frac{1}{n} \left(n + \frac{(n-1)n(2n-1)}{6n^2} \right)$ $= \lim_{n \rightarrow \infty} \left(1 + \frac{(1-\frac{1}{n})(2-\frac{1}{n})}{6} \right)$ $= 1 + \frac{2}{6} = \frac{4}{3}$ <p>Remark: for direct integration give 1 score</p>	<p>$\frac{1}{2}$</p>	<p>6</p>
21	a	<p>f is continuous</p> <p>$f'(x) = 2x - 4$, f is differentiable</p> <p>$f(4) = -3$, $f(1) = -6$</p> <p>$f'(x) = \frac{f(b) - f(a)}{b - a} \Rightarrow 2x - 4 = \frac{-3 + 6}{4 - 1} = 1$</p> <p>$\Rightarrow x = \frac{5}{2}$</p> <p>$c = \frac{5}{2} \in [1, 4]$</p> <p>Mean Value theorem is verified</p> <p>Remarks Write the statement only give 1 score</p> <p>b(i) Put $x = \sin \theta$</p> <p>$f(x) = \sin^{-1} (2 \sin \theta \sqrt{1 - \sin^2 \theta})$</p> <p>$= \sin^{-1} (\sin 2\theta)$</p> <p>$= 2\theta$</p> <p>$= 2 \sin^{-1} x$</p> <p>(ii) $f'(x) = \frac{2}{\sqrt{1-x^2}}$</p> <p>Remarks Use $x = \cos \theta$, proceed (b) give 2 Score</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>	<p>6</p>
22	a	<p>Points $(2, -1, 3)$ and $(3, 1, 4)$</p> <p>$\vec{a}_2 - \vec{a}_1 = \hat{i} + 2\hat{j} + \hat{k}$</p> <p>$(\vec{a}_2 - \vec{a}_1) \cdot (\vec{b}_1 \times \vec{b}_2) = \begin{vmatrix} 1 & 2 & 1 \\ 1 & 2 & 1 \\ 2 & 1 & 2 \end{vmatrix} = 0$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2} + \frac{1}{2}$</p>	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total										
	<p>b</p> <p>c</p>	<p>So the lines are coplanar</p> $\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 1 \\ 2 & 1 & 2 \end{vmatrix} = 3\hat{i} - 0\hat{j} - 3\hat{k}$ <p>dir's of normal (3, 0, -3)</p> <p>equation of the plane</p> $3(x-2) - 3(z-3) = 0$ $x - z + 1 = 0$ <p>Remarks Alternate method give full score</p> <p>(3, 1, 4) is on the second line, any point on the first line is $(\lambda+2, 2\lambda-1, \lambda+3)$</p> $(3, 1, 4) = (\lambda+2, 2\lambda-1, \lambda+3)$ $\Rightarrow \lambda+2=3, \lambda=1$ <p>Put $\lambda=1$ in $(\lambda+2, 2\lambda-1, \lambda+3) \Rightarrow (3, 1, 4)$</p>	<p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>	<p>6</p>										
23	<p>a</p> <p>b</p>	<p>$X = \{0, 1, 2, 3\}$ OR $P(X=x) = {}^n C_x p^x q^{n-x}$</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>X</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>P(X)</td> <td>1/8</td> <td>3/8</td> <td>3/8</td> <td>1/8</td> </tr> </table> <p>Remark for writing sample space only give 1 score</p> <p>E_1: balls added are black E_2: balls added are white A: ball drawn is white</p> $P(E_1) = \frac{1}{2}, P(E_2) = \frac{1}{2}, P(A/E_1) = \frac{2}{5}, P(A/E_2) = \frac{2}{3}$ $P(E_1/A) = \frac{P(E_1) \cdot P(A/E_1)}{P(E_1) \cdot P(A/E_1) + P(E_2) \cdot P(A/E_2)}$ $= \frac{3}{8}$	X	0	1	2	3	P(X)	1/8	3/8	3/8	1/8	<p>1</p> <p>2</p> <p>1</p> <p>1/2</p> <p>1/2</p>	<p>6</p>
X	0	1	2	3										
P(X)	1/8	3/8	3/8	1/8										

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total
24		 <p>Equation of the circle : $x^2 + y^2 = 2^2$</p> <p>Area of the first quadrant = $\int_0^2 \sqrt{2^2 - x^2} dx$</p> $= \left[\frac{x}{2} \sqrt{2^2 - x^2} + \frac{4}{2} \sin^{-1} \left(\frac{x}{2} \right) \right]_0^2$ $= \frac{4}{2} \sin^{-1} 1 = \pi$ <p>Area of the triangle = $\frac{1}{2} \times 2 \times 2 = 2$</p> <p>Area of the shaded region in the first quadrant = $\pi - 2$</p> <p>Required area = $4(\pi - 2) = 4\pi - 8$ sq units</p> <p><u>Remarks</u> for $\int \sqrt{a^2 - x^2} dx$ give 1 score</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>	<p>6</p>

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