MARKING SCHEME OF PRE BOARD 1-2026-27 – MATHEMATICS(041)

SECTION: A (Solution of MCQ s of 1 mark each)

QN .NO	ANS	HINTS/SOLUTION	MARKS
1	(b)	1 x 1	1
2	(d)	$\frac{1}{6}$	1
3	(a)	$\frac{\pi}{6}$	1
4	(c)	Skew symmetric matrix	1
5	(a)	1-1	1
6	(d)	$\left(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$	1
7	(b)	$\frac{7}{2}$	1
8	(c)	Tan x- Cot x +c	1
9	(a)	$\frac{9}{4}$ sq. units	1
10	(d)	1 sq.units	1
11	(a)	3	1
12	(a)	$y^{\frac{2}{3}} - x^{\frac{2}{3}} = C$	1
13	(d)	$2\hat{\imath}$ -2 $\hat{\jmath}$ +2 $\hat{k}$	1
14	(c)	-8	1
15	(a)	$\frac{\vec{a} + 2\vec{b}}{3}$	1
16	(c)	-1	1
17	(a)	a=2b	1
18	(b)	100	1
19	(d)	(A) is false but (R) is true	1
20	(c)	(A) is true but (R) is false	1

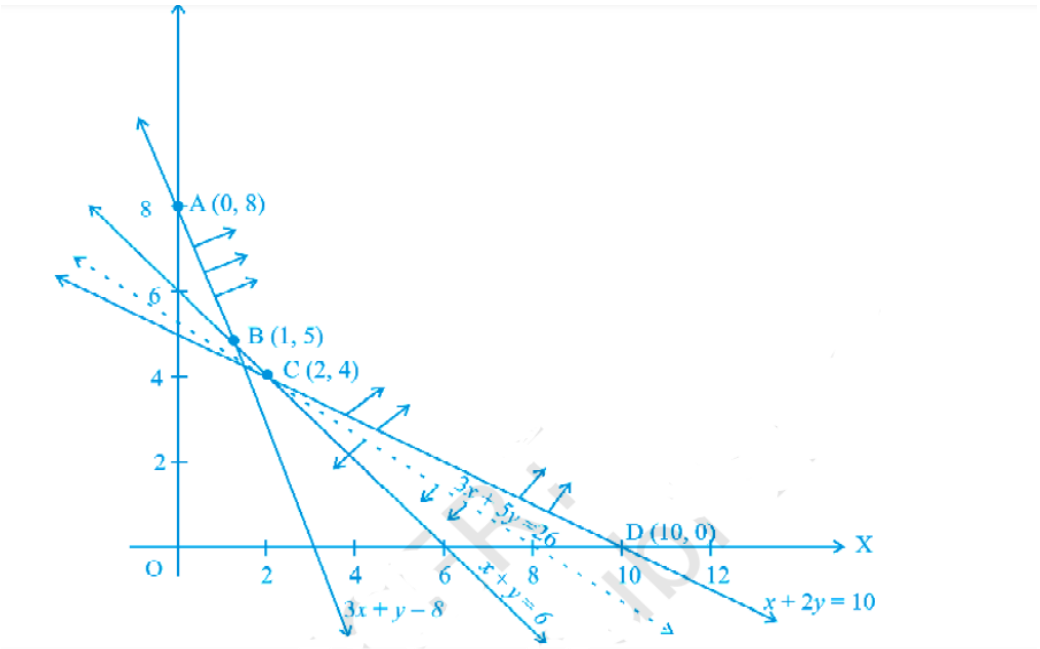
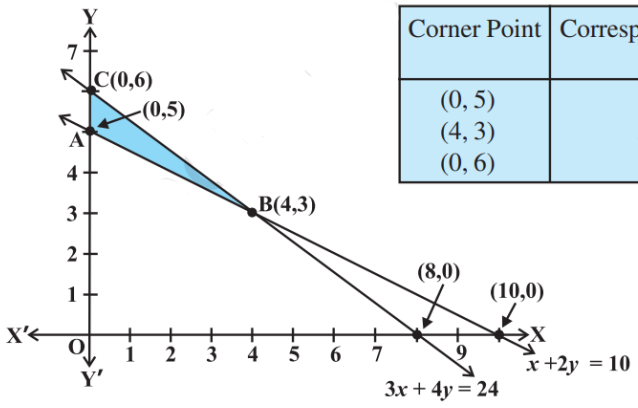
SECTION: B

[This section comprises of solution of very short answer type questions(VSA) of 2 mark each]

21	Differentiating & getting the answer $\frac{dy}{dx} = \frac{2\tan^{-1}x}{1+x^2}$ Differentiating again and getting the answer as $(x^2+1)^2 y_2 + 2x(x^2+1)y_1 = 2$. =	1 1

22	I = $\int e^x(tan^{-1}x + \frac{1}{1+x^2})\,dx$ Consider $f(x) = tan^{-1}x$, then $f'(x) = \frac{1}{1+x^2}$ Thus, the given integrand is of the form e^x [f (x) + f ′(x)]. Therefore, $\int e^x(tan^{-1}x + \frac{1}{1+x^2})\,dx = e^x tan^{-1}x$ + C OR Substitution u=$\tan^{-1}x^4$,du=$\frac{4x^3}{1+x^8}\,dx$= $\frac{1}{4}\int \sin u du$ Answer : - $\frac{1}{4}Cos(\tan^{-1}x^4)$+c	1 1 1 1
23	$(\vec{a}+\vec{b})\,.\,(\vec{a}-\vec{b})=\|\vec{a}\|^2 - \|\vec{b}\|^2$ $=(3^2+-2^2+5^2)-(5^2+-3^2+-2^2)=0$ $(\vec{a}+\vec{b})$ & $(\vec{a}-\vec{b})$ are perpendicular to each other	1 $1\frac{1}{2}$ $\frac{1}{2}$
24	$\vec{a}$ &$\vec{b}$ are perpendicular to each other.,hence $\vec{a}\,.\vec{b}$=0 $\|\vec{a}+\vec{b}\|^2 = \|\vec{a}\|^2 + \|\vec{b}\|^2 + 2\vec{a}\,.\vec{b}$ =0 Substituting the values $\|\vec{b}\|^2$ =144, $\|\vec{b}\| = 12$.	$\frac{1}{2}$ 1 $\frac{1}{2}$
25	Cartesian equation of the line:$\frac{x-1}{3} = \frac{y-1}{2} = \frac{z-3}{-2}$ Vector equation of the line : $\hat{\imath}$ +2$\hat{\jmath}$ +3$\hat{k}$ + $\mu(3\hat{\imath} + 2\hat{\jmath} - 2\hat{k})$ OR D R of a line parallel to the line AB are -3,-2,6 D C of a line parallel to the line AB are $\frac{-3}{7}, \frac{-2}{7}, \frac{6}{7}$	1 1 1 1
	SECTION -C (This section comprises solutions of short answer type questions (SA) of 3 marks each.)	
26	Divide Nr&Dr by cosx and getting the answer $\tan^{-1}\left(\frac{\cos x-\sin x}{\cos x+\sin x}\right)$ = $\tan^{-1}\left(\frac{1-\tan x}{1+\tan x}\right)$ =$\tan^{-1}\left(\tan\left(\frac{\pi}{4}-x\right)\right)$ = $\frac{\pi}{4}-x$	1 $1\frac{1}{2}$ $\frac{1}{2}$

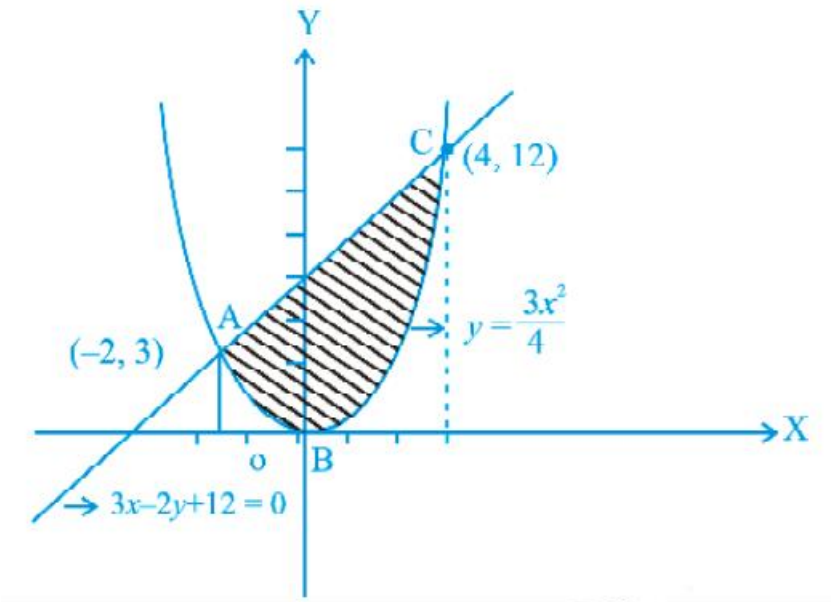
27	$\frac{dx}{dt} = 2acos2t$ $\frac{dy}{dt}$ =2a$\left(-sin2t + \frac{sec^2t}{2\,tant}\right)$ =2a $\frac{cos^2 2t}{sin2t}$ $\frac{dy}{dx}$= cot 2t. OR y= $\sin^{-1}\left(\frac{2.2^x}{1+(2^x)^2}\right)$ =$\sin^{-1}\left(\frac{2\,tan\theta}{1+tan^2\,\theta}\right)$ $\tan\theta = 2^x$ =$\sin^{-1}(sin2\theta)$ =2θ=2$\tan^{-1}2^x$ $\frac{dy}{dx} = log2.\left(\frac{2^{x+1}}{1+4^x}\right)$	1 1 1 1 1 1
28	u+ v= a^b, $\frac{du}{dx}+\frac{dv}{dx}$ =0 u=x^y,logu =y.logx $\frac{du}{dx} = x^y\left(\frac{y}{x} + logx.\frac{dy}{dx}\right)$ *similarly we can prove* $\frac{dv}{dx} = y^x\left(\frac{x}{y}\frac{dy}{dx} + logy\right)$ $\frac{dy}{dx} = -\left(\frac{y^x.logy+yx^{y-1}}{x^y logx+xy^{x-1}}\right)$	*1* 1 1
29	p'(x)=24-36x, p'(x)=0 $\Rightarrow x = \frac{2}{3}$ second derivative at $\frac{2}{3} = -36 < 0$ Maximum profit= p ($\frac{2}{3}$)=49	3 3
30	$2e^{\frac{x}{y}} + \log\lvert y\rvert = 2$ (Textbook example qn) y = $x^2 - \frac{\pi^2}{4\,sins\,x}$ (sin $x \neq 0$) (Text book example qn)	3 3

31		$1\frac{1}{2}$
	For finding the value of Z at the vertices and minimum value of Z as 26	1
	Draw the graph of 3x + 5y < 26 by dotted line. We see that the open half plane determined by 3x + 5y < 26 and R do not have a point in common. Thus, 26 is the minimum value of Z.	$\frac{1}{2}$
	OR	
		1
	A, B and C are (0,5), (4,3) and (0,6) respectively. Now we evaluate Z = 200x + 500y at these points. Hence, minimum value of Z is 2300 attained at the point (4, 3)	$1\frac{1}{2}$
		$\frac{1}{2}$

Corner Point	Corresponding value of Z	
(0, 5)	2500	
(4, 3)	**2300** ←	Minimum
(0, 6)	3000	

	SECTION -D (This section comprises of solutions of long answer type qns (LA) of 5 marks each)	
32	$\|A\| = \begin{vmatrix} 2 & 3 & 10 \\ 4 & -6 & 5 \\ 6 & 9 & -20 \end{vmatrix}$=1200, $A \neq 0$ henceA^{-1} exists	1
	Adj A=$\begin{bmatrix} 75 & 150 & 75 \\ 110 & -100 & 30 \\ 72 & 0 & -24 \end{bmatrix}$	1
	$A^{-1} = \frac{1}{1200}\begin{bmatrix} 75 & 150 & 75 \\ 110 & -100 & 30 \\ 72 & 0 & -24 \end{bmatrix}$	
	System of equations can be written as AX=B	
	Where A=$\begin{bmatrix} 75 & 150 & 75 \\ 110 & -100 & 30 \\ 72 & 0 & -24 \end{bmatrix}$,X=$\begin{bmatrix} \frac{1}{X} \\ \frac{1}{Y} \\ \frac{1}{Z} \end{bmatrix}$,B=$\begin{bmatrix} 2 \\ 5 \\ -4 \end{bmatrix}$,	1+1
	Solution is X= A^{-1}B	
	Getting the answer as x=2,y= -3,z=5	1
	OR	
	x+ y + z =6,y+3z=11, x-2y+z=0	1
	writing in matrix form AX =B where A= $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}$,X= $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$,B=$\begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$,	1
	$A^{-1} = \frac{1}{9}\begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}$, X= A^{-1} B	1
	$=\frac{1}{9}\begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}.\begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$	1
		1
	Soln is x= 1, y= 2 , z= 3	

33	$\int \frac{X^2}{(x^2+1)(x^2+4)}\, dx$ consider $\frac{X^2}{(x^2+1)(x^2+4)}$ and put x^2 = y. Then $\frac{X^2}{(x^2+1)(x^2+4)} = \frac{y}{(y+1)(y+4)}$ Write $\frac{y}{(y+1)(y+4)} = \frac{A}{(y+1)} + \frac{B}{(y+4)}$ So that y = A (y + 4) + B (y + 1) Comparing coefficients of y and constant terms on both sides, we get A + B = 1 and 4A + B = 0, which give A = $\frac{-1}{3}$ and B = $\frac{4}{3}$ Thus, $\frac{X^2}{(x^2+1)(x^2+4)} = \frac{-1}{3(X^2+1)} + \frac{4}{3(X^2+4)}$ Therefore, $\int \frac{X^2}{(x^2+1)(x^2+4)} = \frac{-1}{3}\int \frac{dx}{(x^2+1)} + \frac{4}{3}\int \frac{dx}{(x^2+4)}$ $= \frac{-1}{3}\tan^{-1} x + \frac{4}{3}\tan^{-1}\frac{x}{2} + C$ OR I=$\int_0^{\frac{\pi}{4}} log(1+tanx) = \int_0^{\frac{\pi}{4}} log(1+\tan(\frac{\pi}{4}-x))$ $= \int_0^{\frac{\pi}{4}} log\left(1+\frac{1-\tan x}{1+\tan x}\right) dx$ I=$\int_0^{\frac{\pi}{4}} log2dx - \int_0^{\frac{\pi}{4}} \log(1+tanx)\ dx$ 2I=$\frac{\pi}{4} log2$,I=$\frac{\pi}{8} log2$	1 1 1 1 1 1 1 1+1
34	$\overrightarrow{b_1} \times \overrightarrow{b_2}$= 3î-ĵ-7k̂,$\left\lvert\overrightarrow{b_1} \times \overrightarrow{b_2}\right\rvert$=$\sqrt{59}$, $\overrightarrow{a_2}$ -$\overrightarrow{a_1}$ = î-k̂ $substituting\ \ and\ getting\ the answer\ \frac{10}{\sqrt{59}}$ OR Equation of the line through B and C is $\frac{x}{2} = \frac{y+1}{-2} = \frac{z-3}{-4}$=$\lambda$ Any point on BC $(2\lambda, -2\lambda-1, -4\lambda+3)$, $D.R\ of\ AB = (2,-2,-4)$ Getting the value of λ=$\frac{-5}{6}$ $Getting\ foot\ of\ perpendicular\ as\ \left(\frac{-5}{3}, \frac{2}{3}, \frac{19}{3}\right)$	1+1+1 2 $\frac{1}{2}$ 1 1 1 $+1\frac{1}{2}$

35		1
	For getting point of intersection as (-2,3) and (4,2) (1 mark)	1
	Required area= $\int_{-2}^{4}\left(\frac{3x+12}{2}-\frac{3x^2}{4}\right)dx$ = 27 sq units (2+1 marks)	2+1
	SECTION - E (This section comprises solution of 3 case- study/passage-based questions of 4 marks each with two sub parts. The solution of first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively. Solution of 3rd case study question has two subparts of 2 marks each.)	
36	(i) 2^6	1
	(ii) 2^3	1
	(iii) Equivalence relation(R is reflexive,symmetric and transitive)	1+1
37	1. 7000 2. 14000 OR 3.Rs.21000	1 1

	4 21250 OR 5. 330	2
38	(i)C(x)= $x^3 - 45x^2 + 600x$ C'(x)=$3x^2 - 90x + 600$=0 ⇒x=10,20 (ii) C"(x)= 6x-90, C"(10)= -30<0 , C"(20)=30>0 C(x) is minimum at x=20 Therefore, the person must place the order for 20 trees in order to spend the least amount.	1 1 1+1