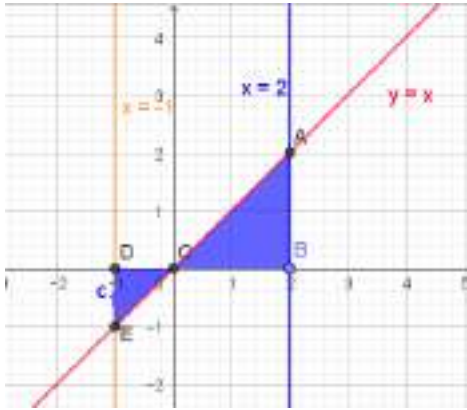


KENDRIYA VIDYALAYA SANGATHAN , BENGALURU REGION
FIRST PRE BOARD EXAMINATION (2025-26)
MATHEMATICS CLASS XII
MARKING SCHEME

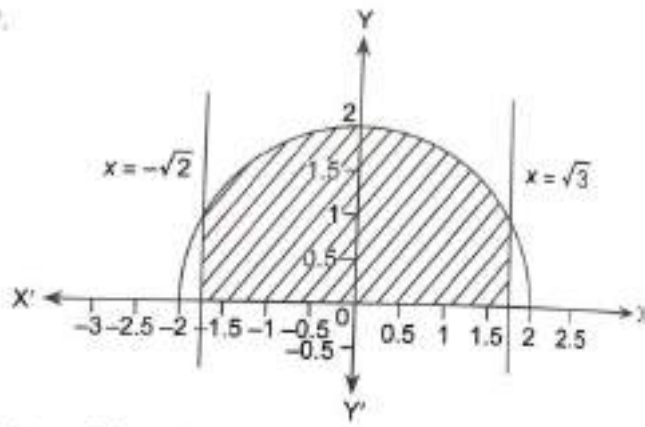
1.	(b)	1m
2	(b)	1m
3	(c)	1m
4	(c)	1m
5	(c)	1m
6	(c)	1m
7	(a)	1m
8	(b)	1m
9	(d)	1m
10	(c)	1m
11	(c)	1m
12	(c)	1m
13	(d)	1m
14	(a)	1m
15	(d)	1m
16	(d)	1m
17	(c)	1m
<u>18</u>	(b)	1m
19	(a)	1m
20	(b)	1m

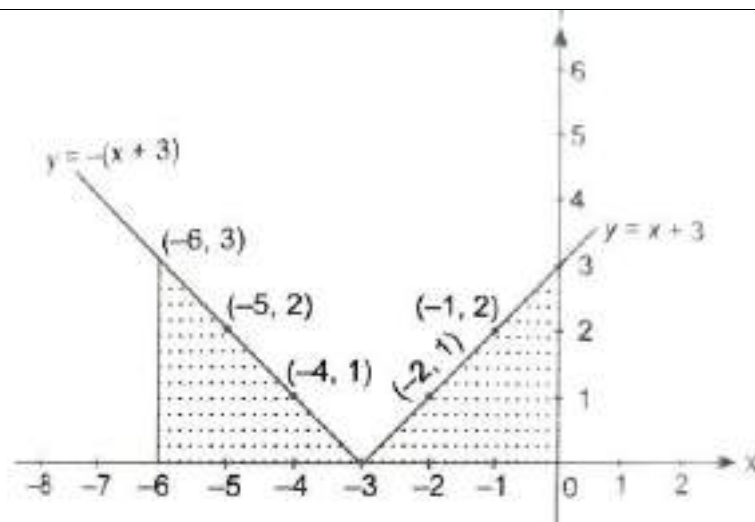
21	a) $\tan^{-1} \left[2 \sin(2 \cos^{-1} \left(\frac{\sqrt{3}}{2} \right)) \right] = \tan^{-1} \left[2 \sin(2 \times \frac{\pi}{6}) \right]$	1/2m
	$= \tan^{-1} \left[2 \times \frac{\sqrt{3}}{2} \right] =$	1/2m
	$= \tan^{-1} \sqrt{3} = \frac{\pi}{3}$	1m
	OR (b) :: $\sin^{-1} \left(\frac{-1}{2} \right) = -\sin^{-1} \left(\frac{1}{2} \right) = -\frac{\pi}{6}$	1/2m

	$\cos^{-1}\left(\frac{-1}{2}\right) = \pi - \cos^{-1}\left(\frac{1}{2}\right) = \pi - \frac{\pi}{3} = \frac{2\pi}{3}$ $\tan^{-1}(1) = \frac{\pi}{4}$ $\therefore \sin^{-1}\left(\frac{-1}{2}\right) + 2 \cos^{-1}\left(\frac{-1}{2}\right) + \tan^{-1}(1) = \frac{-\pi}{6} + \frac{2\pi}{3} + \frac{\pi}{4} = \frac{3\pi}{4}$	1/2m 1/2m 1/2m
22	$\cos y = x \cos(a + y)$ $x = \frac{\cos y}{\cos(a+y)}$ $\frac{dx}{dy} = \frac{-\cos(a+y) \sin y + \cos y \sin(a+y)}{\cos^2(a+y)}$ $\frac{dx}{dy} = \frac{\sin a}{\cos^2(a+y)}$ $\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$	 1m 1/2m 1/2m
23	(a) $\int \frac{2 + 2\sin x \cdot \cos x}{2 \cos^2 x} e^x \cdot dx = \int (\sec^2 x + \tan x) e^x \cdot dx$ $= e^x \cdot \tan x + C$ (b) $\therefore = \int_0^2 x \, dx + \left \int_{-1}^0 x \, dx \right$ $= \frac{5}{2}$ 	1m 1m 1m 1/2m figure 1/2m

24	$f(x) = \frac{\sin^2 \lambda x}{x^2}$ is continuous at $x = 0$ Then $f(0) = \lim_{x \rightarrow 0} \frac{\sin^2 \lambda x}{x^2}$ $= \lim_{x \rightarrow 0} \frac{\sin^2 \lambda x}{x^2} = \lim_{x \rightarrow 0} \left[\frac{\sin(\lambda x)}{(\lambda x)^2} \right]^2 \times \lambda^2$ $= 1 \times \lambda^2 = \lambda^2 \quad \left\{ \because \lim_{x \rightarrow 0} \frac{\sin x}{x} = 1 \right\}$ Since function is continuous at $x = 0$. $\lambda^2 = 1$ $\lambda = \pm 1$	1/2m 1m 1/2m
25	Angle between $\vec{a}$ and $\vec{b}$ is $\sin \Theta = \frac{ \vec{a} \times \vec{b} }{ \vec{a} \vec{b} }$ $\sin \Theta = \frac{1}{3 \cdot \frac{2}{3}} \quad \{ \because \vec{a} \times \vec{b} = 1 \}$ $\sin \Theta = \frac{1}{2}$ $\Theta = \frac{\pi}{6}$	1/2m 1/2m 1m

26	(a) $y = \sin^{-1} x$ $\frac{dy}{dx} = \frac{1}{\sqrt{1-x^2}}$ $\sqrt{1-x^2} \frac{dy}{dx} = 1$ $\sqrt{1-x^2} \frac{d^2y}{dx^2} + \frac{dy}{dx} \cdot \frac{-2x}{\sqrt{1-x^2}} = 0$ $(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} = 0$ (b) $y = \sin^{-1} \left(\frac{2^{x+1}}{1+4^x} \right)$ $= \sin^{-1} \left(\frac{2^x \cdot 2}{1+(2^x)^2} \right)$ Put $2^x = \tan \theta$ $Y = \sin^{-1} \left(\frac{2 \tan \theta}{1+\tan^2 \theta} \right)$ $Y = \sin^{-1} \sin 2\theta$ $Y = 2\theta$ $Y = 2 \tan^{-1} 2^x$ $\frac{dy}{dx} = 2 \frac{1}{1+(2^x)^2} \cdot \frac{d}{dx}(2^x)$ $\frac{dy}{dx} = \frac{2}{1+(4^x)} \cdot 2^x \log 2$ $= \frac{2^{x+1}}{1+(4^x)} \log 2$	1m 1m 1m 1m 1m 1m 1/2m 1/2m
27	$f(x) = 2x^3 - 9x^2 + 12x + 15$ $\Rightarrow f'(x) = 6x^2 - 18x + 12 = 6(x^2 - 3x + 2)$ (i) For $f(x)$ to be increasing, we must have $f'(x) > 0$ $\Rightarrow 6(x^2 - 3x + 2) > 0$ $\Rightarrow x^2 - 3x + 2 > 0 \quad [\because 6 > 0 \therefore 6(x^2 - 3x + 2) > 0 \Rightarrow x^2 - 3x + 2 > 0]$ $\Rightarrow (x-1)(x-2) > 0 \quad (\text{See fig})$ $\Rightarrow x < 1 \text{ or } x > 2$	1/2m 1/2m 1m

	$\Rightarrow x \in (-\infty, 1) \cup (2, \infty).$ So, $f(x)$ is increasing on $(-\infty, 1) \cup (2, \infty).$	1m
28(a)	 Area of the region bounded by the curve $ \begin{aligned} &= \int_{-\sqrt{2}}^{\sqrt{3}} \sqrt{4-x^2} dx \\ &= \left[\frac{x}{2} \sqrt{4-x^2} + 2 \sin^{-1} \frac{x}{2} \right]_{-\sqrt{2}}^{\sqrt{3}} \\ &= \frac{\sqrt{3}}{2} + 2 \cdot \frac{\pi}{3} + 1 + 2 \cdot \frac{\pi}{4} \\ &= \frac{\sqrt{3}}{2} + 1 + \frac{7\pi}{6} \end{aligned} $	Same distribution for (b) Fig. 1m 1/2m 1/2m 1m



Area of the region enclosed by the curve $y = |x + 3|$, the x -axis between $x = -6$ and $x = 0$ is

$$\begin{aligned}\text{Area} &= \int_{-6}^0 |x + 3| dx \\ &= \int_{-6}^{-3} -(x + 3) dx + \int_{-3}^0 (x + 3) dx\end{aligned}$$

Application of Integrals

$$\begin{aligned}&= \left[-\frac{x^2}{2} - 3x \right]_{-6}^{-3} + \left[\frac{x^2}{2} + 3x \right]_{-3}^0 \\ &= \left(-\frac{9}{2} + 9 \right) - \left(-\frac{36}{2} + 18 \right) + \left(\frac{0}{2} + 0 \right) - \left(\frac{9}{2} - 9 \right) \\ &= \frac{9}{2} - 0 + 0 + \frac{9}{2} = 9 \text{ sq units}\end{aligned}$$

(b)

29

(a) The general point Q on the given line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ is
 $x = 3\lambda - 2, y = 2\lambda - 1, z = 2\lambda + 3$

Given PQ = $3\sqrt{2}$. $\therefore$

$$\sqrt{(3\lambda - 2 - 1)^2 + (2\lambda - 1 - 2)^2 + (2\lambda + 3 - 3)^2} = 3\sqrt{2}$$

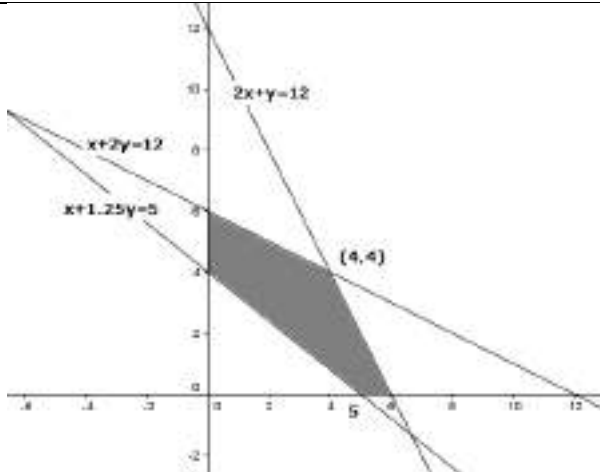
So $\lambda = \frac{30}{7}$,

And the required point P is $\left(\frac{56}{17}, \frac{43}{17}, \frac{111}{17}\right)$

1m

1m

1m

	(b) : DRs of the required lines can be obtained by calculating the determinant $\begin{vmatrix} i & j & k \\ 3 & -16 & 7 \\ 3 & 8 & -5 \end{vmatrix}$ which is equal to $24\hat{i} + 36\hat{j} + 72\hat{k}$													
	$\therefore$ DRs are 24, 36, 72	2m												
	i.e DRs 2, 3, 6													
	equation of line is $\hat{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$	1m												
30	 <table border="1" data-bbox="323 1099 782 1516"><thead><tr><th>Corner Points</th><th>Z=600x+400y</th></tr></thead><tbody><tr><td>(5,0)</td><td>3000</td></tr><tr><td>(6,0)</td><td>3600</td></tr><tr><td>(4,4)</td><td>4000=Maximum</td></tr><tr><td>(0,6)</td><td>2400</td></tr><tr><td>(0,4)</td><td>1600</td></tr></tbody></table> Optimal Sol: x=4, y=4	Corner Points	Z=600x+400y	(5,0)	3000	(6,0)	3600	(4,4)	4000=Maximum	(0,6)	2400	(0,4)	1600	$1\frac{1}{2}$ 1 1/2
Corner Points	Z=600x+400y													
(5,0)	3000													
(6,0)	3600													
(4,4)	4000=Maximum													
(0,6)	2400													
(0,4)	1600													
31	Ans: E: Selecting A F: Selecting B E and F are independent events. $P(E) = 0.7, P[(E \cap F') \cup (E' \cap F)] = 0.6$ $P(E).P(F') + P(E').P(F) = 0.6$ $P(E)(1 - P(F)) + (1 - P(E))P(F) = 0.6$ $P(E) + P(F) - 2.P(E).P(F) = 0.6; 0.7 + x - 2(0.7).x = 0.6$ $0.1 = 0.4xx = \frac{1}{4} = P(F).$	1/2m 1/2m 1m 1/2m 1/2m												

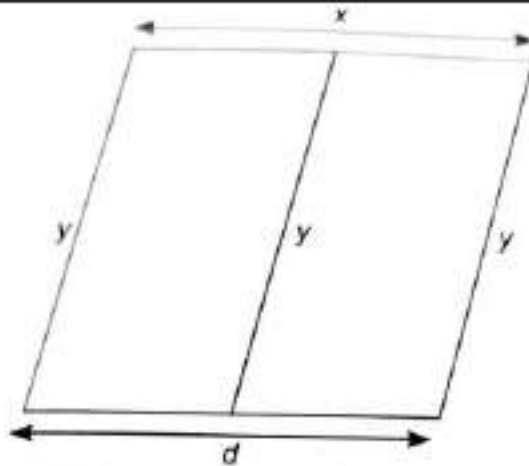
32	$AB = I$, Given system of equations $CX=D$ $C= A^T$ $X = C^{-1} D = (AT)^{-1}D = B^T D$, $x=0$, $y = 5$, $z = 3$	2m $1\frac{1}{2}m$ $1\frac{1}{2}m$
33	(a) Apply the properties of definite integral and proving $I = -\pi \cdot \log 2$. Appropriate (b) $\int \frac{3x+5}{x^3-x^2-x+1} dx = \int \frac{3x+5}{(x-1)^2(x+1)} dx$ $\frac{3x+5}{(x-1)^2(x+1)} = \frac{A}{(x-1)} + \frac{B}{(x-1)^2} + \frac{C}{(x+1)}$ $A = \frac{-1}{2}$, $B = 4$ and $C = \frac{1}{2}$ $I = \frac{1}{2} \log \frac{x+1}{x-1} - \frac{4}{x-1} + C$	1m 1m $1\frac{1}{2}$ $1\frac{1}{2}$
34	(a) : $\frac{dy}{dx} = \frac{y}{x} - \tan\left(\frac{y}{x}\right)$, homogenous equation Let $y = vx \Rightarrow \frac{dy}{dx} = v + x \frac{dv}{dx}$ $v + x \frac{dv}{dx} = v - \tan v$ $\Rightarrow \int \frac{1}{\tan v} dv = - \int \frac{1}{x} dx$ $\Rightarrow \int \cot v dv = - \int \frac{1}{x} dx$ $\Rightarrow \log \sin v = -\log x + \log C$ $\Rightarrow \log \sin v = \log \left \frac{C}{x} \right$ $\Rightarrow x \sin \frac{y}{x} = C$ is the required solution.	1/2m 1m 1m 2m 1/2m
(b)	The given equation $(x + y + 1) \frac{dy}{dx} = 1$ $\Rightarrow \frac{dx}{dy} = x + y + 1$	

	$\Rightarrow \frac{dx}{dy} - x = y + 1 \text{ (L.D.E)}$ $\therefore \text{I.F.} = e^{\int -dy} = e^{-y}$ Now solution is $x e^{-y} = \int (y + 1) e^{-y} dy$ $\Rightarrow x e^{-y} = \frac{(y+1)e^{-y}}{-1} - \int \frac{e^{-y}}{-1} dy$ $\Rightarrow x e^{-y} = -(y + 1)e^{-y} - e^{-y} + C$ $\Rightarrow x = C e^y - (y + 2)$	$\frac{1}{2}m$ 1m 1/2m 2m
35	(a) General pt. on line (1): $(2\lambda + 1, 3\lambda + 2, 4\lambda + 3)$ General pt. on line (2): $(5k + 4, 2k + 1, k)$ Equating coordinates: $2\lambda + 1 = 5k + 4 \rightarrow (3)$ $3\lambda + 2 = 2k + 1 \rightarrow (4)$ Solving (3) & (4): $\lambda = -1, k = -1$ Substituting in z-coordinate: $4\lambda + 3 = 4(-1) + 3 = -1 \quad \& \quad k = -1$ For $\lambda = -1, k = -1$, z-coordinates are also equal. $\therefore$ Lines intersect Point of intersection: $(-1, -1, -1)$	1/2m 1/2m 1m+1m 1m 1m
b	P (1, 6, 3) A (0, 1, 2) M B (1, 3, 5) Q(x₃, y₃, z₃)	

	Let M be the foot of the perpendicular. Let $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3} = \lambda$ (say) General point on the line AB is $x = \lambda$, $y = 2\lambda + 1$, $z = 3\lambda + 2$ DRs of PM = $\lambda - 1, 2\lambda - 5, 3\lambda - 1$ PM is perpendicular to AB. So $a_1 a_2 + b_1 b_2 + c_1 c_2 = 0$ $\Rightarrow 1(\lambda - 1) + 2(2\lambda - 5) + 3(3\lambda - 1) = 0$ $\Rightarrow \lambda - 1 + 4\lambda - 10 + 9\lambda - 3 = 0$ So $14\lambda = 14$, and $\lambda = 1$ $\therefore$ Point M is (1, 3, 5) Let the image be Q (x_3, y_3, z_3) Now , using M as mid point of PQ $\frac{x_1 + x_3}{2} = x_2 \Rightarrow \frac{1 + x_3}{2} = 1 \text{ and } x_3 = 1$ $\frac{y_1 + y_3}{2} = y_2 \Rightarrow \frac{6 + y_3}{2} = 3 \text{ and } y_3 = 0$ $\frac{z_1 + z_3}{2} = z_2 \Rightarrow \frac{3 + z_3}{2} = 5 \text{ and } z_3 = 7$ $\therefore$ Image Q is (1, 0, 7)	1/2m 1m 1/2m 1m 1m 1m
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36	a) R is reflexive and transitive but not symmetric. b) No. Because $n(B)$ is greater than $n(A)$ c) R is neither reflexive nor symmetric nor transitive or no. of relations = 2^{12}	1m 1m 2m
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(i) Total boundary material used, $2x + 3y = 300$

$$\begin{aligned} \text{(ii)} \quad A &= xy = \frac{1}{3}x(300 - 2x) \\ &= \frac{1}{3}(300x - 2x^2) \end{aligned}$$

$$\text{(iii) (a)} \quad \frac{dA}{dx} = \frac{1}{3}(300 - 4x)$$

For critical point of area function,

$$\frac{dA}{dx} = 0 \Rightarrow 300 - 4x = 0 \Rightarrow x = 75$$

$$\frac{d^2A}{dx^2} = \frac{1}{3}(-4) < 0 \text{ for } x = 75$$

$$\begin{aligned} \therefore \text{Maximum area} &= \frac{75}{3}(300 - 150) \\ &= 25 \times 150 \\ &= 3750 \text{ m}^2 \end{aligned}$$

1m

1m

1/2m

1/2m

1m

	OR (iii) (b) from (a) critical point is $x = 75$ For $x < 75$, $\frac{dA}{dx} > 0$ For $x > 75$, $\frac{dA}{dx} < 0$ $\therefore x = 75$ is point of maximum. $\therefore$ Maximum area $= \frac{75}{3}(300 - 150)$ $= 25 \times 150$ $= 3750 \text{ m}^2$	
38	<i>A: Cab B: Metro C: Bike D: other</i> <i>E: Late arrival</i> $P(E) = P(A).P(E/A) + P(B).P(E/B) + P(C).P(E/C) + P(D).P(E/D)$ $= \frac{3}{10} \cdot \frac{1}{4} + \frac{1}{5} \cdot \frac{1}{3} + \frac{1}{10} \cdot \frac{1}{12} + \frac{2}{5} \cdot \frac{1}{10} = \frac{114}{600}$ $(b) P\left(\frac{B}{E}\right) = \frac{P(B).P\left(\frac{E}{B}\right)}{P(E)}$ $= \frac{\frac{1}{5}}{\frac{114}{600}}$ $= 40/114 = 20/57$	1/2m 1/2m 1/2m 1/2m 1m 1/2m 1/2m
