Marking Scheme - Class XII Mathematics Pre-Board 1 Exam (2024-25)

SECTION - A

(1) $R = \{(a,b): a = b-2,\ b > 6\}$. clearly option (b) $(6,8) \in R$

(2) $|adj A| = 144 \Rightarrow |A|^{n-1} = 144 \Rightarrow |A|^2 = 144 \Rightarrow |A| = \pm 12$

$\Rightarrow |A^T| = \pm 12$ $\therefore$ option (c) $(\because n = 3,\ |A| = |A^T|)$

(3) For A to be skew-symmetric, $x+2 = -(2x-3) \Rightarrow x + 2x = 3-2 \Rightarrow x = \frac{1}{3}$

$\therefore$ option (a) $\frac{1}{3}$

(4) $f(x) = \tan x - x \Rightarrow f'(x) = \sec^2 x - 1 = \tan^2 x \geq 0$ $\therefore f$ is always increasing.

$\therefore$ (a) always increases.

(5) $2A + B = 0 \Rightarrow 2\begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix} + B = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \Rightarrow B = \begin{bmatrix} -6 & -8 \\ -10 & -4 \end{bmatrix}$ $\therefore$ option (b)

(6) $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix} \Rightarrow A^2 = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} x^2+1 & x \\ x & 1 \end{bmatrix}$. Given $A^2 = I \Rightarrow x^2 + 1 = 1$

$\Rightarrow x = 0$

$\therefore$ option (a) 0

(7) order = 2, degree = 3 $\therefore$ sum = 2+3 = 5 $\therefore$ option (d) 5

(8) Let $f(x) = x^3 \cos^2 x \Rightarrow f(-x) = (-x)^3 \cdot \cos^2(-x) = -x^3 \cos^2 x = -f(x)$

$\therefore f$ is an odd function. $\therefore I = 0$ $\therefore$ option (a)

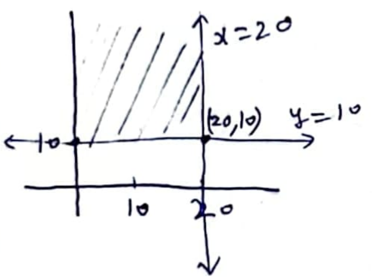
(9) clearly, option (c) 2

(10) $\frac{dx}{x} = -\frac{dy}{y} \Rightarrow \int \frac{dx}{x} = -\int \frac{dy}{y} \Rightarrow \log|x| = -\log|y| + \log C \Rightarrow \log|x| + \log|y| = \log C$

$\Rightarrow \log xy = \log C$

$\Rightarrow xy = C$ $\therefore$ opition (c)

(11)



$Z = 3x + 8y$

$Z_{(0,10)} = 80$; $Z_{(20,10)} = 3(20) + 8(10) = 60 + 80 = 140$

$\therefore$ min Z = 80 $\therefore$ option (a) 80

(12) $F = 4x + 6y$

Now, $F(0,2) = 12$, $F(3,0) = 12$, $F(6,0) = 24$, $F(6,8) = 24 + 48 = 72$

$F(0,5) = 30$

As, F is min. at (0,2) and (3,0)

$\therefore$ option (d) any point on line segment joining the points (0,2) and (3,0).

(13) $f(x) = x^3$, $x = 0$

$f'(x) = 3x^2$; $f'(0) = 0$ also, $f''(x) = 6x \Rightarrow f''(0) = 0$

$\Rightarrow x = 0$ is a point of inflexion $\therefore$ option (d) inflexion

(14) $P(A \cap B) = \frac{1}{8}$, $P(\bar{A}) = \frac{3}{4}$

$P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{P(A \cap B)}{1 - P(\bar{A})} = \frac{\frac{1}{8}}{1 - \frac{3}{4}} = \frac{\frac{1}{8}}{\frac{1}{4}} = \frac{1}{8} \times \frac{4}{1} = \frac{1}{2}$ $\therefore$ option (a) $\frac{1}{2}$

(15) $\cos^2\frac{\pi}{4} + \cos^2\frac{\pi}{4} + \cos^2\theta = 1 \Rightarrow \frac{1}{2} + \frac{1}{2} + \cos^2\theta = 1 \Rightarrow \cos\theta = 0 \Rightarrow \theta = \frac{\pi}{2}$

$\therefore$ option (c) $\frac{\pi}{2}$

(16) $\int a^x dx = \frac{a^x}{\log a} + C$ $\therefore \int 2^{x+2} dx = \frac{2^{x+2}}{\log 2} + C$ $\therefore$ option (c) $\frac{2^{x+2}}{\log 2} + C$

(17) $I = \int \frac{x+3}{(x+4)^2} e^x dx = \int \frac{x+4-1}{(x+4)^2} e^x dx = \int \left[\frac{1}{x+4} - \frac{1}{(x+4)^2}\right] . e^x dx$

$= \frac{1}{x+4} . e^x + C$ $\therefore$ option (a)

(18) required d.c. is d.c. of y-axis ie. $0, 1, 0$ $\therefore$ option (d) $0, 1, 0$

(19) $|A| = \begin{vmatrix} 1 & \cos\theta & 1 \\ -\cos\theta & 1 & \cos\theta \\ -1 & -\cos\theta & 1 \end{vmatrix} = 1(1 + \cos^2\theta) - \cos\theta(-\cos\theta + \cos\theta) + 1(\cos^2\theta + 1)$

$= 2(1 + \cos^2\theta)$

Now, $0 \leq \cos^2\theta \leq 1$ $\therefore$ $1 \leq 1 + \cos^2\theta \leq 2$ $\Rightarrow 2 \leq 2(1 + \cos^2\theta) \leq 4$

$\therefore |A| = [2, 4]$ $\Rightarrow$ A is true.

Also, R is true. $\therefore$ option (a) is correct.

(20) d.r. of first line is $< 2-4, 3-7, 4-8 >$ ie. $< -2, -4, -4 >$

d.r. of second line is $< 1+1, 2+2, 5-1 >$ ie. $< 2, 4, 4 >$

as d.r.'s are proportional, so lineas are parallel.

$\therefore$ Assertion is true.

clearly, Reason is not true.

$\therefore$ option (c) A is correct but R is not correct.

SECTION-B

(21) $\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}(\cos\pi) + \tan^{-1}1$

$= \sin^{-1}\left(\sin\left(\pi-\frac{\pi}{4}\right)\right) + \cos^{-1}(\cos\pi) + \tan^{-1}1$

$= \frac{\pi}{4} + \pi + \frac{\pi}{4} = \frac{3\pi}{2}$

OR

$\sin\left(\frac{\pi}{6} - \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right) = \sin\left(\frac{\pi}{6}+\frac{\pi}{3}\right) = \sin\frac{\pi}{2} = 1$

(22) diagonal $= \vec{a}+\vec{b} = 3\hat{i}+6\hat{j}-2\hat{k}$

$|\vec{a}+\vec{b}| = \sqrt{9+36+4} = 7$

Required unit vector $= \frac{1}{7}(3\hat{i}+6\hat{j}-2\hat{k})$

(23) Given, $\frac{dA}{dt} = 2\ cm^2/sec$. $A = \pi r^2 \Rightarrow \frac{dA}{dt} = 2\pi r.\frac{dr}{dt}$

$\Rightarrow 2 = 2\pi r\frac{dr}{dt} \Rightarrow \frac{dr}{dt} = \frac{1}{\pi r}$

Now, $C = 2\pi r \Rightarrow \frac{dC}{dt} = 2\pi.\frac{dr}{dt}$

$= 2\pi \times \frac{1}{\pi r} = \frac{2}{r}$

$\therefore \left.\frac{dC}{dt}\right]_{r=5cm} = \frac{2}{5}\ cm/sec$ Ans

OR

$f(x) = \sin x + \cos x$

$\Rightarrow f'(x) = \cos x - \sin x$; $f'(x)=0 \Rightarrow \cos x - \sin x = 0 \Rightarrow \tan x = 1$

S	A ✓
T ✓	C

$\therefore x = \frac{\pi}{4}, \pi+\frac{\pi}{4}$ i.e. $x = \frac{\pi}{4}, \frac{5\pi}{4}$

$0 \quad + \quad \pi/4 \quad - \quad 5\pi/4 \quad + \quad 2\pi$

as $f'(x) < 0$ for all $x \in \left[\frac{\pi}{4}, \frac{5\pi}{4}\right]$

$\therefore f$ is strictly decreasing in $\left[\frac{\pi}{4}, \frac{5\pi}{4}\right]$.

(24) $f(x) = 4x^3 - 18x^2 + 27x - 7$

$f'(x) = 12x^2 - 36x + 27$

$= 3(4x^2 - 12x + 9)$

$= 3[(2x-3)^2]$

$f'(x) = 0 \Rightarrow x = \frac{3}{2}$

as the sign of $f'(x)$ does not change as x passes through $\frac{3}{2}$,

$\therefore f$ has neither maxima nor minima.

(25) $y = (\sin^{-1}x)^2$

$\Rightarrow \dfrac{dy}{dx} = 2.\sin^{-1}x.\dfrac{1}{\sqrt{1-x^2}}$

$\Rightarrow \sqrt{1-x^2}.\dfrac{dy}{dx} = 2\sin^{-1}x$

again differentiating,

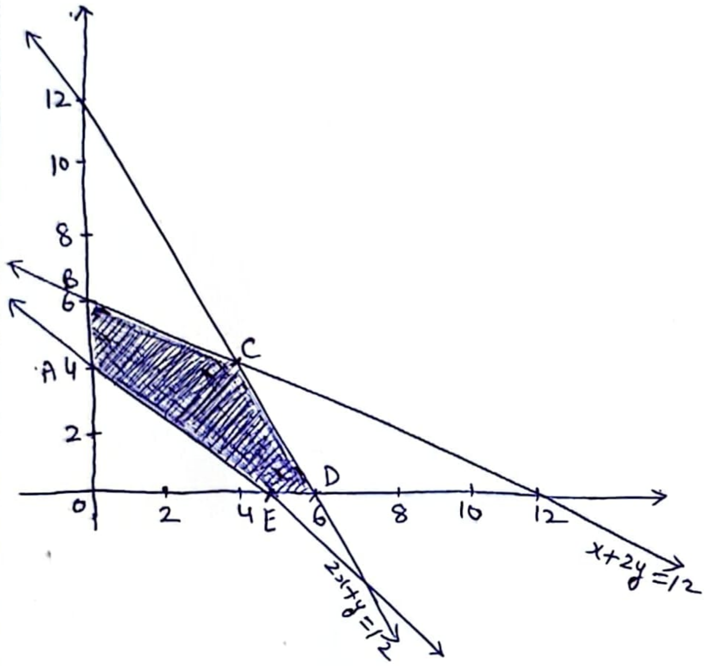
$\sqrt{1-x^2}.\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx}.\dfrac{1}{\cancel{2}\sqrt{1-x^2}}.(-\cancel{2}x) = \dfrac{2}{\sqrt{1-x^2}}$

$\Rightarrow (1-x^2).\dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} = 2$

$\therefore$ Required answer $= 2$

SECTION-C

(26)



Corner Point	Value of Z
A(0,4)	160
B(0,6)	240
C(4,4)	400 → Max
D(6,0)	360
E(5,0)	300

Max. $Z_{(4,4)} = 400$

(27) Let X = no. of red balls out of 2 balls drawn.

X	0	1	2
P(X)	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$

Mean $= \Sigma X.P(X) = 0\times\frac{1}{4} + 1\times\frac{1}{2} + 2\times\frac{1}{4} = 1$

OR

As $\Sigma P(X)=1 \Rightarrow 0.2+a+a+0.2+b=1 \Rightarrow 2a+b=0.6$ .....(i)

also, $E(X)=\Sigma X.P(X)=3$ ie. $1(0.2)+2a+3a+4(0.2)+5(b)=3$.

$\Rightarrow 5a+5b=2$ or $a+b=0.4$ ..... (ii)

Also, $P(X\geq 3)=P(X=3)+P(X=4)+P(X=5) = a+0.2+b = \underline{0.6}$

Now, $\underline{a=0.2}$, $\underline{b=0.2}$

(28) $I = \int \frac{2x}{(x^2+1)(x^2-4)} dx$

Let $x^2 = t \Rightarrow 2x\,dx = dt$

$I = \int \frac{dt}{(t+1)(t-4)} = \frac{-1}{5}\int\left(\frac{1}{t+1} - \frac{1}{t-4}\right) dt$

$= -\frac{1}{5}\left[\log|t+1| - \log|t-4|\right] + C$

$= -\frac{1}{5}\log\left|\frac{t+1}{t-4}\right| + C = \frac{-1}{5}\log\left|\frac{x^2+1}{x^2-4}\right| + C$ Ans.

OR

$I = \int \frac{2x+1}{\sqrt{3+2x-x^2}} dx$

$= -\int \frac{2-2x}{\sqrt{3+2x-x^2}} dx + 3\int \frac{1}{\sqrt{(2)^2-(x-1)^2}} dx$

$= -2\sqrt{3+2x-x^2} + 3\sin^{-1}\left(\frac{x-1}{2}\right) + C$ Ans

(29) $\frac{dy}{dx} + \frac{2x}{1+x^2}\cdot y = \frac{\sqrt{x^2+4}}{1+x^2}$; $P = \frac{2x}{1+x^2}$, $Q = \frac{\sqrt{x^2+4}}{1+x^2}$

$I.F. = e^{\int P dx}$

$= e^{\int \frac{2x}{1+x^2} dx} = e^{\log(1+x^2)} = 1+x^2$

Solution is given by,

$y.(1+x^2) = \int \frac{\sqrt{x^2+4}}{1+x^2}.(1+x^2)\,dx$

$= \int \sqrt{x^2+4}\,dx$

$\therefore y(1+x^2) = \frac{x}{2}.\sqrt{x^2+4} + 2\log|x+\sqrt{x^2+4}| + C$ Ans.

OR

$\frac{dy}{dx} = e^{\frac{y}{x}} + \frac{y}{x}$.

Put $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$

$\Rightarrow v + x\frac{dv}{dx} = e^v + v$

$\Rightarrow \int e^{-v} dv = \int \frac{dx}{x}$

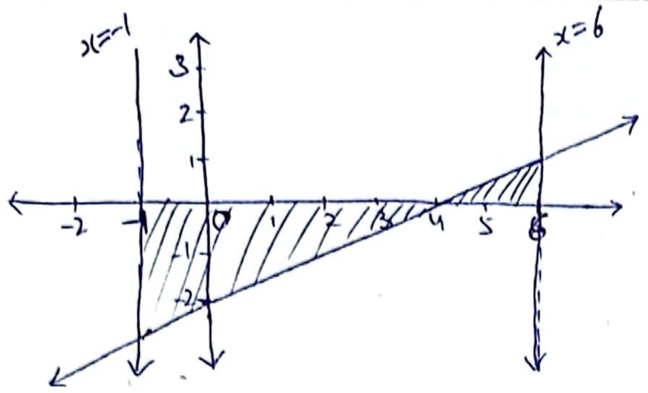
$\Rightarrow -e^{-v} = \log|x| + C$

$\Rightarrow -e^{-y/x} = \log|x| + C$

Now, $x = 1$, $y = 1 \Rightarrow C = -e^{-1}$

$\therefore$ solution is $e^{-y/x} = \frac{1}{e} - \log|x|$ Ans

(30)



$$\text{Area} = \left|\int_{-1}^{4} \frac{x-4}{2}\,dx\right| + \int_{4}^{6} \frac{x-4}{2}\,dx$$

$$= \frac{1}{2}\cdot\left[\frac{(x-4)^2}{2}\right]_{-1}^{4} + \frac{1}{2}\left[\frac{(x-4)^2}{2}\right]_{4}^{6}$$

$$= \left|\frac{1}{2}(0-25)\right| + \frac{1}{4}(4-0)$$

$$= \frac{25}{4} + 1 = \frac{29}{4} \text{ sq. units}$$

(31) $y = (\sin x)^x + \sin^{-1}\sqrt{x}$

$$= e^{\log(\sin x)^x} + \sin^{-1}\sqrt{x}$$

$$= e^{x.\log(\sin x)} + \sin^{-1}\sqrt{x}$$

$$\Rightarrow \frac{dy}{dx} = e^{x\log(\sin x)}\left[x\cdot\frac{1}{\sin x}\cdot\cos x + \log(\sin x).1\right] + \frac{1}{\sqrt{1-(\sqrt{x})^2}} \times \frac{1}{2\sqrt{x}}$$

$$= (\sin x)^x\left[x\cot x + \log(\sin x)\right] + \frac{1}{2\sqrt{x}\sqrt{1-x}} \quad \text{Ans}$$

SECTION - D

(32) $A = \begin{bmatrix} 2 & 3 & 4 \\ 3 & -2 & 2 \\ 4 & 2 & -3 \end{bmatrix}$; $|A| = 2(6-4) - 3(-9-8) + 4(6+8)$

$= 2(2) - 3(-17) + 4(14) = 4 + 51 + 56 = 111 \neq 0$

$\Rightarrow A^{-1}$ exists

Now, $A_{11} = 6-4 = 2$, $A_{12} = -(-9-8) = 17$, $A_{13} = 6+8 = 14$

$A_{21} = -(-9-8) = 17$, $A_{22} = -6-16 = -22$, $A_{23} = (4-12) = 8$

$A_{31} = 6+8 = 14$, $A_{32} = -(4-12) = 8$, $A_{33} = -4-9 = -13$

Cofactor matrix $= \begin{bmatrix} 2 & 17 & 14 \\ 17 & -22 & 8 \\ 14 & 8 & -13 \end{bmatrix}$

$\therefore \text{adj}\, A = \begin{bmatrix} 2 & 17 & 14 \\ 17 & -22 & 8 \\ 14 & 8 & -13 \end{bmatrix} \Rightarrow A^{-1} = \frac{1}{|A|}.\text{adj}\, A = \frac{1}{111}\begin{bmatrix} 2 & 17 & 14 \\ 17 & -22 & 8 \\ 14 & 8 & -13 \end{bmatrix}$

Given system can be written as $AX = B$, $B = \begin{bmatrix} 17 \\ 11 \\ 8 \end{bmatrix}$, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

$X = A^{-1}.B$

$$= \frac{1}{111}\begin{bmatrix} 2 & 17 & 14 \\ 17 & -22 & 8 \\ 14 & 8 & -13 \end{bmatrix}\begin{bmatrix} 17 \\ 11 \\ 8 \end{bmatrix} = \frac{1}{111}\begin{bmatrix} 34+187+112 \\ 289-242+64 \\ 238+88-104 \end{bmatrix} = \frac{1}{111}\begin{bmatrix} 333 \\ 111 \\ 222 \end{bmatrix}$$

$$= \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$$

$\therefore x = 3,\ y = 1,\ z = 2$

(33) $\vec{a_1} = \hat{i} + 2\hat{j} - 4\hat{k}$, $\vec{a_2} = 3\hat{i} - 3\hat{j} - 5\hat{k}$

$\vec{b_1} = 2\hat{i} + 3\hat{j} + 6\hat{k}$, $\vec{b_2} = -2\hat{i} + 3\hat{j} + 8\hat{k}$

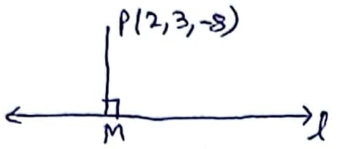
here, $\vec{a_2} - \vec{a_1} = 2\hat{i} - 5\hat{j} - \hat{k}$

$$\vec{b_1} \times \vec{b_2} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 6 \\ -2 & 3 & 8 \end{vmatrix} = 6\hat{i} - 28\hat{j} + 12\hat{k}$$

$|\vec{b_1} \times \vec{b_2}| = \sqrt{964}$

$$S.D. = \left| \frac{(\vec{a_2} - \vec{a_1}) \cdot (\vec{b_1} \times \vec{b_2})}{|\vec{b_1} \times \vec{b_2}|} \right| = \left| \frac{2(6) + (-5)(-28) + (-1)(12)}{\sqrt{964}} \right| = \frac{140}{\sqrt{964}} \text{ or } \frac{70}{\sqrt{241}} \text{ units}$$

OR



Coordinates of any point on l are $M(4-2\lambda, 6\lambda, 1-3\lambda)$.

d.r. of PM are $2-2\lambda$, $6\lambda - 3$, $9 - 3\lambda$

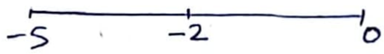
also, d.r. of l are $-2, 6, -3$

according to que, $-2(2-2\lambda) + 6(6\lambda - 3) - 3(9 - 3\lambda) = 0 \Rightarrow \lambda = 1$

$\therefore$ Co-ordinates of rep. foot of perpendicular, $M(2, 6, -2)$.

Also, $PM = \sqrt{0^2 + 3^2 + 6^2} = 3\sqrt{5}$ units

(34) $I = \int_{-5}^{0} (|x| + |x+2| + |x+5|)\, dx$



$$= \int_{-5}^{-2} [-x - (x+2) + (x+5)]\, dx + \int_{-2}^{0} [-x + (x+2) + (x+5)]\, dx$$

$$= \int_{-5}^{-2} (-x + 3)\, dx + \int_{-2}^{0} (x+7)\, dx$$

$$= -\frac{1}{2}\left[(x-3)^2\right]_{-5}^{-2} + \frac{1}{2}\left[(x+7)^2\right]_{-2}^{0}$$

$$= -\frac{1}{2}[25 - 64] + \frac{1}{2}[49 - 25] = \frac{39}{2} + 12 = \frac{63}{2}$$

OR

$$I = \int_{0}^{\pi/2} 2\sin x \cdot \tan^{-1}(\sin x) \cdot \cos x\, dx$$

Put $\sin x = t \Rightarrow \cos x\, dx = dt$

when $x = 0$, $t = 0$; when $x = \pi/2$, $t = 1$

$$\therefore I = 2\int_{0}^{1} t \cdot \tan^{-1} t\, dt$$

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

$$= \left[t^2 \tan^{-1} t - t + \tan^{-1} t\right]_0^1$$

$$= \frac{\pi}{2} - 1$$

(35) $f : R - \{-\frac{4}{3}\} \to R$

$f(x) = \frac{4x}{3x+4}$

for one-one

Let $x_1, x_2 \in R - \{-\frac{4}{3}\}$ (domain)

Let $f(x_1) = f(x_2)$

$\Rightarrow \frac{4x_1}{3x_1+4} = \frac{4x_2}{3x_2+4}$

$\Rightarrow 4x_1(3x_2+4) = 4x_2(3x_1+4)$

$\Rightarrow \cancel{12x_1x_2} + 16x_1 = \cancel{12x_1x_2} + 16x_2$

$\Rightarrow x_1 = x_2 \Rightarrow f$ is one-one.

for onto

Let $y = f(x) \Rightarrow y = \frac{4x}{3x+4} \Rightarrow 3xy + 4y = 4x \Rightarrow 3xy - 4x = 4y$

$\Rightarrow x(3y-4) = 4y \Rightarrow x = \frac{4y}{3y-4}$

clearly, $y \neq \frac{4}{3}$

$\therefore R_f = R - \{\frac{4}{3}\} \neq$ co-domain (R)

$\Rightarrow f$ is not onto.

SECTION-E

(36) Area of printed matter, $xy = 24$

$\therefore$ Area of visiting card $(A) = (x+3)(y+2)$

$= xy + 2x + 3y + 6 = 24 + 2x + 3\left(\frac{24}{x}\right) + 6$

$\Rightarrow A = 30 + 2x + \frac{72}{x}$

Now, $\frac{dA}{dx} = 2 - \frac{72}{x^2}$, $\frac{d^2A}{dx^2} = \frac{144}{x^3}$

for $\frac{dA}{dx} = 0 \Rightarrow x^2 = 36 \Rightarrow x = 6$ cm

Now, $\left.\frac{d^2A}{dx^2}\right]_{x=6cm} = \frac{144}{6^3} > 0$

$\therefore A$ is minimum at $x = 6$

$\therefore$ Length of card $= x + 3 = 9$ cm

and, breadth of card $= y + 2$

$= \frac{24}{x} + 2 = 6$ cm

(37) E_1: seed is of type A_1

E_2: seed is of type A_2

E_3: seed is of type A_3

A: seed germinates

$P(E_1) = \frac{4}{10}$, $P(E_2) = \frac{4}{10}$, $P(E_3) = \frac{2}{10}$

$P(A/E_1) = \frac{45}{100}$, $P(A/E_2) = \frac{60}{100}$, $P(A/E_3) = \frac{35}{100}$

(a) $P(A) = P(E_1).P(A/E_1) + P(E_2).P(A/E_2) + P(E_3).P(A/E_3)$

$$= \frac{4}{10} \times \frac{45}{100} + \frac{4}{10} \times \frac{60}{100} + \frac{2}{10} \times \frac{35}{100} = \frac{49}{100}$$

(b) $$P(E_2/A) = \frac{P(E_2).P(A/E_2)}{P(A)}$$

$$= \frac{\frac{4}{10} \times \frac{60}{100}}{\frac{490}{1000}} = \frac{24}{49}$$

(38) (i) $\vec{AV} = (-3\hat{i} + 7\hat{j} + 11\hat{k}) - (7\hat{i} + 5\hat{j} + 8\hat{k}) = -10\hat{i} + 2\hat{j} + 3\hat{k}$

$\therefore$ $|\vec{AV}| = \sqrt{100 + 4 + 9} = \sqrt{113}$ units

(ii) $\vec{DA} = 5\hat{i} + 2\hat{j} + 4\hat{k}$

$\therefore$ unit vector in direction of $\vec{DA}$

$$= \frac{5\hat{i} + 2\hat{j} + 4\hat{k}}{\sqrt{25 + 4 + 16}} = \frac{1}{3\sqrt{5}}(5\hat{i} + 2\hat{j} + 4\hat{k})$$

(iii) $\vec{DV} = -5\hat{i} + 4\hat{j} + 7\hat{k}$, $\vec{DA} = 5\hat{i} + 2\hat{j} + 4\hat{k}$

$$\cos(\angle VDA) = \frac{(-5\hat{i} + 4\hat{j} + 7\hat{k}).(5\hat{i} + 2\hat{j} + 4\hat{k})}{\sqrt{25 + 16 + 49}\ \sqrt{25 + 4 + 16}}$$

$$= \frac{-25 + 8 + 28}{\sqrt{90}\ \sqrt{45}} = \frac{11}{45\sqrt{2}}$$

$\therefore$ $\angle VDA = \cos^{-1}\left(\frac{11}{45\sqrt{2}}\right)$

OR

(iii) Projection of $\vec{DV}$ on $\vec{DA}$

$$= \frac{(-5\hat{i} + 4\hat{j} + 7\hat{k}).(5\hat{i} + 2\hat{j} + 4\hat{k})}{3\sqrt{5}}$$

$$= \frac{11}{3\sqrt{5}}$$