COMMON PRE-BOARD EXAMINATION 2024-25

Subject: MATHEMATICS (041)

Class XII

MARKING SCHEME

1	d) 5	11	b) $\frac{y}{x}$
2	c) 30.255	12	b) 7
3	b) 4	13	d) $\frac{2}{7}, \frac{-3}{7}, \frac{6}{7}$
4	d) $\frac{-2}{x^2}$	14	a) $4\hat{\imath} + \hat{\jmath} - 2\hat{k}$
5	b) $\frac{\pi}{3}$	15	c) 0
6	a) 1	16	d) $\frac{2}{3}$ sq. units
7	c) $\|\vec{a}\|^2 \ \|\vec{b}\|^2$	17	d) $\frac{4}{7}$
8	b) 0	18	b) $\sqrt{27}$
9	a) $\frac{5}{x\log(x^5)\,.\,\log(\log(x^5))}$	19	a) Both A and R are true and R is the correct explanation of A
10	b) -6, -4, -9	20	(D) A is false and R is True

21

$p(x) = 41 - 72x - 18x^2$.

$\therefore p'(x) = -72 - 36x$

$p'(x) = 0 \quad \Rightarrow x = \frac{-72}{36} = -2$ (1m)

$p''(x) = -36$

$p''(-2) = -36 < 0$

, $x = -2$ is the point of local maxima of p.

, Maximum profit $= p(-2)$ (1/2m)

$= 41 - 72(-2) - 18(-2)^2 = 41 + 144 - 72$ (1/2m)

the maximum profit that the company can make is 113 units.

22

$\vec{a} + \vec{b} = 4\hat{i} + \hat{j} - \hat{k}$

and $\vec{a} - \vec{b} = -2\hat{i} + 3\hat{j} - 5\hat{k}$

Consider $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) =$

$= (4\hat{i} + \hat{j} - \hat{k}) \cdot (-2\hat{i} + 3\hat{j} - 5\hat{k})$

$= -8 + 3 + 5 = 0$ (1m)

As dot product is zero

$\therefore (\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$

are perpendicular to each other. (1m)

\- OR -

For given vectors $\vec{a}$ and $\vec{b}$,

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 6 & 27 \\ 1 & \lambda & \mu \end{vmatrix} = 0$$

(1m)

gives,

$(6\mu - 27\lambda)\hat{i} - (2\mu - 27)\hat{j} + (2\lambda - 6)\hat{k} = 0$

$\Rightarrow 6\mu - 27\lambda = 0;\ 2\mu - 27 = 0;\ 2\lambda - 6 = 0$

$\Rightarrow \lambda = 3, \mu = \frac{27}{2}$ (1m)

23 Let $\cot^{-1}(x+1) = A$ and $\tan^{-1} x = B$

$\Rightarrow x+1 = \cot A \Rightarrow \sin A = \dfrac{1}{\sqrt{(x+1)^2+1}}$ (1/2m)

Also, $x = \tan B \quad \therefore \quad \cos B = \dfrac{1}{\sqrt{x^2+1}}$ (1/2m)

$\sin A = \cos B$ [From (1)]

$\Rightarrow \dfrac{1}{\sqrt{(x+1)^2+1}} = \dfrac{1}{\sqrt{x^2+1}} \Rightarrow (x+1)^2+1 = x^2+1$

$1+2x = 0 \Rightarrow x = -\dfrac{1}{2}$ (1m)

- OR -

As $\cos^{-1}\left(\cos\dfrac{2\pi}{3}\right)+\sin^{-1}\left(\dfrac{\sin 2\pi}{3}\right)$

$= \dfrac{2\pi}{3}+\sin^{-1}\left[\sin\left(\pi-\dfrac{\pi}{3}\right)\right]$ (1m)

$= \dfrac{2\pi}{3}+\sin^{-1}\left(\sin\dfrac{\pi}{3}\right) = \dfrac{2\pi}{3}+\dfrac{\pi}{3} = \dfrac{3\pi}{3} = \pi$ (1m)

24 $\cos\dfrac{\pi}{4} = \dfrac{|\alpha.1+0+\beta|}{\sqrt{\alpha^2+\beta^2+25}\sqrt{2}} \Rightarrow \dfrac{1}{\sqrt{2}} = \dfrac{|\alpha+\beta|}{\sqrt{\alpha^2+\beta^2+25}\sqrt{2}}$ (1m)

Squaring both sides, we get $\alpha^2+\beta^2+2\alpha\beta = \alpha^2+\beta^2+25 \Rightarrow \alpha\beta = \dfrac{25}{2}$ (1m)

25 Given $f(x) = \sqrt{\tan\sqrt{x}}$

$\therefore \quad f'(x) = \dfrac{1}{2\sqrt{\tan\sqrt{x}}}\times\sec^2\sqrt{x}\times\dfrac{1}{2\sqrt{x}} \Rightarrow f'(x) = \dfrac{\sec^2\sqrt{x}}{4\sqrt{x}\tan\sqrt{x}}$ (1m)

$\therefore \quad f'\left(\dfrac{\pi^2}{16}\right) = \dfrac{\sec^2\frac{\pi}{4}}{4\sqrt{\frac{\pi^2}{16}}\tan\sqrt{\frac{\pi^2}{16}}} \qquad f'\left(\dfrac{\pi^2}{16}\right) = \dfrac{(\sqrt{2})^2}{4\times\frac{\pi}{4}\times\sqrt{\tan\frac{\pi}{4}}} = \dfrac{2}{\pi\times 1} = \dfrac{2}{\pi}$ (1m)

26 Let $I = \displaystyle\int\frac{2x}{(x^2+1)(x^2+2)}dx$

let $\dfrac{1}{(x^2+1)(x^2+2)} = \dfrac{A}{x^2+1}+\dfrac{B}{x^2+2}$ (1/2m)

$\Rightarrow 1 = A(x^2+2)+B(x^2+1)$

$\Rightarrow 1 = (A+B)x^2+(2A+B)$

On comparing both sides, we get $A+B = 0$ and $2A+B = 0$

On solving above equations, we get $A = 1$ and $B = -1$ (1m)

$\therefore I = \displaystyle\int\left(\frac{1}{x^2+1}-\frac{1}{x^2+2}\right)2x\,dx = \int\frac{2x}{x^2+1}dx-\int\frac{2x}{x^2+2}dx$

$= \log|x^2+1|-\log|x^2+2|+C = \log\left|\dfrac{x^2+1}{x^2+2}\right|+C$ (1.5m)

27 Since the event of raining today and not raining today are complementary events so if the probability that it rains today is 0.4 then the probability that it does not rain today is 1 - 0.4 = 0.6 $\Rightarrow P_1 = 0.6$

If it rains today, the probability that it will rain tomorrow is 0.8 then the probability that it will not rain tomorrow is 1 - 0.8 = 0.2

If it does not rain today, the probability that it will rain tomorrow is 0.7 then the probability that it will not rain tomorrow is 1 - 0.7 = 0.3

(i) $P_1\times P_4 - P_2\times P_3 = 0.6\times0.3-0.2\times0.7 = 0.04.$ (2m)

(ii) Let E_1 and E_2 be the events that it will rain today and it will not rain today respectively.

$P(E_1) = 0.4$ & $P(E_2) = 0.6$

A be the event that it will rain tomorrow. $P\left(\frac{A}{E_1}\right) = 0.8$ & $P\left(\frac{A}{E_2}\right) = 0.7$

We have, $P(A) = P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P\left(\frac{A}{E_2}\right) = 0.4 \times 0.8 + 0.6 \times 0.7 = 0.74.$ (1m)

The probability of rain tomorrow is $\mathbf{0.74}$.

- OR -

Ans: Let X denote the Random Variable defined by the number of defective items.

$P(X=0) = \frac{4}{6} \times \frac{3}{5} = \frac{2}{5}$ $\quad P(X=1) = 2 \times \left(\frac{2}{6} \times \frac{4}{5}\right) = \frac{8}{15}$ $\quad P(X=2) = \frac{2}{6} \times \frac{1}{5} = \frac{1}{15}$

x_i	0	1	2
p_i	2/5	8/15	1/15
$p_i x_i$	0	8/15	2/15

(2m)

$Mean = \sum p_i x_i = \frac{10}{15} = \frac{2}{3}$ (1m)

28 Let $I = \int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$ ... (i)

$= \int_0^{\pi} \frac{(\pi - x)\sin(\pi - x)}{1+[\cos(\pi - x)]^2} dx \quad \left[\because \int_0^a f(x)dx = \int_0^a f(a-x)dx\right] \Rightarrow I = \int_0^{\pi} \frac{(\pi - x)\sin x}{1+\cos^2 x} dx$ ...(ii) (1m)

Adding (i) and (ii), we get $2I = \int_0^{\pi} \frac{\pi \sin x}{1+\cos^2 x} dx$

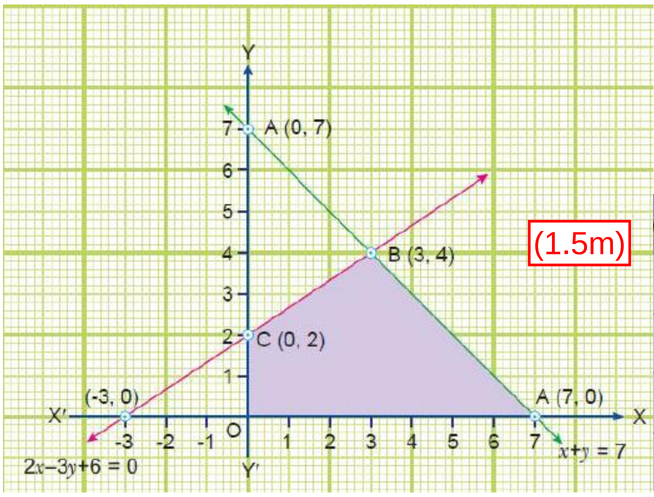
Put $\cos x = t \Rightarrow -\sin x \, dx = dt$

Also, $x = 0 \Rightarrow t = 1$ and $x = \pi \Rightarrow t = -1$ (1m)

$\therefore 2I = \int_1^{-1} \frac{-\pi dt}{1+t^2} \Rightarrow I = \frac{\pi}{2} \int_{-1}^{1} \frac{dt}{1+t^2}$

$\therefore I = \frac{\pi}{2}[\tan^{-1} t]_{-1}^{1} = \frac{\pi}{2}[\tan^{-1}(1) - \tan^{-1}(-1)] = \frac{\pi}{2}\left[\frac{\pi}{4} - \left(-\frac{\pi}{4}\right)\right] = \frac{\pi^2}{4}$ (1m)

29



(1.5m)

Corner Points	$Z = 13x - 15y$
O (0, 0)	0
A (7, 0)	91
B (3, 4)	−21
C (0, 2)	−30

(1m)

minimum value of Z is −30 at (0, 2) (0.5m)

30

Consider $I = \int_1^3 |x^2 - 2x|\, dx$

$$|x^2 - 2x| = \begin{cases} -(x^2 - 2x) & \text{where } 1 \le x < 2 \\ (x^2 - 2x) & \text{where } 2 \le x \le 3 \end{cases}$$

(1m) $I = \int_1^2 |x^2 - 2x|\, dx + \int_2^3 |x^2 - 2x|\, dx$

(1m) $I = \int_1^2 -(x^2 - 2x)\, dx + \int_2^3 (x^2 - 2x)\, dx$

$$I = -\left[\frac{x^3}{3} - x^2\right]_1^2 + \left[\frac{x^3}{3} - x^2\right]_2^3$$

$$I = -\left[\frac{8}{3} - 4 - \frac{1}{3} + 1\right] + \left[9 - 9 - \frac{8}{3} + 4\right]$$

$$= -\frac{7}{3} + 3 - \frac{8}{3} + 4$$

$I = \frac{6}{3} = 2$ (1m)

- **OR** -

Let $I = \int_{-2}^{1} \sqrt{5 - 4x - x^2}\, dx = \int_{-2}^{1} \sqrt{-(x^2 + 4x - 5)}\, dx = \int_{-2}^{1} \sqrt{-(x^2 + 4x + 2^2 - 2^2 - 5)}\, dx$ (1m)

$= \int_{-2}^{1} \sqrt{-\left\{(x+2)^2 - 9\right\}}\, dx = \int_{-2}^{1} \sqrt{3^2 - (x+2)^2}\, dx$ (1m)

$= \left[\frac{x+2}{2}\sqrt{3^2 - (x+2)^2} + \frac{3^2}{2}\sin^{-1}\left(\frac{x+2}{3}\right)\right]_{-2}^{1} = 0 + \frac{9}{2}\cdot\frac{\pi}{2} - (0+0) = \frac{9\pi}{4}$ (1m)

31

Ans: Given differential equation is $x\frac{dy}{dx} - y = x^2.e^x$

$\Rightarrow \frac{dy}{dx} - \frac{y}{x} = xe^x$, which is of the form $\frac{dy}{dx} + Py = Q$

Here, $P = -\frac{1}{x}$ and $Q = xe^x$ (1m)

$\text{I.F.} = e^{\int p dx} = e^{\int \frac{-1}{x} dx} = e^{-\log x} = e^{\log \frac{1}{x}}$

The solution is given by $y.\text{I.F.} = \int Q \times \text{I.F.}\, dx + C$

$y.\frac{1}{x} = \int xe^x \times \frac{1}{x} dx + C \Rightarrow \frac{y}{x} = \int e^x dx + C \Rightarrow \frac{y}{x} = e^x + C \Rightarrow \frac{y}{x} = e^x$ (1m) ...(i)

Given $y = 0$ when $x = 1$

from eq (i), we get $0 = 1.e^1 + C.1$ $\Rightarrow C = -e$ (1m)

- OR -

We have, $x\frac{dy}{dx} = y - x\tan\left(\frac{y}{x}\right) \Rightarrow \frac{dy}{dx} = \frac{y}{x} - \tan\left(\frac{y}{x}\right)$,

which is a homogeneous differential equation.

Now, put $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$ (1m)

$\therefore\ v + x\frac{dv}{dx} = v - \tan v \Rightarrow x\frac{dv}{dx} = -\tan v \Rightarrow \frac{dv}{\tan v} = -\frac{dx}{x} \Rightarrow \cot v\, dv + \frac{dx}{x} = 0$

Integrating both sides, we get $\log|\sin v| + \log x = \log C \Rightarrow x \sin v = C \Rightarrow x\sin\left(\frac{y}{x}\right) = C$ (1m)

When $x = 1, y = \frac{\pi}{4}$, we get $1\cdot\sin\left(\frac{\pi}{4}\right) = C \Rightarrow C = \frac{1}{\sqrt{2}}$

So, $x\sin\left(\frac{y}{x}\right) = \frac{1}{\sqrt{2}}$ is the required particular solution. (1m)

32 $S = \{(a, b) : a, b \in R \text{ and } a \le b^3\}$

Reflexive: As $\frac{1}{2} \le \left(\frac{1}{2}\right)^3$ where $\frac{1}{2} \in R$, is not true $\therefore \left(\frac{1}{2}, \frac{1}{2}\right) \notin S$

Thus, S is not reflexive. (1.5m)

Symmetric: As $(-2) \le 3^3$, where $-2, 3 \in R$, is true
but $3 \le (-2)^3$ is not true
i.e. $(-2, 3) \in S$ but $(3, -2) \notin S$. Thus, S is not symmetric (1.5m)

Transitive: As $3 \le \left(\frac{3}{2}\right)^3$ and $\frac{3}{2} \le \left(\frac{4}{3}\right)^3$, where $3, \frac{3}{2}, \frac{4}{3} \in R$ are true but $3 \le \left(\frac{4}{3}\right)^3$ is not tru

i.e., $\left(3, \frac{3}{2}\right) \in S$ and $\left(\frac{3}{2}, \frac{4}{3}\right) \in S$ but $\left(3, \frac{4}{3}\right) \notin S$

Thus, R is not transitive. (1.5m)

Hence, S is neither reflexive nor symmetric nor transitive (0.5m)

- OR -

Here, $f : A \to B$ is given by $f(x) = \frac{x-1}{x-2}$,

where $A = R - \{2\}$ and $B = R - \{1\}$

Let $f(x_1) = f(x_2)$, where $x_1, x_2 \in A$ (*i.e.*, $x_1 \ne 2, x_2 \ne 2$)

$\Rightarrow \frac{x_1 - 1}{x_1 - 2} = \frac{x_2 - 1}{x_2 - 2} \Rightarrow (x_1 - 1)(x_2 - 2) = (x_1 - 2)(x_2 - 1)$

$\Rightarrow x_1x_2 - 2x_1 - x_2 + 2 = x_1x_2 - x_1 - 2x_2 + 2 \Rightarrow -2x_1 - x_2 = -x_1 - 2x_2$

$\Rightarrow x_1 = x_2 \Rightarrow f$ is one-one. (2.5m)

Let $y \in B = R - \{1\}$ *i.e.*, $y \in R$ and $y \ne 1$

such that $f(x) = y$

$\Rightarrow \frac{x-1}{x-2} = y \Rightarrow (x-2)y = x - 1$

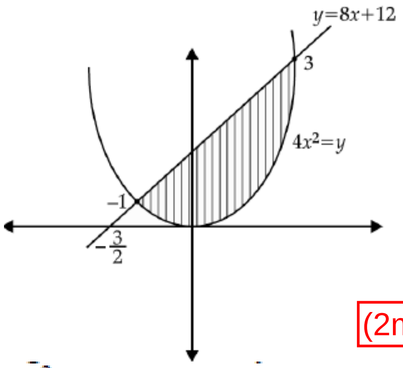
$\Rightarrow xy - 2y = x - 1 \Rightarrow x(y - 1) = 2y - 1 \Rightarrow x = \frac{2y-1}{y-1}$

$\therefore f(x) = y$ when $x = \frac{2y-1}{y-1} \in A$ (as $y \ne 1$)

Hence, f is onto. (2.5m)

Thus, f is one–one and onto.

33



(2m)

$4x^2 = y$ and line is $y = 8x + 12$
we get $4x^2 = 8x + 12$

$\Rightarrow x^2 = 2x + 3 \Rightarrow x^2 - 2x - 3 = 0 \Rightarrow x = 3, -1$ (1m)

Required area $= \int_{-1}^{3} \{(8x+12) - 4x^2\} dx$

$= 4\int_{-1}^{3} (2x + 3 - x^2) dx = 4\left[x^2 + 3x - \frac{x^3}{3}\right]_{-1}^{3}$ (1m)

$= 4\left[(9 + 9 - 9) - \left(1 - 3 + \frac{1}{3}\right)\right]$

$= \frac{128}{2}$ sq. units (1m)

34	$x+y+z=12$ $2x+3y+3z=33$ $x-2y+z=0$ $A=\begin{bmatrix}1&1&1\\2&3&3\\1&-2&1\end{bmatrix}, X=\begin{bmatrix}x\\y\\z\end{bmatrix}$ and $B=\begin{bmatrix}12\\33\\0\end{bmatrix}$ $\|A\|=\begin{vmatrix}1&1&1\\2&3&3\\1&-2&1\end{vmatrix}$ $= 1\ (3+6) - 1\ (2-3) + 1\ (-4-3) = 9+1-7 = 3$ $\therefore$ A^{-1} exists. (2m)	$adj(A)=\begin{bmatrix}9&-3&0\\1&0&-1\\-7&3&1\end{bmatrix}$ $X=A^{-1}B \Rightarrow \begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{3}\begin{bmatrix}9&-3&0\\1&0&-1\\-7&3&1\end{bmatrix}\begin{bmatrix}12\\33\\0\end{bmatrix}$ (1.5m) $\Rightarrow \begin{bmatrix}x\\y\\z\end{bmatrix}=\frac{1}{3}\begin{bmatrix}108-99\\12+0+0\\-84+99\end{bmatrix}=\frac{1}{3}\begin{bmatrix}9\\12\\15\end{bmatrix}=\begin{bmatrix}3\\4\\5\end{bmatrix}$ No. of awards for honesty = 3 No. of awards for helping others = 4 (1.5m) No. of awards for supervising = 5
35	shortest distance between the lines $\vec{r}=\vec{a}_1+\lambda\vec{b}_1$ and $\vec{r}=\vec{a}_2+\mu\vec{b}_2$ is given by $d=\left\|\frac{(\vec{a}_2-\vec{a}_1)\cdot(\vec{b}_1\times\vec{b}_2)}{\|\vec{b}_1\times\vec{b}_2\|}\right\|$ Comparing the given equations with the equations $\vec{r}=\vec{a}_1+\lambda\vec{b}_1$ and $\vec{r}=\vec{a}_2+\mu\vec{b}_2$ respectively, we have $\vec{a}_1=4\hat{i}-\hat{j}, \vec{a}_2=\hat{i}-\hat{j}+2\hat{k}, \vec{b}_1=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{b}_2=2\hat{i}+4\hat{j}-5\hat{k}$ Now, $\vec{a}_2-\vec{a}_1=-3\hat{i}+0\hat{j}+2\hat{k}$ (1.5m) and $\vec{b}_1\times\vec{b}_2=\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\1&2&-3\\2&4&-5\end{vmatrix}=2\hat{i}-\hat{j}+0\hat{k}$ $\therefore\ (\vec{a}_2-\vec{a}_1)\cdot(\vec{b}_1\times\vec{b}_2)=(-3\hat{i}+0\hat{j}+2\hat{k})\cdot(2\hat{i}-\hat{j}+0\hat{k})=-6+0+0=-6$ and $\|\vec{b}_1\times\vec{b}_2\|=\sqrt{4+1+0}=\sqrt{5}$ (1.5m) $\therefore$ Shortest distance $=\left\|\frac{(\vec{a}_2-\vec{a}_1)\cdot(\vec{b}_1\times\vec{b}_2)}{\|\vec{b}_1\times\vec{b}_2\|}\right\|=\frac{6}{\sqrt{5}}$ units. (2m) - **OR** - **Equation of diagonal PR:** $\frac{x-4}{8}=\frac{y-2}{2}=\frac{z+6}{11}$ (1m) **Equation of diagonal QS:** $\frac{x-5}{6}=\frac{y+3}{12}=\frac{z-1}{-3}$ (1m) **General points on PR & QS are** $(8k+4, 2k+2, 11k-6)$ **and** $(6t+5, 12t-3, -3t+1)$ **for real numbers 'k' and 't' respectively.** (1m) **For point of intersection of PR and QS:** $8k+4=6t+5,\ 2k+2=12t-3$ (1m) **Solving, we get** $k=\frac{1}{2}, t=\frac{1}{2}$ $\therefore$ **The point of intersection is** $\left(8,3,-\frac{1}{2}\right)$ (1m)	

36

(i) E1 be the event that he guesses

E2 - he copies

E3 - he knows the answer.

A - he answered correctly.

$P(E_1)=\frac{1}{3}, P(E_2)=\frac{1}{6}, P(E_3)=\frac{1}{2}$

$P(E_3)=1-\left(\frac{1}{3}+\frac{1}{6}\right)=1-\frac{1}{2}=\frac{1}{2}$

(ii) $P(A/E_1)=\frac{1}{8}, P(A/E_3)=1$

(iii) $P(E_3/A)=$

$$=\frac{P(E_3)\times P(A/E_3)}{P(E_1)\times P(A/E_1)+P(E_2)\times P(A/E_2)+P(E_3)\times P(A/E_3)}$$

$$\Rightarrow P(E_3/A)=\frac{\frac{1}{2}\times 1}{\frac{1}{3}\times\frac{1}{8}+\frac{1}{6}\times\frac{1}{4}+\frac{1}{2}\times 1}=\frac{6}{7}$$

$$P(A)=P(E_1)\times P(A/E_1)+P(E_2)\times P(A/E_2)+P(E_3)\times P(A/E_3)$$

$$=\frac{1}{3}\times\frac{1}{8}+\frac{1}{6}\times\frac{1}{4}+\frac{1}{2}\times 1=\frac{7}{12}$$

37

Ans: (a) Height of open box = x cm

Length of open box = 20 - 2x and width of open box = 20 - 2x

∴ Volume (V) of the open box = x (20 - 2x)(20 - 2x)

$\therefore \frac{dV}{dx}=x\cdot 2(20-2x)(-2)+(20-2x)^2=(20-2x)(-4x+20-2x)=(20-2x)(20-6x)$

Now, $\frac{dV}{dx}=0\Rightarrow 20-2x=0\, or\, 20-6x=0 \Rightarrow x=10\, or\, \frac{10}{3}$

(b) $\frac{dV}{dx}=(20-2x)(20-6x)$

$\Rightarrow \frac{d^2V}{dx^2}=(20-2x)(-6)+(20-6x)(-2)=(-2)[60-6x+20-6x]=(-2)[80-12x]=24x-1$

For $x=\frac{10}{3}, \frac{d^2V}{dx^2}<0$ and for $x=10, \frac{d^2V}{dx^2}>0$

volume will be maximum when $x=\frac{10}{3}$

38

Ans: (i) $f(x)=-0.1x^2+mx+98.6$, being a polynomial function, is differentiable everywhere, hence, differentiable in (0, 12)

(ii) $f'(x)=-0.2x+m$

Since, 6 is the critical point,

$f'(6)=0\Rightarrow m=1.2$

(iii) $f(x)=-0.1x^2+1.2x+98.6$

$f'(x)=-0.2x+1.2=-0.2(x-6)$

In the Interval	f'(x)	Conclusion
(0, 6)	+ve	f is strictly increasing in [0, 6]
(6, 12)	-ve	f is strictly decreasing in [6, 12]

OR

(iii) $f(x)=-0.1x^2+1.2x+98.6$,

$f'(x)=-0.2x+1.2$, $f'(6)=0$,

$f''(x)=-0.2$

$f''(6)=-0.2<0$

Hence, by second derivative test 6 is a point of local maximum. The local maximum value = $f(6)$
$=-0.1\times 6^2+1.2\times 6+98.6=102.2$