# BHARTIYA SHIKSHA BOARD
# MARKING SCHEME
# SAMPLE QUESTION PAPER 2025-26
# CLASS - XII
# MATHEMATICS (149)

| | | |
|---|---|---|
| 1. | (B) symmetric | 1. |
| 2. | (C) $2^9 A$. | 1 |
| 3. | (A) skew symmetric | 1 |
| 4. | (D) 2. | 1 |
| 5. | (D) 2. | 1 |
| 6. | (B) $\frac{-3}{\sqrt{4-x^2}}$ | 1 |
| 7. | (D) $15\sqrt{3}$ $cm^2/s$ | 1 |
| 8. | (B) (0,2) | 1 |
| 9. | (C) $\log\lvert 1-e^{-x}\rvert + c$. | 1 |
| 10. | (A) 5. | 1 |
| 11. | (A) $\pi$ sq.units | 1 |
| 12. | (C) $\frac{1}{y}$ | 1 |
| 13. | (B) $xy=c$. | 1 |
| 14. | (B) $\hat{j}$ | 1 |
| 15. | (C) $90^\circ$ | 1 |
| 16. | (C) 2,-1,3 | 1 |
| 17. | (D) $\frac{1}{2}$. | 1 |
| 18. | (A) $\frac{1}{12}$. | 1 |
| 19. | (A) Both true and R justifies | 1 |
| 20 | (C) Reason is false. | 1 |
| | | |

| | | |
|---|---|---|
| 21. | $\tan^2(\sec^{-1}2) + \cot^2(\operatorname{cosec}^{-1}3)$ | |
| | let $\sec^{-1}2 = x$ and $\operatorname{cosec}^{-1}3 = y$ | ½ |
| | $\Rightarrow \sec x = 2$ and $\operatorname{cosec} y = 3$ | |
| | Given expression $= \tan^2 x + \cot^2 y$ | ½ |
| | $= \sec^2 x - 1 + \operatorname{cosec}^2 y - 1$ | |
| | $= 4 - 1 + 9 - 1 = 11$ | 1 |
| | OR | |
| | $\cos^{-1}\left(-\frac{1}{2}\right) - 2\sin^{-1}\left(\frac{1}{2}\right) + 3\cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) - 4\tan^{-1}(-1)$ | |
| | $= \left(\pi - \pi/3\right) - 2\left(\pi/6\right) + 3\left(\pi - \pi/4\right) + 4\,\pi/4$ | 1 |
| | $= 2\pi/3 - \pi/3 + 9\pi/4 + \pi$ | |
| | $= \frac{8 - 4 + 27 + 12}{12}\pi$ | |
| | $= \frac{43\pi}{12}$ | 1 |
| 22. | $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix} \therefore A^2 = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} -5 & -18 \\ 18 & 7 \end{bmatrix}$ | 1 |
| | $\therefore A^2 - 6A + 17I = \begin{bmatrix} -5 & -18 \\ 18 & 7 \end{bmatrix} - \begin{bmatrix} 12 & -18 \\ 18 & 24 \end{bmatrix} + \begin{bmatrix} 17 & 0 \\ 0 & 17 \end{bmatrix}$ | ½ |
| | $= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ | ½ |
| | OR | |
| 63<br>15<br>48 | $\Delta ABC = \frac{1}{2}\begin{vmatrix} 3 & 1 & 1 \\ 9 & 3 & 1 \\ 5 & 7 & 1 \end{vmatrix} = \frac{1}{2}\left(3(-4) - 1(4) + 1(48)\right) = 16$ sq. U | 1 |
| | Eqn AB $= \begin{vmatrix} x & y & 1 \\ 3 & 1 & 1 \\ 9 & 3 & 1 \end{vmatrix} = 0 \Rightarrow -2x + 6y = 0$ or $x - 3y = 0$ | 1 |

| | | of Marks |
|---|---|---|
| 23. | $V = \frac{4}{3}\pi r^3$ and surface area $S = 4\pi r^2$ | |
| | $\frac{dV}{dr} = 4\pi r^2$ and $\frac{dS}{dr} = 8\pi r$ | 1 |
| | $\Rightarrow \frac{dV}{dS} = \frac{4\pi r^2}{8\pi r} = \frac{r}{2}$ | $\frac{1}{2}$ |
| | At $r = 2$, $\frac{dV}{dS} = \frac{2}{2} = 1$ cm. | $\frac{1}{2}$ |
| 24. | $\vec{a} + \vec{b} + \vec{c} = 0 \Rightarrow \vec{a} + \vec{b} = -\vec{c}$ | |
| | $\therefore (\vec{a} + \vec{b})^2 = \vec{c}^2 \Rightarrow \lvert\vec{a}\rvert^2 + \lvert\vec{b}\rvert^2 + 2\vec{a}\cdot\vec{b} = \lvert c\rvert^2$ | |
| | $\Rightarrow \vec{a}\cdot\vec{b} = \frac{49 - 9 - 25}{2} = \frac{15}{2}$. | 1 |
| | Let $\theta$ be the angle between $\vec{a}$ and $\vec{b}$ | |
| | Then $\cos\theta = \frac{\vec{a}\cdot\vec{b}}{\lvert\vec{a}\rvert\lvert\vec{b}\rvert} = \frac{15/2}{3\cdot 5} = 1/2 \Rightarrow \theta = \pi/3$ | 1 |
| 25. | Bag I: W 3, B 4     Bag II: W 4, B 5 | |
| | Ball drawn from bag I can be white or Black | |
| | Case I $P$(white from first and black from 2nd) | $\frac{1}{2}$ |
| | $= \frac{3}{7} \times \frac{5}{10}$ | |
| | Case II $P$(black from first and black from 2nd) | $\frac{1}{2}$ |
| | $= \frac{4}{7} \times \frac{6}{10}$ | |
| | $\therefore$ Total Probability $= \frac{3}{7} \times \frac{5}{10} + \frac{4}{7} \times \frac{6}{10} = \frac{15 + 24}{70} = \frac{39}{70}$ | 1 |

26.

$$\lim_{x\to 0^-} \frac{\sqrt{1+kx}-\sqrt{1-kx}}{x} \times \frac{\sqrt{1+kx}+\sqrt{1-kx}}{\sqrt{1+kx}+\sqrt{1-kx}}$$ 1

$$= \lim_{x\to 0^-} \frac{\cancel{1}+kx-\cancel{1}+kx}{x\left(\sqrt{1+kx}+\sqrt{1-kx}\right)}$$

$$= \frac{2k}{2} = k.$$ 1

$$\lim_{x\to 0^+} \frac{2x+1}{x-1} = -1. \Rightarrow k=-1.$$ 1

OR

$$\frac{dx}{d\theta} = -3a\cos^2\theta\sin\theta;\ \frac{dy}{d\theta} = 3a\sin^2\theta\cos\theta$$ 1

$$\therefore \frac{dy}{dx} = -\tan\theta.$$ ½

$$\frac{d^2y}{dx^2} = -\sec^2\theta \times \frac{1}{-3a\cos^2\theta\sin\theta}$$ 1

At $\theta = \pi/6$ $= +\frac{4}{3}\ \frac{1}{3a}\ \frac{4}{3}\cdot\frac{2}{1} = \frac{32}{27a}$ ½

27 $f(x) = \frac{x}{2}+\frac{2}{x} \Rightarrow f'(x) = \frac{1}{2}-\frac{2}{x^2} = \frac{x^2-4}{2x^2}$ 1

$f'(x) = 0 \Rightarrow x = \pm 2.$ ½

$\therefore$ Intervals are

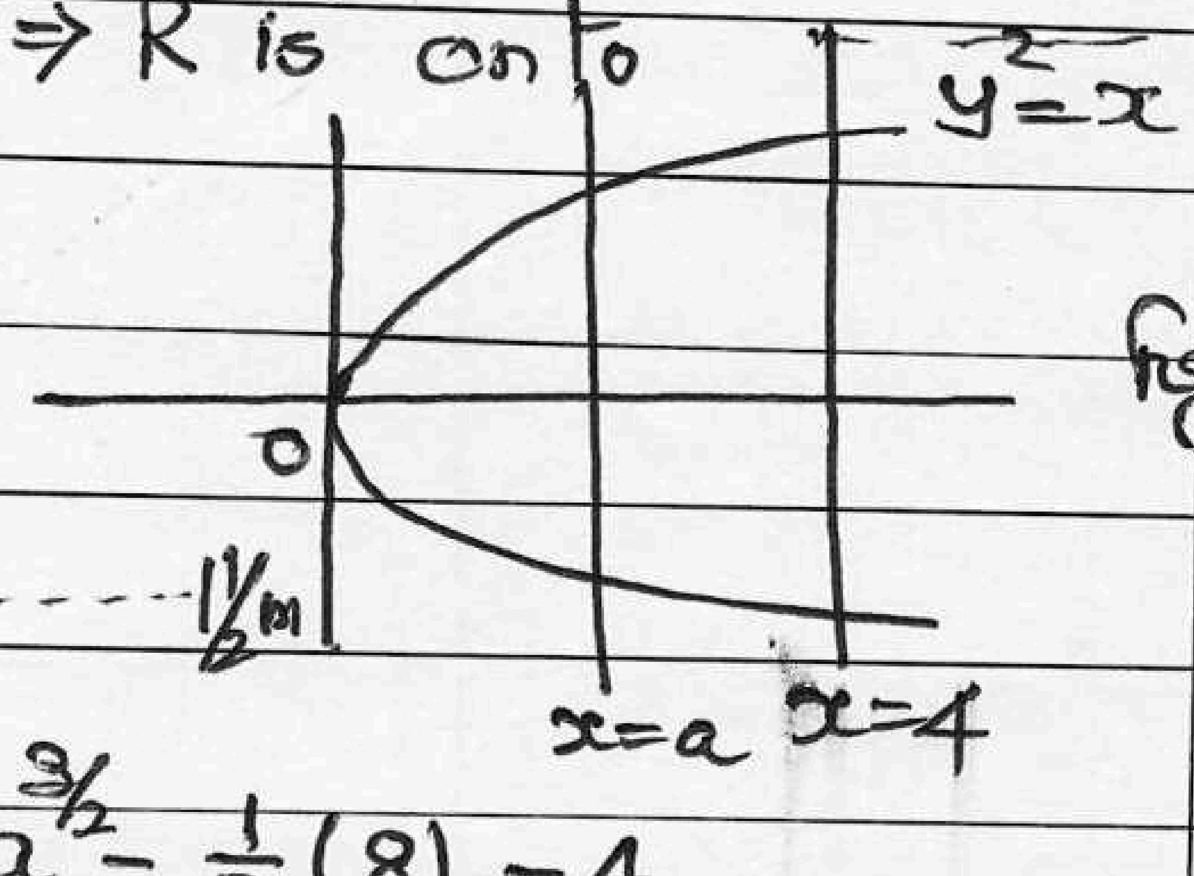
$(-\infty,-2]$, $[-2,0)$, $(0,2]$, $[2,\infty)$ ½

$f'(x)>0$ in $(-\infty,-2]$ and $[2,\infty)$ $\therefore$ strictly increasing

and $f'(x)<0$ in $[-2,0)\cup(0,2)$ $\therefore$ strictly decreasing 1.

| | | of Marks |
|---|---|---|
| 28 (a) | $I = \int \frac{2}{(1-x)(1+x^2)} dx$ | |
| | Writing $\frac{2}{(1-x)(1+x^2)} = \frac{A}{1-x} + \frac{Bx+C}{1+x^2}$ | $\frac{1}{2}$ |
| | Getting $A = B = C = 1$ | 1 |
| | $I = \int \frac{1}{1-x} dx + \int \frac{x+1}{x^2+1} dx$ | |
| | $= -\log\|1-x\| + \frac{1}{2}\log\|x^2+1\| + \tan^{-1}x + C$ | $1\frac{1}{2}$ |
| (b) | $I = \int \frac{x+3}{\sqrt{5-4x-x^2}} dx$ | |
| | $= -\frac{1}{2}\int \frac{-2x-4-2}{\sqrt{5-4x-x^2}} dx$ | |
| | $= -\frac{1}{2}\int \frac{-4-2x}{\sqrt{5-4x-x^2}} dx + \int \frac{1}{\sqrt{9-(x+2)^2}} dx$ | |
| | $= -\frac{1}{\cancel{2}} \cdot \cancel{2}\sqrt{5-4x-x^2} + \sin^{-1}\left(\frac{x+2}{3}\right) + C$ | |
| 29. | $I = \int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx \quad (i) \quad = \int_0^{\pi} \frac{(\pi - x)\sin(\pi - x)}{1+\cos^2(\pi - x)} dx$ | 1 |
| | $= \int_0^{\pi} \frac{(\pi - x)\sin x}{1+\cos^2 x} dx \quad \text{---}(ii)$ | $\frac{1}{2}$ |
| | $2I = \pi \int_0^{\pi} \frac{\sin x}{1+\cos^2 x} dx$ | |
| | $2I = \pi \int_1^{-1} \frac{-dt}{1+t^2} = \pi \int_{-1}^{1} \frac{dt}{1+t^2}$ Put $\cos x = t \Rightarrow \sin x\, dx = -dt$ | $\frac{1}{2}$ |
| | $I = \frac{\pi}{2} \tan^{-1} t \Big]_{-1}^{1} = \pi/2\left[\pi/4 + \pi/4\right] = \frac{\pi^2}{4}$ | 1 |

| | Expected Answer/ Value Points | of Marks |
|---|---|---|
| 30. (a) | We can write $\frac{dy}{1+y} = -\frac{\cos x}{2+\sin x}dx$ | |
| | $\Rightarrow \log\lvert 1+y\rvert = -\log\lvert 2+\sin x\rvert + C$ | 1 |
| | $x=0, y=1 \Rightarrow 2\log 2 = C$ or $C = \log 4$ | ½ |
| | $\therefore \log(1+y) + \log(2+\sin x) = \log 4$ | ½ |
| | $\Rightarrow (2+\sin x)(1+y) = 4$ | ½ |
| | At $x = \pi/2$ $(2+1)(1+y) = 4 \Rightarrow y = \frac{4}{3} - 1 = \frac{1}{3}$ | ½ |
| (b) | Here $\frac{dy}{dx} = \frac{y}{2x - x\log y/x} = \frac{y/x}{2-\log y/x}$ | |
| | $y/x = v \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$ | |
| | $\Rightarrow v + x\frac{dv}{dx} = \frac{v}{2-\log v}$ | 1 |
| | $x\frac{dv}{dx} = \frac{v-2v+v\log v}{2-\log v} = -\frac{v-v\log v}{2-\log v}$ | |
| | $\Rightarrow \int \frac{2-\log v}{v-v\log v}dv = -\int\frac{dx}{x}$ | 1 |
| | $\int \frac{1}{v(1-\log v)}dx + \int\frac{1}{v}dv = -\int\frac{dx}{x}$ | |
| | $\log\lvert 1-\log v\rvert + \log v + \log x = \log c$ | |
| | $(1-\log v)xv = c$ | |
| | $(1-\log y/x) = \frac{c}{y}$ | 1 |
| 31. | $\vec{d} = \lambda(\vec{a}\times\vec{b})$    $\vec{a}\times\vec{b} = \begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 1 & 4 & 2\\ 3 & -2 & 7\end{vmatrix}$ | |
| | $\vec{d} = \lambda(32\hat{i} - \hat{j} - 14\hat{k})$    $= 32\hat{i} - \hat{j} - 14\hat{k}$ | 1 |
| | $\vec{c}\cdot\vec{d} = (64+1-56)\lambda = 15$ | 1 |
| | $\Rightarrow 9\lambda = 15 \Rightarrow \lambda = 5/3$ $\therefore \vec{d} = 5/3(32\hat{i} - \hat{j} - 14\hat{k})$ | 1 |

| | | of Marks |
|---|---|---|
| 32. (a) | (i) $\forall (a,b) \in N \times N$, we have $(a,b) R (a,b)$ $\because ab = ba \Rightarrow R$ is Reflexive. | $1\frac{1}{2}$ |
| | (ii) $\forall (a,b),(c,d) \in N \times N$. Let $(a,b) R (c,d)$ i.e $ad = bc \Rightarrow da = cb$ or $cb = da$ $\Rightarrow (c,d) R (a,b) \Rightarrow R$ is Symmetric | $1\frac{1}{2}$ |
| | (iii) Let $(a,b) R (c,d)$ and $(c,d) R (e,f)$, $\Rightarrow ad = bc$ and $cf = de \Rightarrow a\cancel{d}\cancel{c}f = b\cancel{c}\cancel{d}e$ $\Rightarrow af = be \Rightarrow (a,b) R (e,f) \therefore R$ is transitive | 2 |
| | $\Rightarrow R$ is an equivalence Relation | 1 |
| | **OR** | |
| | for $x_1 x_2 \in A$ Let $f(x_1) = f(x_2)$ $\Rightarrow \frac{x_1-2}{x_1-3} = \frac{x_2-2}{x_2-3} \Rightarrow x_1x_2 - 3x_1 - 2x_2 + 6 = x_1x_2 - 2x_1 - 3x_2 + 6$ $\Rightarrow (x_1 - x_2) = 0 \Rightarrow x_1 = x_2$ $\Rightarrow f$ is 1-1. | $2\frac{1}{2}$ |
| | Let $y = \frac{x_0-2}{x_0-3} \Rightarrow xy - 3y = x - 2$; $x(y-1) = 3y - 2$; $x = \frac{3y-2}{y-1}$ Since $y \neq 1 \therefore x \in A$ $\Rightarrow R$ is onto | $2\frac{1}{2}$ |
| 33. | Given $\cancel{2}\int_0^a \sqrt{x}\,dx = \cancel{2}\int_a^4 \sqrt{x}\,dx$   | fig: $1\frac{1}{2}$ |
| | $\frac{2x^{3/2}}{3}\Big\vert_0^a = \frac{2x^{3/2}}{3}\Big\vert_a^4$ $\Rightarrow a^{3/2} = (4)^{3/2} - a^{3/2} \Rightarrow a^{3/2} = \frac{1}{2}(8) = 4$ $a = (4)^{2/3} = (16)^{1/3}$ sq.u. | 2m. |

34 (a) Given lines are $\vec{r}=(8\hat{i}-9\hat{j}+10\hat{k})+\lambda(3\hat{i}-16\hat{j}+7\hat{k})$ and

$\vec{r}=(15\hat{i}+29\hat{j}+5\hat{k})+\mu(3\hat{i}+8\hat{j}-5\hat{k})$

$\vec{a}_2-\vec{a}_1=(7\hat{i}+38\hat{j}-5\hat{k})$ $\quad b_1\times b_2=\begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 3 & -16 & 7\\ 3 & 8 & -5\end{vmatrix}$ ——— 1

$=24\hat{i}+36\hat{j}+72\hat{k}$ ——— 1½

$\therefore$ ~~SD~~ $=(\vec{a}_2-\vec{a}_1)\cdot(b_1\times b_2)$

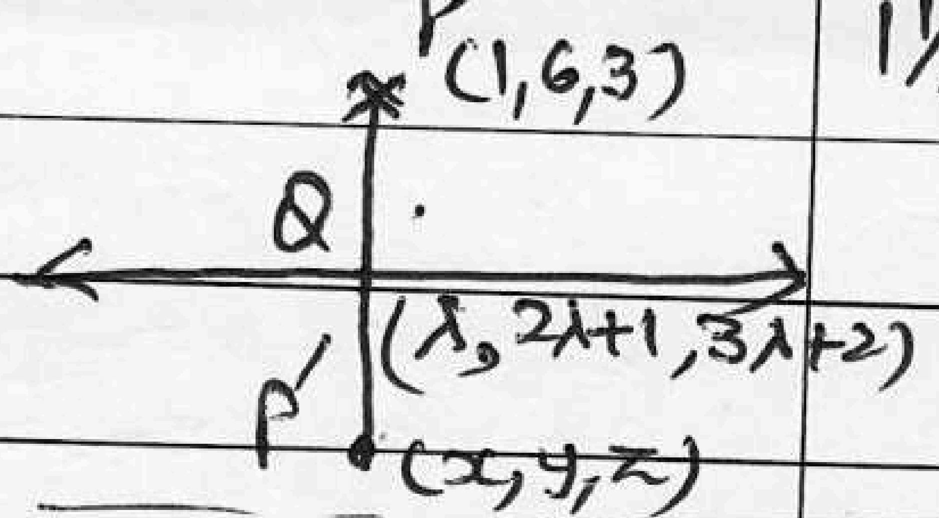
$=168+1368-360=1176$ ——— 1

$|b_1\times b_2|=576+1296+5184,\ \sqrt{7056}=84$

$SD=\dfrac{1176}{84}=14$ 1½

(b) Any pt. on the line is

$(\lambda,2\lambda+1,3\lambda+2)$




1

DRs of PQ $<\lambda-1,2\lambda-5,3\lambda-1>$ ——— 1

$\vec{PQ}\cdot(1,2,3)=0 \Rightarrow \lambda-1+4\lambda-10+9\lambda-3=0$

$14\lambda=14 \Rightarrow \lambda=1$ ——— 1

$\Rightarrow Q(1,3,5)$ ——— 1

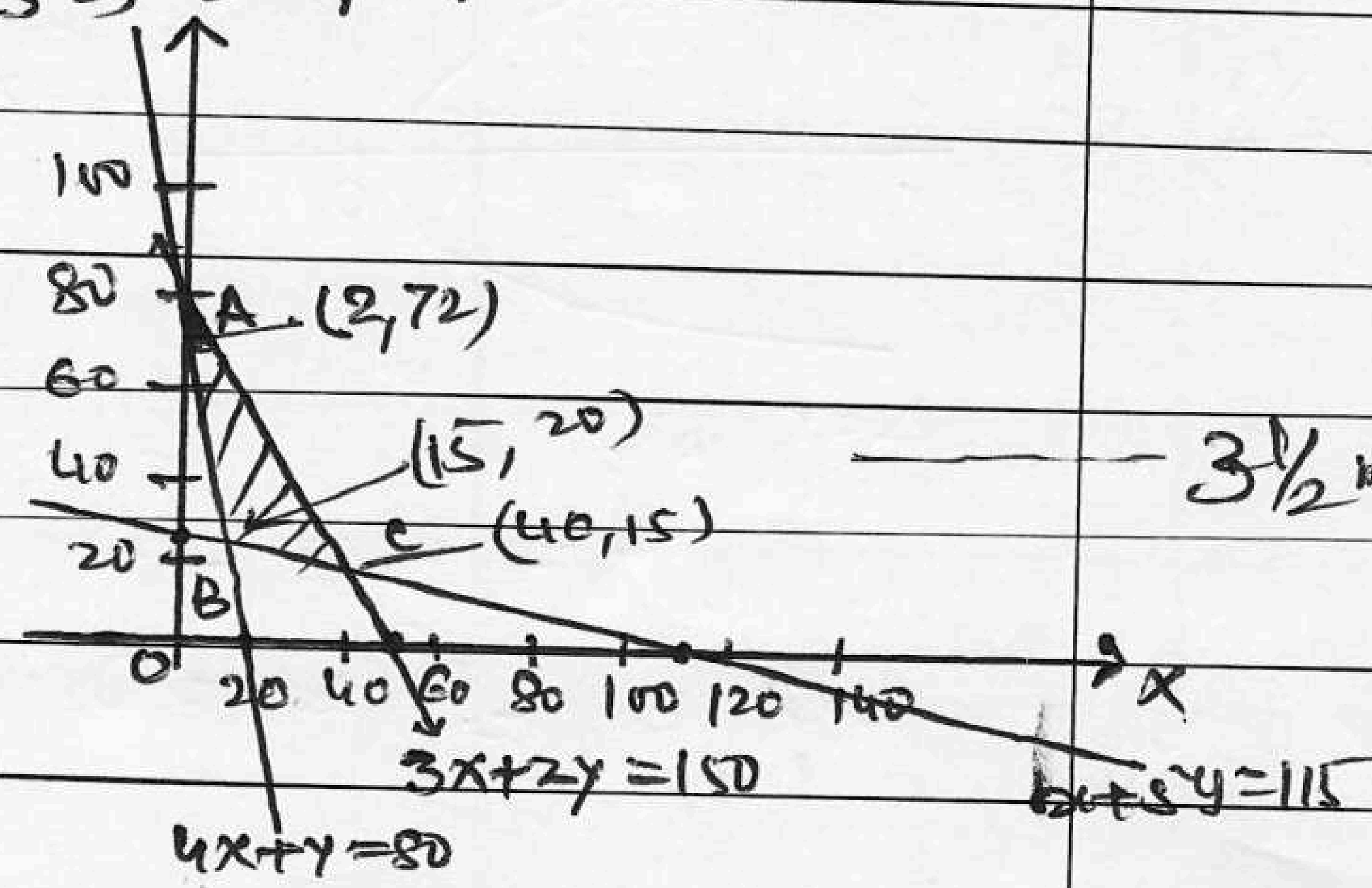
$P'(x,y,z) \Rightarrow \dfrac{x+1}{2}=1 \Rightarrow x=1,$

$\dfrac{y+6}{2}=3 \Rightarrow y=0$

$\dfrac{z+3}{2}=5 \Rightarrow z=7$

$\Big\}\ P'(1,0,7)$ ——— 1

35. $Z=6x+3y$




——— 3½ m

$Z_A=228$

$Z_B=150$

$Z_C=285$

$\therefore$ MIN $=150$ at $x=15,\ y=20$ ] 1½ m

| | | |
|---|---|---|
| 36 | (i) $3x + 2y + z = 2200$ | 1 |
| | (ii) $4x + y + 3z = 3100$ | 1 |
| | (iii) $x = ₹300 \quad y = ₹400, \quad z = ₹500.$ | 2 |
| | OR | |
| | $x = ₹500 \quad y = ₹200 \quad z = ₹300.$ | 2 |
| 37. | (i) $h(t) = -7t^2 + 28t + 1$ is a polynomial function | |
| | So, a continuous function. | |
| | (ii) $h(1) = -7 + 28 + 1 = 22$ m. | |
| | (iii) $h'(t) = -14t + 28$ | |
| | $h'(t) = 0 \Rightarrow t = 2$ sec. | 1 |
| | and $h(2) = -28 + 56 + 1 = 29$ m. | 1 |
| | OR | |
| | $h'(t) = -14t + 28 = 0 \Rightarrow t = 2$ | |
| | $\therefore$ Intervals $(-\infty, 2)$, $(2, \infty)$ | 1 |
| | $h(t)$ is $\uparrow$ in $(-\infty, 2)$ and $\downarrow$ in $(2, \infty)$ | 1 |
| 38. | (i) $P(A/E_1) = \frac{6}{10}$ | 1 |
| | (ii) $P(A/E_2) = \frac{2}{10}$ | 1 |
| | (iii) $P(A) = P(E_1)P(A/E_1) + P(E_2)P(A/E_2)$ ~~+P(E~~ | 1 |
| | $= \frac{20}{100} \times \frac{6}{10} + \frac{80}{100} \times \frac{2}{10} = \frac{7}{25}$ | 1 |
| | OR | |
| | $P(E_1/A) = \frac{P(E_1) \cdot P(A/E_1)}{P(E_1) \cdot P(A/E_1) + P(E_2) \cdot P(A/E_2)}$ | 1 |
| | $= \frac{20/100 \times 6/10}{7/25} = \frac{3}{7}$ | 1 |