

## KENDRIYA VIDYALAYA SANGATHAN

ERNAKULAM REGION - PRE BOARD EXAMINATION (2025-26)

CLASS XII

MATHEMATICS

SUBJECT CODE :041

DURATION: 3 Hours

MAX MARKS :80

## SECTION A (1 MARKS)

1. C.  $\frac{x}{\sqrt{1+x^2}}$
2. C.  $1 - \alpha^2 - \beta\gamma = 0$
3. D. 0
4. B.  $AB = -BA$
5. A.  $\frac{2\pi}{3}$
6. D.  $B^{-1} = \frac{1}{6} A$
7. B. 8
8. C.  $\frac{1}{x^3y}$ .
9. A.  $(-\infty, -\frac{1}{4}]$
10. B. 3
11. C. 0
12. D.  $\frac{1}{2} \tan^{-1}\left(\frac{x+2}{2}\right) + C$
13. A.  $\sqrt{7}$
14. B.  $2\vec{a}^2$
15. D.  $\frac{x-2}{1} = \frac{y+1}{2} = \frac{z}{-2}$
16. C. line segment EG
17. B.  $2p = q$
18. A.  $\frac{61}{63}$
19. C. (A) is true but (R) is false
20. C. (A) is true but (R) is false

## SECTION B(2 MARKS)

21A.  $y = \sin^{-1}(x^2 - 4)$

$$\Rightarrow -1 \leq x^2 - 4 \leq 1$$

$$\Rightarrow -1 + 4 \leq x^2 \leq 1 + 4$$

$$\Rightarrow 3 \leq x^2 \leq 5 \quad \frac{1}{2}$$

$$\Rightarrow \sqrt{3} \leq |x| \leq \sqrt{5} \quad \frac{1}{2}$$

$$\Rightarrow x \in [-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}] \quad \frac{1}{2}$$

OR

$$21B. \sin^{-1}\left\{\sin \frac{13\pi}{7}\right\} = \sin^{-1}\left\{\sin\left(2\pi - \frac{\pi}{7}\right)\right\} \quad \frac{1}{2}$$

$$= \sin^{-1}\left\{\sin \frac{-\pi}{7}\right\}, \quad \frac{-\pi}{7} \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right], \quad 1$$

$$= -\frac{\pi}{7} \quad \frac{1}{2}$$

22.  $e^y(x+1) = 1$ , differentiating with respect to  $x$

$$\Rightarrow e^y + (x+1)e^y \frac{dy}{dx} = 0 \quad \frac{1}{2}$$

.Dividing by  $e^y$

$$\Rightarrow 1 + (x+1) \frac{dy}{dx} = 0 \quad \frac{1}{2}$$

$$\Rightarrow \frac{dy}{dx} = -\frac{1}{x+1} \quad \frac{1}{2}$$

$$\Rightarrow \frac{d^2y}{dx^2} = \frac{1}{(x+1)^2} = \left(\frac{dy}{dx}\right)^2 \quad \frac{1}{2}$$

$$23. f(x) = |x| - |x+1| = \begin{cases} 1, & x < -1 \\ -2x - 1, & -1 \leq x < 0 \\ -1, & x \geq 0 \end{cases} \quad \frac{1}{2}$$

For checking continuity at  $x = -1$  and  $x = 0$  1

Function is continuous for all values of  $x$ . Hence no discontinuous point exist. 1/2

$$24A. I = \int \cos^3 x e^{\log \sin x} dx = \int \cos^3 x \sin x dx \quad \frac{1}{2}$$

$$\text{Put } \cos x = t \Rightarrow -\sin x dx = dt$$

$$\Rightarrow \sin x dx = -dt \quad \frac{1}{2}$$

$$I = -\int t^3 dt = -\frac{t^4}{4} + C \quad \frac{1}{2}$$

$$= -\frac{(\cos^4 x)}{4} + C \quad \frac{1}{2}$$

OR

24B. For correct figure 1/2

$$\text{Required area} = \int_0^{\frac{\pi}{2}} \cos x dx + \left| \int_{\frac{\pi}{2}}^{\pi} \cos x dx \right| \quad \frac{1}{2}$$

$$= [\sin x]_0^{\pi/2} + \left| [\sin x]_{\frac{\pi}{2}} \right| \quad \frac{1}{2}$$

$$= 2 \text{ sq units} \quad \frac{1}{2}$$

25.  $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ ,  $\vec{b} = 2\hat{i} + \hat{j} - 7\hat{k}$

$$\vec{a} + \vec{b} = 2\hat{i} + 2\hat{j} - 5\hat{k} + 2\hat{i} + \hat{j} - 7\hat{k} = 4\hat{i} + 3\hat{j} - 12\hat{k} \quad \frac{1}{2}$$

$$|\vec{a} + \vec{b}| = 13 \quad \frac{1}{2}$$

$$\text{Required unit vector} = \frac{\vec{a} + \vec{b}}{|\vec{a} + \vec{b}|} = \frac{1}{13} (4\hat{i} + 3\hat{j} - 12\hat{k}) \quad 1$$

SECTION C (3 MARKS)

26A.  $(\cos x)^y = (\cos y)^x$

Taking log both sides,  $y \log(\cos x) = x \log(\cos y)$  1/2

Differentiating w r t x on both sides,

$$-y \tan x + \log(\cos x) \frac{dy}{dx} = -x \tan y \frac{dy}{dx} + \log(\cos y) \quad 1\frac{1}{2}$$

$$\frac{dy}{dx} = \frac{\log(\cos y) + y \tan x}{x \tan y + \log(\cos x)} \quad 1$$

OR

26B.  $x = a(2\theta - \sin 2\theta)$

$$\frac{dx}{d\theta} = a(2 - 2\cos 2\theta) = 2a(1 - \cos 2\theta) = 4a \sin^2 \theta \quad 1$$

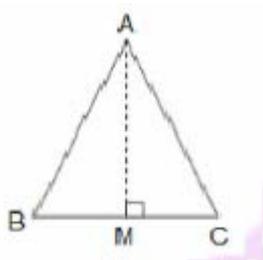
$$y = a(1 - \cos 2\theta)$$

$$\frac{dy}{d\theta} = 2a \sin 2\theta = 4a \sin \theta \cos \theta \quad 1$$

$$\frac{dy}{dx} = \cot \theta \quad \frac{1}{2}$$

$$\text{at } \theta = \frac{\pi}{3}, \frac{dy}{dx} = \frac{1}{\sqrt{3}} \quad \frac{1}{2}$$

27 Consider  $BC = b$  be the fixed base and  $AB = AC = x$  be the two sides of isosceles triangle.



1/2

$$\frac{dx}{dt} = -3cm/s$$

$$\text{Area of triangle } A = \frac{1}{2} BC \times AM = \frac{1}{2} b \sqrt{x^2 - \frac{b^2}{4}} \quad \frac{1}{2}$$

$$A = \frac{b}{4} \sqrt{4x^2 - b^2} \quad \frac{1}{2}$$

$$\frac{dA}{dt} = \frac{b}{4} \frac{-8x}{2\sqrt{4x^2 - b^2}} \frac{dx}{dt} = -\frac{3bx}{\sqrt{4x^2 - b^2}} \quad 1$$

$$\text{When } x = b, \frac{dA}{dt} = -\sqrt{3} bcm^2/s$$

Therefore area is decreasing at the rate of  $\sqrt{3} bcm^2/s$  1/2

28A. Given curve is  $4x^2 + y^2 = 36$

$$\Rightarrow \frac{x^2}{9} + \frac{y^2}{36} = 1$$

Correct figure 1

Required area = 4(area of region in first quadrant)

$$= 4 \int_0^3 2\sqrt{9 - x^2} dx \quad \frac{1}{2}$$

$$= 8 \left[ \frac{x}{2} \sqrt{9 - x^2} + \frac{9}{2} \sin^{-1} \left( \frac{x}{3} \right) \right]_0^3$$

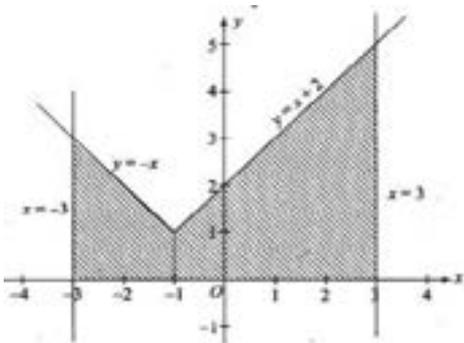
$$= 8 \times \frac{9\pi}{2 \cdot 2} \quad 1$$

$$= 18\pi \text{ sq units} \quad \frac{1}{2}$$

OR

$$28B. y = |x + 1| + 1 = \begin{cases} x + 2, & x \geq -1 \\ -x, & x < -1 \end{cases}$$

Correct figure 1



$$\text{Required area} = \int_{-3}^{-1} -x dx + \int_{-1}^3 x + 2 dx \quad \frac{1}{2}$$

$$= -\left[ \frac{x^2}{2} \right]_{-3}^{-1} + \left[ \frac{x^2}{2} + 2x \right]_{-1}^3 \quad \frac{1}{2}$$

$$= \frac{1}{2}(1 - 9) + \left[ \left( \frac{9}{2} + 6 \right) - \left( \frac{1}{2} - 2 \right) \right] \quad \frac{1}{2}$$

= 16sq units 1/2

29A .Any line through (2,1,3)can be written as  $\frac{x-2}{a} = \frac{y-1}{b} = \frac{z-3}{c} \dots \dots (1)$  1/2

Where  $a, b, c$  are the direction ratios of line(1).

Line(1) is perpendicular to the lines  $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$  and  $\frac{x}{-3} = \frac{y}{2} = \frac{z}{5}$

DR'S of these lines (1,2,3) and (-3,2,5)respectively. 1/2

Then  $a + b + c = 0 \dots (2)$  and  $-3a + 2b + 5c = 0 \dots (3)$

Solving (2) and (3)  $a = 2k, b = -7k, c = 4k$  1 1/2

Substituting in (1) ,required equation of the line is  $\frac{x-2}{2k} = \frac{y-1}{-7k} = \frac{z-3}{4k}$

$\Rightarrow \frac{x-2}{2} = \frac{y-1}{-7} = \frac{z-3}{4}$  1/2

OR

29B.Given lines are  $\vec{r} = 4\hat{i} - \hat{j} + s(\hat{i} + 2\hat{j} - 3\hat{k})$  and  $\vec{r} = \hat{i} - \hat{j} + 2\hat{k} + t(2\hat{i} + 4\hat{j} - 5\hat{k})$

$\vec{a}_1 = 4\hat{i} - \hat{j}, \vec{b}_1 = \hat{i} + 2\hat{j} - 3\hat{k}, \vec{a}_2 = \hat{i} - \hat{j} + 2\hat{k}, \vec{b}_2 = 2\hat{i} + 4\hat{j} - 5\hat{k}$  1/2

$\vec{a}_2 - \vec{a}_1 = -3\hat{i} + 2\hat{k}$  1/2

$\vec{b}_1 \times \vec{b}_2 = 2\hat{i} - \hat{j}$  1/2

$|\vec{b}_1 \times \vec{b}_2| = \sqrt{5}$  1/2

$d = \left| \frac{(\vec{b}_1 \times \vec{b}_2) \cdot (\vec{a}_2 - \vec{a}_1)}{|\vec{b}_1 \times \vec{b}_2|} \right|$

=  $6/\sqrt{5}$  units 1

30.For sketching graph 1 1/2

Corner points are  $A(0,4) B(5,0), C(6,0) D(4,4) E(0,6)$  1/2

For finding maximum value

Value of  $Z$  at  $A = 160, B = 300, C = 360, D = 400, E = 240$  1/2

Maximum value of  $Z = 400$  at  $D(4,4)$  1/2

31. Let the events be:

Given  $P(A) = \frac{4}{5}, P(B) = \frac{3}{4}, P(C) = \frac{2}{3}$

Then  $P(\bar{A}) = \frac{1}{5}, P(\bar{B}) = \frac{1}{4}, P(\bar{C}) = \frac{1}{3}$  1

$P(\text{any two of them hit the target}) = P(A \cap B \cap \bar{C}) + P(A \cap \bar{B} \cap C) + P(\bar{A} \cap B \cap C)$  1

$$= P(A).P(B)P(\bar{C}) + P(A)P(\bar{B})P(C) + P(\bar{A})P(B)P(C) \quad \frac{1}{2}$$

$$= \frac{13}{30} \quad \frac{1}{2}$$

SECTION D(5 MARKS)

$$32. A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}$$

$$|A| = 67 \quad \frac{1}{2}$$

$$\text{adj } A = \begin{bmatrix} -6 & 17 & 13 \\ 14 & 5 & -8 \\ -15 & 9 & -1 \end{bmatrix} \quad 2$$

$$A^{-1} = \frac{1}{67} \begin{bmatrix} -6 & 17 & 13 \\ 14 & 5 & -8 \\ -15 & 9 & -1 \end{bmatrix} \quad \frac{1}{2}$$

Given system of equation is  $x + 2y - 3z = -4$ ;  $2x + 3y + 2z = 2$  and  $3x - 3y - 4z = 11$

In matrix form it can be written as  $AX = B$ , where

$$A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}, B = \begin{bmatrix} -4 \\ 2 \\ 11 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \quad \frac{1}{2}$$

$$X = A^{-1}B = \frac{1}{67} \begin{bmatrix} -6 & 17 & 13 \\ 14 & 5 & -8 \\ -15 & 9 & -1 \end{bmatrix} \begin{bmatrix} -4 \\ 2 \\ 11 \end{bmatrix} \quad 1$$

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

Thus  $x = 3, y = -2, z = 1$   $\frac{1}{2}$

$$33A. I = \int \frac{x \tan^{-1} x}{(1+x^2)^{\frac{3}{2}}} dx = \int \frac{x \tan^{-1} x}{(1+x^2)\sqrt{1+x^2}} dx \quad \frac{1}{2}$$

Put  $\tan^{-1} x = t \Rightarrow \frac{1}{1+x^2} dx = dt$  and  $\tan t = x$   $\frac{1}{2}$

$$I = \int \frac{\tan t \cdot t dt}{\sqrt{1+\tan^2 t}} = \int t \sin t dt \quad 1$$

$$= -t \cos t + \int \cos t dt$$

$$= \sin t - t \cos t + C \quad 2$$

$$= \frac{x}{\sqrt{1+x^2}} - \tan^{-1} x \cdot \left(\frac{1}{\sqrt{1+x^2}}\right) + C$$

$$= \frac{1}{\sqrt{1+x^2}} [x - \tan^{-1} x] + C \quad 1$$

$$33B. I = \int_0^{\pi} \frac{x}{a^2 \cos^2 x + b^2 \sin^2 x} dx \dots \dots (1)$$

$$I = \int_0^\pi \frac{\pi-x}{a^2 \cos^2(\pi-x) + b^2 \sin^2(\pi-x)} dx \quad \frac{1}{2}$$

$$= \int_0^\pi \frac{\pi-x}{a^2 \cos^2 x + b^2 \sin^2 x} dx \dots \dots (2) \quad \frac{1}{2}$$

Adding  $2I = \int_0^\pi \frac{\pi}{a^2 \cos^2 x + b^2 \sin^2 x} dx \quad \frac{1}{2}$

$$I = \frac{\pi}{2} \int_0^\pi \frac{1}{a^2 \cos^2 x + b^2 \sin^2 x} dx \quad \frac{1}{2}$$

$$I = \pi \left[ \int_0^{\frac{\pi}{4}} \frac{1}{a^2 \cos^2 x + b^2 \sin^2 x} dx + \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \frac{1}{a^2 \cos^2 x + b^2 \sin^2 x} dx \right] \quad \frac{1}{2}$$

$$I = \pi \left[ \int_0^{\frac{\pi}{4}} \frac{\sec^2 x}{a^2 + b^2 \tan^2 x} dx + \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \frac{\operatorname{cosec}^2 x}{a^2 \cot^2 x + b^2} dx \right] \quad \frac{1}{2}$$

Put  $\tan x = t$ ,  $\cot x = u$

$$I = \pi \left[ \int_0^1 \frac{1}{a^2 + b^2 t^2} dt - \int_1^0 \frac{1}{a^2 u^2 + b^2} du \right] \quad 1$$

$$= \frac{\pi}{ab} \left[ \tan^{-1} \frac{a}{b} + \tan^{-1} \frac{b}{a} \right] = \frac{\pi^2}{2ab} \quad 1$$

34A.  $x^2 dy + (xy + y^2) dx = 0$

$$\frac{dy}{dx} = -\frac{xy+y^2}{x^2} \dots \dots (1) \text{ .it is a homogeneous differential equation} \quad \frac{1}{2}$$

Put  $y = vx$  and  $\frac{dy}{dx} = v + x \frac{dv}{dx}$  in (1)

$$v + x \frac{dv}{dx} = -\frac{x vx + (vx)^2}{x^2}$$

$$= -(v + v^2)$$

$$x \frac{dv}{dx} = -2v - v^2 \quad 1 \frac{1}{2}$$

$$\int \frac{1}{v(v+2)} dv = -\int \frac{1}{x} dx$$

$$\Rightarrow \frac{1}{2} \int \left( \frac{1}{v} - \frac{1}{v+2} \right) dv = -\int \frac{1}{x} dx$$

$$\Rightarrow \frac{1}{2} \log \frac{v}{v+2} = -\log x + \log C \quad 1$$

$$\Rightarrow \log \frac{v}{v+2} = 2 \log \frac{C}{x}$$

$$\Rightarrow \frac{v}{v+2} = \left( \frac{C}{x} \right)^2$$

$$\frac{y}{y+2x} = \left( \frac{C}{x} \right)^2 \text{ is the general solution} \quad 1$$

Given that  $y = 1$  when  $x = 1$ ,  $C^2 = \frac{1}{3}$

Particular solution is  $\frac{y}{y+2x} = \left( \frac{1}{3x} \right)^2 \quad 1$

$$\Rightarrow 3x^2 y = y + 2x$$

34B .Given  $(\tan^{-1} x - y)dx = (1 + x^2)dy$

$$\frac{dy}{dx} + \frac{1}{1+x^2}y = \frac{\tan^{-1}x}{1+x^2}, \text{ is a linear differential equation} \quad \frac{1}{2}$$

$$P = \frac{1}{1+x^2}, Q = \frac{\tan^{-1}x}{1+x^2} \quad \frac{1}{2}$$

$$\text{IF} = e^{\int P dx} = e^{\int \frac{1}{1+x^2} dx} = e^{\tan^{-1}x} \quad \frac{1}{2}$$

$$\text{Solution is } y e^{\int P dx} = \int Q e^{\int P dx} dx + C \quad \frac{1}{2}$$

$$\Rightarrow y e^{\tan^{-1}x} = \int \frac{\tan^{-1}x}{1+x^2} e^{\tan^{-1}x} dx \quad \frac{1}{2}$$

$$\text{Put } t = \tan^{-1}x \Rightarrow dt = \frac{1}{1+x^2} dx$$

$$\begin{aligned} \Rightarrow y e^{\tan^{-1}x} &= \int t e^t dt \\ &= t e^t - e^t + C \end{aligned} \quad 1 \frac{1}{2}$$

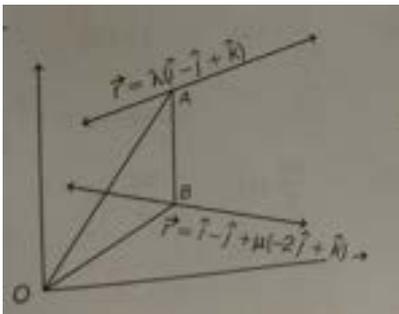
$$\Rightarrow y e^{\tan^{-1}x} = \tan^{-1}x e^{\tan^{-1}x} - e^{\tan^{-1}x} + C$$

$$y e^{\tan^{-1}x} = (\tan^{-1}x - 1)e^{\tan^{-1}x} + C \quad 1$$

35. Given equation of lines are

$$\vec{r} = \lambda(\hat{i} - \hat{j} + \hat{k}) \quad \text{and} \quad \vec{r} = \hat{i} - \hat{j} + \mu(-2\hat{j} + \hat{k}).$$

These lines are not parallel as  $\hat{i} - \hat{j} + \hat{k}$  is not parallel to  $-2\hat{j} + \hat{k}$



$\frac{1}{2}$

Let AB be the shortest distance between the lines such that AB is perpendicular to both the lines.

Let Position vector of the point A lying on the line  $\vec{r} = \lambda(\hat{i} - \hat{j} + \hat{k})$  and Let the position vector of the point B lying on the line  $\vec{r} = \hat{i} - \hat{j} + \mu(-2\hat{j} + \hat{k}) = \hat{i} + (-1 - 2\mu)\hat{j} + \mu\hat{k}$

$$\vec{AB} = \vec{OB} - \vec{OA} = (1 - \lambda)\hat{i} + (-1 - 2\mu + \lambda)\hat{j} + (\mu - \lambda)\hat{k} \quad 1$$

$\vec{AB}$  is perpendicular to both  $\hat{i} - \hat{j} + \hat{k}$  and  $-2\hat{j} + \hat{k}$

$$\Rightarrow 2 + 3\mu - 3\lambda = 0 \dots (1) \quad \text{and} \quad 2 + 5\mu - 3\lambda = 0 \dots (2)$$

$$\text{From (1) and (2) } \lambda = \frac{2}{3}, \mu = 0 \quad 2$$

$$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \frac{1}{3}\hat{i} - \frac{1}{3}\hat{j} - \frac{2}{3}\hat{k} \quad 1$$

$$|\overrightarrow{AB}| = 2/\sqrt{3} \text{ units} \quad \frac{1}{2}$$

SECTION E (4 MARKS)

36.  $1.2^6 = 64$  1

II.  $G = \{g_1, g_2\}$

$$R = \{(g_1, g_1), (g_2, g_2)\} \quad 1$$

III A.  $B = \{b_1, b_2, b_3\}$

$$R_1 = \{(b_1, b_2), (b_2, b_3)\}$$

Ordered pairs to be added to make  $R_1$

(a) reflexive but not symmetric :  $\{(b_1, b_1), (b_2, b_2), (b_3, b_3)\}$  1

(b) reflexive and symmetric but not transitive.

$$\{(b_1, b_1), (b_2, b_2), (b_3, b_3), ((b_2, b_1)(b_3, b_2))\} \quad 1$$

III B.  $x^2 = 4y$ ; where  $0 \leq x \leq 20\sqrt{2}$  &  $0 \leq y \leq 200$ ,

$$\text{Let } y = \frac{x^2}{4} \text{ in } [0, 20\sqrt{2}] \rightarrow [0, 200]$$

To prove one one

$$f(x) = f(y) \Rightarrow \frac{x^2}{4} = \frac{y^2}{4}$$

$$\Rightarrow x^2 = y^2$$

$$\Rightarrow x = \pm y \quad \frac{1}{2}$$

$x = -y$  is not possible as  $0 \leq x \leq 20\sqrt{2}$

$$\Rightarrow x = y \quad \frac{1}{2}$$

To prove on to

$$y \in [0, 200] \text{ and } y = \frac{x^2}{4}$$

$$\Rightarrow x = \pm 2\sqrt{y}$$

Since  $0 \leq y \leq 200$ , for all  $y \in [0, 200]$  there exist a pre image in  $x \in [0, 20\sqrt{2}]$  1

37.I Let  $x$  is the number of days after 1<sup>st</sup> July,

$$\text{Price} = \text{Rs } (300 - 3x) \quad \frac{1}{2}$$

$$\text{Quantity} = 80 \text{ quintals} + x \text{ (1 quintal per day)} \quad \frac{1}{2}$$

$$\begin{aligned} \text{II. } R(x) &= \text{quantity} \times \text{Price} = (300 - 3x)(80 + x) && \frac{1}{2} \\ &= 24000 + 60x - 3x^2 && \frac{1}{2} \end{aligned}$$

$$\text{III A. } R'(x) = 60 - 6x \quad \frac{1}{2}$$

$$R'(x) = 0 \Rightarrow 60 - 6x = 0$$

$$x = 10 \quad 1$$

$$\text{For maximum revenue, } R''(x) = -6 < 0 \quad \frac{1}{2}$$

OR

III B. Pranav's father attains maximum revenue after 10 days. So he should harvest the onions after 10 days of 1<sup>st</sup> July, i.e. on 11<sup>th</sup> July. 1

$$\text{Maximum revenue} = R(10) = \text{Rs } 24300 \quad 1$$

38. Given  $P(A) = P(B) = P(C) = P(D) = \frac{1}{4}$

$$P\left(\frac{L}{A}\right) = \frac{24}{100}, P\left(\frac{L}{B}\right) = \frac{22}{100}, P\left(\frac{L}{C}\right) = \frac{17}{100}, P\left(\frac{L}{D}\right) = \frac{9}{100}$$

$$\text{I. } P\left(\frac{A}{L}\right) = \frac{P(A)P\left(\frac{L}{A}\right)}{P(A)P\left(\frac{L}{A}\right) + P(B)P\left(\frac{L}{B}\right) + P(C)P\left(\frac{L}{C}\right) + P(D)P\left(\frac{L}{D}\right)} \quad \frac{1}{2}$$

$$= \frac{\frac{1}{4} \times \frac{24}{100}}{\frac{1}{4} \times \frac{24}{100} + \frac{1}{4} \times \frac{22}{100} + \frac{1}{4} \times \frac{17}{100} + \frac{1}{4} \times \frac{9}{100}} \quad 1$$

$$= \frac{1}{3} \quad \frac{1}{2}$$

II. Let S = Event that exactly one of the parent is left handed

$$P\left(\frac{L}{S}\right) = \frac{P(L \cap S)}{P(S)} \quad 1$$

$$= \frac{\frac{12}{100}}{\frac{39}{100}} = \frac{12}{39} \quad 1$$

