

APPLIED MATHEMATICS – Code No.241
MARKING SCHEME
CLASS – XII (2025 - 26)

SECTION – A (Solutions of MCQs of 1 Mark each)		
Q. No.	HINTS/SOLUTIONS	Marks
1.	<p>Answer: (A)</p> <p>S. P of 1 kg of the mixture = ₹ 68.20, Gain = 10%</p> <p>C. P of 1 kg of the mixture = ₹ $\left(\frac{100}{110} \times 68.20\right) = ₹ 62$</p> <p>By the rule of alligation, we have</p> <p>Cost of 1 kg tea of 1st kind Cost of 1 kg tea of 2nd kind</p> <div style="text-align: center; margin: 10px 0;"> <p style="margin: 0;"> $₹ 60 \swarrow \quad \searrow ₹ 65$ Mean Price $₹ 62$ $3 \swarrow \quad \searrow 2$ </p> </div> <p>∴ Required ratio = 3:2</p>	1
2.	<p>Answer: (B)</p> <p>Ratio of distances covered by three of them can be expressed as A : B : C :: 100 : 90 : 72 When B covers 90m, C covers 72m When B covers 100m, C covers $\frac{72}{90} \times 100 = 80$ m. ∴ B can give C a start of (100 – 80) m = 20 m</p>	1
3.	<p>Answer: (A)</p> $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at} = \frac{1}{t} \Rightarrow \frac{d^2y}{dx^2} = \frac{d}{dx} \left(\frac{1}{t} \right) = -\frac{1}{t^2} \frac{dt}{dx} = -\frac{1}{t^2} \left(\frac{1}{2at} \right) = -\frac{1}{2at^3}$ <p>At $t = 2$, $\frac{d^2y}{dx^2} = -\frac{1}{2a(2)^3} = -\frac{1}{16a}$</p>	1
4.	<p>Answer: (B)</p> <p>I – b – iii; II – c – i; III – a – ii</p>	1
5.	<p>Answer: (C)</p> <p>The present value of the perpetuity will increase as interest rate and present value of perpetuity are in inverse variation.</p>	1

6.	<p>Answer: (B)</p> <p>$\frac{k-p}{m}$ will be largest when k is largest, p is smallest and m is smallest</p> <p>So $\frac{k-p}{m} \leq \frac{21-9}{3} = \frac{12}{3} = 4$</p>	1
7.	<p>Answer: (A)</p> <p>$A^2 = I$</p>	1
8.	<p>Answer: (C)</p> <p>$x + 2 = \frac{1}{4}(4x + 6) + \frac{1}{2}$ so, $P = \frac{1}{4}$</p>	1
9.	<p>Answer: (A)</p> <p>increases then sampling distribution must approach normal distribution</p>	1
10.	<p>Answer: (A)</p> <p>Degree of freedom = $12 + 10 - 2 = 20$</p>	1
11.	<p>Answer: (C)</p> <p>$P = 1(12 - 12) - \alpha(4 - 6) + 3(4 - 6) = 2(\alpha - 3)$</p> <p>Given $P = adj A \Rightarrow P = adj A = A ^2$</p> <p>$\Rightarrow 2(\alpha - 3) = 4^2 = 16 \Rightarrow 2\alpha = 16 + 6 = 22$</p> <p>$\Rightarrow \alpha = 11$</p>	1
12.	<p>Answer: (A)</p> <p>$\frac{d}{dx} \left[\left(\frac{dy}{dx} \right)^3 \right] = 0 \Rightarrow 3 \left(\frac{dy}{dx} \right)^2 \frac{d^2y}{dx^2} = 0$</p> <p>Order of the differential equation = 2</p>	1
13.	<p>Answer: (C)</p> <p>$P = \frac{R}{i}$</p> <p>$\Rightarrow 40000 = \frac{500}{i}$</p> <p>$\Rightarrow i = 0.0125$</p> <p>$\Rightarrow \frac{r}{4} = 0.0125$</p> <p>$\therefore r = 0.0125 \times 4 = 0.05 = 5\% \text{ p.a.}$</p>	1

14.	<p>Answer: (B)</p> <p>Given $B = -A^{-1}BA \Rightarrow AB = -BA$</p> <p>$\therefore (A + B)^2 = (A + B)(A + B)$ $= A^2 + AB + BA + B^2 = A^2 - BA + BA + B^2 = A^2 + B^2$</p>	1
15.	<p>Answer: (D)</p> <p>Redundant constraints are the constraints that can be removed without changing or affecting the feasible region of a problem</p> <p>$2x + y \geq 10, x \geq 0, y \geq 0$ are the constraints that can be removed.</p>	1
16.	<p>Answer: (C)</p> <p>$P(X = k) = P(X = k + 2)$</p> <p>$\Rightarrow 6C_k \left(\frac{1}{2}\right)^{6-k} \left(\frac{1}{2}\right)^k = 6C_{k+2} \left(\frac{1}{2}\right)^{6-k-2} \left(\frac{1}{2}\right)^{k+2}$</p> <p>$\Rightarrow 6C_k = 6C_{k+2} \Rightarrow 2k + 2 = 6 (\because k \neq k + 2)$</p> <p>$\Rightarrow k = 2$</p>	1
17.	<p>Answer: (D)</p> <p>$4A^2B = 4^3 A ^2 B = 4^3 \times 5^2 \times 4 = 6400$</p>	1
18.	<p>Answer: (B)</p> <p>$n = 2\frac{1}{2}$ years = 30 months</p> <p>$I = ₹ 20000 \times \frac{8}{100} \times \frac{5}{2} = ₹ 4000$</p> <p>$EMI = \frac{P+I}{n}$</p> <p>$= ₹ \left(\frac{20000+4000}{30}\right) = ₹ 800$</p>	1
19.	<p>Answer: (B)</p> <p>$adj(adj A) = adj \left[adj \begin{pmatrix} a & b \\ c & d \end{pmatrix}\right] = adj \begin{pmatrix} d & -b \\ -c & a \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} = A$</p> <p>So, assertion is true.</p> <p>$adj A = da - b(-c) = ad - bc = A$</p> <p>Reason statement is true</p> <p>However, Reason statement is not the correct explanation of Assertion.</p> <p>\therefore Both Assertion (A) and Reason (R) are true and (R) is not the correct explanation of Assertion (A).</p>	1
20.	<p>Answer: (D)</p> <p>Since $0 \leq p \leq 1$, we have $0 \leq (1 - p) \leq 1$</p> <p>$np(1 - p) \leq np \Rightarrow \text{Variance} \leq \text{Mean}$</p> <p>$\therefore$ Assertion (A) is false and Reason (R) is true.</p>	1

Section –B

[This section comprises of solution of very short answer type questions (VSA) of 2 marks each]

<p>21 (A)</p>	<p>Last digit can be obtained by division with 10. required answer = $(2^{100} + 100!) \text{ mod } 10$ $2^5 \text{ mod } 10 = 32 \text{ mod } 10 \equiv 2 \text{ mod } 10 \Rightarrow 2^5 \equiv 2 \text{ mod } 10 \Rightarrow (2^5)^5 \equiv 2^5 \text{ mod } 10$ $\equiv 2 \text{ mod } 10$ $\Rightarrow (2^{25})^4 \equiv 2^4 \text{ mod } 10 \equiv 16 \text{ mod } 10 \equiv 6 \text{ mod } 10 = 6$ Also $100! = 100 \times 99!$ which is divisible by 10 So, $100! \text{ mod } 10 = 0 \Rightarrow (2^{100} + 100!) \text{ mod } 10 \equiv (6 + 0) \text{ mod } 10 = 6$</p> <p align="center">OR</p>	<p align="center">1</p> <p align="center">1</p>
<p>21 (B)</p>	<p>Obviously $\sqrt{6} + \sqrt{5} > \sqrt{3} + \sqrt{2} \Rightarrow \frac{(\sqrt{6} + \sqrt{5})(\sqrt{6} - \sqrt{5})}{(\sqrt{6} - \sqrt{5})} > \frac{(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})}{(\sqrt{3} - \sqrt{2})}$ $\Rightarrow \frac{6-5}{(\sqrt{6} - \sqrt{5})} > \frac{3-2}{(\sqrt{3} - \sqrt{2})} \Rightarrow \frac{1}{(\sqrt{6} - \sqrt{5})} > \frac{1}{(\sqrt{3} - \sqrt{2})}$ $\Rightarrow \sqrt{6} - \sqrt{5} < \sqrt{3} - \sqrt{2} \Rightarrow \sqrt{5} + \sqrt{3} > \sqrt{6} + \sqrt{2}$</p>	<p align="center">$\frac{1}{2}$</p> <p align="center">1</p> <p align="center">$\frac{1}{2}$</p>
<p>22.</p>	<p>$P(X = 1) + P(X = 2) + P(X = 3) + P(X = 4) = 1$ $\Rightarrow 1 \times a + 2 \times a + 3 \times a + b = 1$ $\Rightarrow 6a + b = 1 \dots (i)$ $E(X) = 1 \times a + 2 \times 2a + 3 \times 3a + 4 \times b = 2.8$ $\Rightarrow 14a + 4b = 2.8 \dots (ii)$ Solving (i) and (ii), we get $a = 0.12$ and $b = 0.28$</p>	<p align="center">$\frac{1}{2}$</p> <p align="center">$\frac{1}{2}$</p> <p align="center">$\frac{1}{2} + \frac{1}{2}$</p>
<p>23.</p>	<p>$\text{CAGR} = \left[\left(\frac{EV}{SV} \right)^{\frac{1}{n}} - 1 \right] \times 100$ $\Rightarrow 5 = \left[\left(\frac{125000}{75000} \right)^{\frac{1}{n}} - 1 \right] \times 100$ $\Rightarrow 1.05 = \left(\frac{5}{3} \right)^{\frac{1}{n}}$ $\Rightarrow \log(1.05) = \frac{1}{n} \log(1.67)$ $\Rightarrow n = \frac{0.223}{0.021} = 10.6 \approx 11$ \therefore required number of years = 11 years</p>	<p align="center">1</p> <p align="center">$\frac{1}{2}$</p> <p align="center">$\frac{1}{2}$</p>
<p>24 (A)</p>	<p>Here, $\lambda = 2$ Required probability = $P(X = 3 / X \geq 1) = \frac{P(X=3 \cap X \geq 1)}{P(X \geq 1)} = \frac{P(X=3)}{P(X \geq 1)}$ $P(X = 3) = \frac{2^3 e^{-2}}{3!} = 0.19$ $P(X \geq 1) = 1 - P(X = 0) = 1 - \frac{2^0 e^{-2}}{0!} = 1 - 0.14 = 0.86$ $\therefore P(X = 3 / X \geq 1) = \frac{0.19}{0.86} = 0.22$</p> <p align="center">OR</p>	<p align="center">$\frac{1}{2}$</p> <p align="center">$\frac{1}{2}$</p> <p align="center">$\frac{1}{2}$</p>

24 (B)	$\lambda = \frac{2}{1000} \times 5000 = 10$	1/2
	$P(\text{more than 1 failure}) = P(X > 1) = 1 - [P(X = 0) + P(X = 1)]$	1/2
	$= 1 - \left[\frac{10^0 e^{-10}}{0!} + \frac{10^1 e^{-10}}{1!} \right]$	1/2
	$= 1 - e^{-10}(1 + 10)$ $= 1 - 4.54 \times 10^{-5} \times 11$ $= 1 - 0.0004994 = 0.9995 \text{ approx.}$	1/2
25.	$D = \frac{C-S}{n}$ $\Rightarrow 2500 = \frac{25000-12500}{n}$ $\Rightarrow n = \frac{12500}{2500} = 5$	1
	So, after 5 years the value of the machine will be half of its initial value.	1/2
	Value of machine after 6 years = $25000 - 2500 \times 6 = ₹ 10,000$	1/2

Section –C

[This section comprises of solution short answer type questions (SA) of 3 marks each]

26.	Let speed upstream be x km/hr and speed downstream be y km/hr Since distance upstream and downstream is same $\therefore 8\frac{4}{5}x = 4y \Rightarrow \frac{44}{5}x = 4y \Rightarrow \frac{y}{x} = \frac{11}{5}$ (i)	1
	Now, speed of boat : speed of stream = $\frac{x+y}{2} : \frac{y-x}{2}$	
	(i) $\Rightarrow \frac{y+x}{y-x} = \frac{11+5}{11-5} \Rightarrow \frac{\frac{y+x}{2}}{\frac{y-x}{2}} = \frac{8}{3}$	
	\therefore speed of boat : speed of stream = 8:3	
27 (A)	Given $y = px^3 + qx^2 \Rightarrow \frac{dy}{dx} = 3px^2 + 2qx$ (i)	1
	Since $x = 1$ is a critical point $\therefore 3p(1)^2 + 2q(1) = 0 \Rightarrow 3p + 2q = 0$ (ii)	
	Also, curve passes through $(1, -1)$ so $-1 = p + q$ (iii)	
	Solving (ii) and (iii) we get, $p = 2$ and $q = -3$	
	Using this in (i) we get $\frac{dy}{dx} = 6x^2 - 6x$ Now for other critical point, $\frac{dy}{dx} = 0 \Rightarrow 6x^2 - 6x = 0 \Rightarrow 6x(x - 1) = 0$ $\Rightarrow x = 0$ or 1 Thus, the other critical point is $(0,0)$	
OR		
27 (B)	$AR(x) = \frac{R(x)}{x} = 15 + \frac{x}{3} - \frac{x^3}{36}$, Now $\frac{d}{dx}AR(x) = 0 \Rightarrow 0 + \frac{1}{3} - \frac{3x^2}{36} = 0$	1/2
	$\Rightarrow x^2 = 4 \Rightarrow x = 2$ (as x is non negative)	1/2
	$\Rightarrow x = 2$ is the critical point of $AR(x)$.	1/2
	Now $\frac{d^2[AR(x)]}{dx^2} = 0 - \frac{6(2)}{36} < 0$ hence $AR(x)$ is maximum at $x = 2$	1/2
	$AR(2) = 15 + \frac{2}{3} - \frac{8}{36} = 15 + \frac{4}{9}$	1/2
	Now, $MR(x) = 15 + \frac{2x}{3} - \frac{4x^3}{36} \Rightarrow MR(2) = 15 + \frac{4}{3} - \frac{8}{9} = 15 + \frac{4}{9}$ $\therefore AR(2) = MR(2)$	1/2

<p>28 (A)</p>	<p>$C = \text{Face value or maturity value} = ₹ 56,000,$</p> <p>$n = \text{number of periodic interest payments} = 4 \times 6 = 24$</p> <p>Yield rate $(i) = \frac{9}{400} = 0.0225$</p> <p>$R = \text{Coupon Payment} = \frac{7 \times 56000}{400} = ₹ 980$</p> <p>Purchase price of the bond $(V) = R \left[\frac{1-(1+i)^{-n}}{i} \right] + C(1+i)^{-n}$</p> <p style="text-align: right;">$\left. \begin{array}{l} \\ \\ \\ \end{array} \right\}$</p> <p style="text-align: center;"> $= 980 \left[\frac{1-(1+0.0225)^{-24}}{0.0225} \right] + 56000(1+0.0225)^{-24}$ $= 980 \left[\frac{1-0.58}{0.0225} \right] + 56000 \times 0.58$ $= ₹ (18293.33 + 32480) = ₹ 50773.33$ </p> <p style="text-align: center;">OR</p>	<p>½</p> <p>½</p> <p>1</p> <p>½</p> <p>½</p>
<p>28 (B)</p>	<p>Cost of new machine $= ₹ (50,000 + 30\% \times 50,000) = ₹ 65,000$</p> <p>$A = \text{Amount required in sinking fund} = ₹ (65,000 - 6,000) = ₹ 59,000$</p> <p>$R \left[\frac{(1+i)^n - 1}{i} \right] = A$</p> <p>$R \left[\frac{(1.06)^8 - 1}{0.06} \right] = 59000$</p> <p>$R \left[\frac{1.6 - 1}{0.06} \right] = 59000$</p> <p>$\Rightarrow R = \frac{59000 \times 0.06}{0.6} = ₹ 5900$</p> <p>So, the required amount to be retained $= ₹ 5900$</p>	<p>½</p> <p>½</p> <p>1</p> <p>1</p>
<p>29.</p>	<p>Let t minutes be the total time taken to fill the tank</p> <p>So according to the question,</p> <p>pipe A is open for $(t - 10)$ minutes, pipe C is open for $(t - 10)$ minutes, pipe B is open for 10 minutes.</p> <p>Using work done per minute, we get</p> <p>$\frac{t-10}{30} + \frac{10}{60} + \frac{t-10}{120} = 1 \Rightarrow \frac{5t-30}{120} = 1$</p> <p>$\Rightarrow 5t = 150 \Rightarrow t = 30$ minutes.</p> <p>\therefore It will take 30 minutes to fill the tank.</p>	<p>1</p> <p>1+½</p> <p>½</p>
<p>30.</p>	<p>$H_0: \mu = 1.84$ cm (machine is working properly)</p> <p>$H_1: \mu \neq 1.84$ cm (machine is not working properly)</p> <p>For sample: $\bar{x} = 1.85$ cm and $s = \sqrt{0.0064} = 0.08$ cm</p> <p>At $\alpha = 0.05$ and $df = 15$</p> <p style="text-align: right;">$\left. \begin{array}{l} \\ \\ \end{array} \right\}$</p> <p>$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{1.85 - 1.84}{\frac{0.08}{\sqrt{16}}} = \frac{0.01}{0.08} \times 4 = 0.5$</p> <p>$t_{cal} = 0.5 < t_{critical} = 2.131$ at $\alpha = 0.05$ and $df = 15$</p> <p>\therefore null hypothesis is accepted, there is no significant difference between the sample mean and the population mean, hence machine is working properly.</p>	<p>½</p> <p>½</p> <p>1</p> <p>½</p> <p>½</p>

31.	Let x be the number of units of Product A produced per day and y be the number of units of Product B produced per day The objective is to maximize the profit , which is given by:	}	½
	$Z = 30x + 40y$ subject to the following constraints: $4x + 6y \leq 500$ $x \leq 80$ $y \leq 60$ $x \geq 0, y \geq 0$		1 1½

Section –D

[This section comprises of solution of long answer type questions (LA) of 5 marks each]

32 (A)	Let the production manager produces x number of strips (of 10 tablets) of Paingo, y number of strips (of 10 tablets) X -prene and z number of strips (of 10 tablets) Relaxo. We have the following information from the question		½																		
	<p>From the table we have</p> $2x + 4y + z = 16000 \quad (1)$ $3x + y + 2z = 10000 \quad (2)$ $x + 3y + 3z = 16000 \quad (3)$ <p>The matrices representation of above system of equations is</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Paingo</th> <th>X-prene</th> <th>Relaxo</th> <th>Availability</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$2x$</td> <td>$4y$</td> <td>z</td> <td>16000</td> </tr> <tr> <td>C</td> <td>$3x$</td> <td>y</td> <td>$2z$</td> <td>10000</td> </tr> <tr> <td>D</td> <td>x</td> <td>$3y$</td> <td>$3z$</td> <td>16000</td> </tr> </tbody> </table> $\begin{bmatrix} 2 & 4 & 1 \\ 3 & 1 & 2 \\ 1 & 3 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 16000 \\ 10000 \\ 16000 \end{bmatrix}$ <p>or $AX = B$</p> <p>Since, $A = 2(3 - 6) - 4(9 - 2) + 1(9 - 1)$ $= -6 - 28 + 8 = -26 \neq 0,$</p> <p>Thus A^{-1} exists, so that the unique solution of $AX = B$ is $X = A^{-1}B$.</p> <p>Here, $\text{adj} A = \begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix}$</p> $A^{-1} = \frac{1}{ A } (\text{adj} A) = \frac{1}{-26} \begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix}$ <p>Now, $X = A^{-1}B = \frac{1}{-26} \begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix} \begin{bmatrix} 16000 \\ 10000 \\ 16000 \end{bmatrix} = \begin{bmatrix} 1000 \\ 3000 \\ 2000 \end{bmatrix}$</p> <p>Hence, number of strips of Paingo, X -prene and Relaxo are 1000, 3000 and 2000 respectively</p>			Paingo	X-prene	Relaxo	Availability	A	$2x$	$4y$	z	16000	C	$3x$	y	$2z$	10000	D	x	$3y$	$3z$
	Paingo	X-prene	Relaxo	Availability																	
A	$2x$	$4y$	z	16000																	
C	$3x$	y	$2z$	10000																	
D	x	$3y$	$3z$	16000																	
OR																					

<p>32 (B)</p>	<p>Under equilibrium condition, For market A $82 - 3p_A + p_B = -5 + 15p_A \Rightarrow 18p_A - p_B = 87$ For market B $92 + 2p_A - 4p_B = -6 + 32p_B \Rightarrow 2p_A - 36p_B = -98$ Now, $D = -646, \quad D_A = -3230, \quad D_B = -1938$ $p_A = \frac{ D_A }{ D } = \frac{-3230}{-646} = 5$ $p_B = \frac{ D_B }{ D } = \frac{-1938}{-646} = 3$</p>	<p>1½ 1 1½ ½ ½</p>																																										
<p>33.</p>	<p>Profit = Revenue – Cost $\Rightarrow \frac{dP}{dx} = \frac{dR}{dx} - \frac{dC}{dx}$ $\Rightarrow \frac{dP}{dx} = MR - MC \Rightarrow \frac{dP}{dx} = -81 + 36x - 3x^2$ For maximum profit $\frac{dP}{dx} = 0 \Rightarrow -81 + 36x - 3x^2 = 0 \Rightarrow x = 3 \text{ or } 9$ Now $\frac{d^2P}{dx^2} = 36 - 6x = 36 - 54 < 0$, at $x = 9$, so P is maximum at $x = 9$. Since $\frac{dP}{dx} = -81 + 36x - 3x^2 \Rightarrow P = \int(-81 + 36x - 3x^2)dx + c$ $\Rightarrow P = -81x + 18x^2 - x^3 + c$ When $x = 0, P = 0 \Rightarrow c = 0$ $\Rightarrow P = -81x + 18x^2 - x^3$ and at $x = 9, P = -729 + 2(729) - 729 = 0$ \therefore Total profit at profit maximizing output is 0.</p>	<p>1 1 ½ 1 ½ 1</p>																																										
<p>34 (A)</p>	<p>Take 2019 as the middle year, i.e., $A = 2019$</p> <table border="1" data-bbox="209 1290 1281 1727"> <thead> <tr> <th>Year (x_i)</th> <th>Rice Production (million tonnes) (Y)</th> <th>$X = x_i - A$</th> <th>X^2</th> <th>XY</th> <th>Trend Values $Y = a + bX$</th> </tr> </thead> <tbody> <tr> <td>2017</td> <td>9.5</td> <td>-2</td> <td>4</td> <td>-19.0</td> <td>9.40</td> </tr> <tr> <td>2018</td> <td>10.0</td> <td>-1</td> <td>1</td> <td>-10.0</td> <td>10.02</td> </tr> <tr> <td>2019</td> <td>10.5</td> <td>0</td> <td>0</td> <td>0.0</td> <td>10.64</td> </tr> <tr> <td>2020</td> <td>11.2</td> <td>1</td> <td>1</td> <td>11.2</td> <td>11.26</td> </tr> <tr> <td>2021</td> <td>12.0</td> <td>2</td> <td>4</td> <td>24.0</td> <td>11.88</td> </tr> <tr> <td>Total</td> <td>53.2</td> <td>0</td> <td>10</td> <td>6.2</td> <td></td> </tr> </tbody> </table> <p>$a = \frac{\sum Y}{n} = \frac{53.2}{5} = 10.64$ $b = \frac{\sum XY}{\sum X^2} = \frac{6.2}{10} = 0.62$ \therefore The trend equation is $y = 10.64 + 0.62x$ For the year 2025; $y = 10.64 + 0.62(6) = 14.36$ million tonnes</p> <p style="text-align: center;">OR</p>	Year (x_i)	Rice Production (million tonnes) (Y)	$X = x_i - A$	X^2	XY	Trend Values $Y = a + bX$	2017	9.5	-2	4	-19.0	9.40	2018	10.0	-1	1	-10.0	10.02	2019	10.5	0	0	0.0	10.64	2020	11.2	1	1	11.2	11.26	2021	12.0	2	4	24.0	11.88	Total	53.2	0	10	6.2		<p>3 marks for correc t table</p> <p>½ ½ ½ ½</p>
Year (x_i)	Rice Production (million tonnes) (Y)	$X = x_i - A$	X^2	XY	Trend Values $Y = a + bX$																																							
2017	9.5	-2	4	-19.0	9.40																																							
2018	10.0	-1	1	-10.0	10.02																																							
2019	10.5	0	0	0.0	10.64																																							
2020	11.2	1	1	11.2	11.26																																							
2021	12.0	2	4	24.0	11.88																																							
Total	53.2	0	10	6.2																																								

34 (B)	Month	Number of vehicles (Thousands)	3-Month Moving Total	3-Month Moving Average	3 marks for correc t table
	March	30	-	-	
	April	35	103	34.33	
	May	38	109	36.33	
	June	36	114	38.00	
	July	40	118	39.33	
	August	42	121	40.33	
	September	39	126	42.00	
	October	45	132	44.00	
	November	48	140	46.67	
	December	47	-	-	
Correct graph					2

35.	<p>Loan amount = $P = ₹ (10,00,000 - 2,00,000) = ₹ 8,00,000$</p> <p>$i = \frac{10}{12 \times 100} = 0.0083$</p> <p>$n = 5 \times 12 = 60$</p> <p>$EMI = \frac{P \times i \times (1+i)^n}{(1+i)^n - 1}$</p> <p>$= \frac{800000 \times 0.0083 \times (1+0.0083)^{60}}{(1+0.0083)^{60} - 1}$</p> <p>$= \frac{800000 \times 0.0083 \times 1.64}{1.64 - 1} = ₹ 17,015$</p> <p>Total interest paid = $n \times EMI - P$</p> <p>$= ₹ (17,015 \times 60 - 8,00,000)$</p> <p>$= ₹ (10,20,900 - 8,00,000) = ₹ 2,20,900$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1½</p> <p>1</p>
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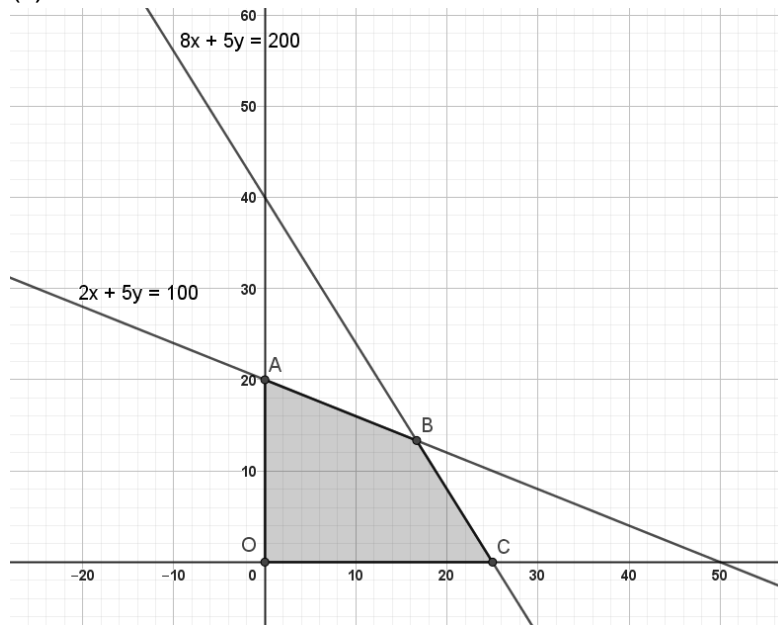
Section –E

[This section comprises solution of 3 case- study/passage-based questions of 4 marks each. Solutions of the first two case study questions have three sub parts (i),(ii),(iii) of 1,1 and 2 marks respectively. Solution of the third case study question has two sub parts of 2 marks each.]

36.	<p>Here, $\mu = 75, \sigma = 8, n = 500$</p> <p>(i) For $X = 75, Z = \frac{X - \mu}{\sigma} = \frac{75 - 75}{8} = 0$</p> <p>$P(X < 75) = P(Z < 0) = 0.5$</p> <p>50 % of students scored below 75 marks.</p> <p>(ii) For $X = 82, Z = \frac{82 - 75}{8} = 0.875$</p> <p>$P((X > 82) = P(Z > 0.875) = 1 - P(Z < 0.875) = 1 - 0.8092 = 0.1908$</p> <p>$\therefore$ Required number of students = $0.1908 \times 500 = 95.4 \approx 95$</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
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	<p>(iii) (A) For $X = 67, Z = \frac{67-75}{8} = -1$</p> <p>For $X = 83, Z = \frac{83-75}{8} = 1$</p> <p>$P(67 < X < 83) = P(-1 < Z < 1)$</p> <p>$= P(Z < 1) - P(Z < -1)$</p> <p>$= 0.8413 - 0.1587 = 0.6826$</p> <p>$\therefore$ Required number of students $= 0.6826 \times 500 = 341.3 \approx 341$</p> <p style="text-align: center;">OR</p> <p>(B) Top 10% corresponds to the 90th percentile.</p> <p>$\Rightarrow Z = \frac{X-\mu}{\sigma} = 1.28$</p> <p>$\Rightarrow \frac{X-75}{8} = 1.28$</p> <p>$\Rightarrow X = 85.24 \approx 85$</p> <p>$\therefore$ The minimum score required to qualify for the scholarship is 85 marks.</p>	<p style="text-align: right;">} } }</p> <p style="text-align: right;">1/2</p> <p style="text-align: right;">1</p> <p style="text-align: right;">1/2</p> <p style="text-align: right;">1</p> <p style="text-align: right;">1</p>
<p>37.</p>	<p>(i) $p_d = a + bx$</p> <p>$\Rightarrow 20 = a + 400b \dots$ (i)</p> <p>and $25 = a + 200b \dots$ (ii)</p> <p>Solving (i) and (ii), we get $a = 30, b = -\frac{1}{40}$</p> <p>$\therefore p_d = 30 - \frac{1}{40}x$</p> <p>(ii) For equilibrium, $p_d = p_s$</p> <p>$\Rightarrow 30 - \frac{1}{40}x = -15 + \frac{x}{20}$</p> <p>$\therefore x = 600$</p> <p>Equilibrium price $= 30 - \frac{1}{40} \times 600 = ₹ 15$</p> <p>(iii) (A) Consumer surplus $= \int_0^{600} \left(30 - \frac{1}{40}x\right) dx - 600 \times 15$</p> <p>$= \left[30x - \frac{1}{80}x^2\right]_0^{600} - 9000$</p> <p>$= 13500 - 9000 = 4500$</p> <p>$\therefore$ Consumer surplus $= ₹ 4500$</p> <p style="text-align: center;">OR</p> <p>(B) Producer surplus $= 600 \times 15 - \int_0^{600} \left(-15 + \frac{x}{20}\right) dx$</p> <p>$= 9000 - \left[-15x + \frac{1}{40}x^2\right]_0^{600}$</p> <p>$= 9000 - (-9000 + 9000) = 9000$</p> <p>$\therefore$ Producer surplus $= ₹ 9000$</p>	<p style="text-align: right;">} }</p> <p style="text-align: right;">1/2</p> <p style="text-align: right;">1/2</p> <p style="text-align: right;">1/2</p> <p style="text-align: right;">1</p> <p style="text-align: right;">1</p> <p style="text-align: right;">1</p> <p style="text-align: right;">1</p>
<p>38.</p>	<p>(i) Let the distance the man travels at 25 km/hr be denoted by x and the distance he travels at 40 km/hr be denoted by y</p> <p>Linear programming problem is</p> <p>Objective function is to Maximize $Z = x + y$</p> <p>Subject to the constraints:</p> <p style="text-align: center;"> $\left. \begin{aligned} \frac{x}{25} + \frac{y}{40} &\leq 1 \text{ i.e., } 8x + 5y \leq 200 \\ 2x + 5y &\leq 100 \\ x \geq 0, y &\geq 0 \end{aligned} \right\}$ </p>	<p style="text-align: right;">1/2</p> <p style="text-align: right;">1/2</p> <p style="text-align: right;">1</p>

(ii)



Corner Points	Value of Z
$O(0,0)$	0
$A(0,20)$	20
$B\left(\frac{50}{3}, \frac{40}{3}\right)$	30
$C(25,0)$	25

Thus, the maximum distance the man can travel within one hour is **30 km**.

1½

½