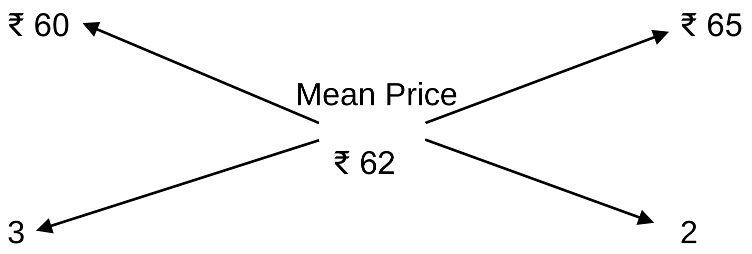
APPLIED MATHEMATICS – Code No.241
MARKING SCHEME
CLASS – XII (2025 - 26)

SECTION – A (Solutions of MCQs of 1 Mark each)		
Q. No.	**HINTS/SOLUTIONS**	**Marks**
1.	**Answer: (A)** S. P of 1 kg of the mixture = ₹ 68.20, Gain = 10% C. P of 1 kg of the mixture = ₹ $\left(\frac{100}{110} \times 68.20\right)$ = ₹ 62 By the rule of alligation, we have Cost of 1 kg tea of 1st kind Cost of 1 kg tea of 2nd kind  ∴ Required ratio = $3:2$	**1**
2.	**Answer: (B)** 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	**1**
3.	**Answer: (A)** $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at} = \frac{1}{t} \quad \Rightarrow \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{1}{t}\right) = -\frac{1}{t^2}\frac{dt}{dx} = -\frac{1}{t^2}\left(\frac{1}{2at}\right) = -\frac{1}{2at^3}$ $At\ t = 2, \frac{d^2y}{dx^2} = -\frac{1}{2a(2)^3} = -\frac{1}{16a}$	**1**
4.	**Answer: (B)** I – b – iii; II – c – i; III – a – ii	**1**
5.	**Answer: (C)** The present value of the perpetuity will increase as interest rate and present value of perpetuity are in inverse variation.	**1**

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

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

Section –B [This section comprises of solution of very short answer type questions (VSA) of 2 marks each]		
21 (A)	Last digit can be obtained by division with 10. required answer = $(2^{100} + 100!)mod\ 10$ $2^5 mod10 = 32mod10 \equiv 2mod10 \Rightarrow 2^5 \equiv 2\text{mod}10 \Rightarrow (2^5)^5 \equiv 2^5\text{mod}10 \equiv 2\text{ mod}10$ $\Rightarrow (2^{25})^4 \equiv 2^4\text{mod}10 \equiv 16\text{ mod}10 \equiv 6\text{ mod}10 = 6$ Also 100! = 100 x 99! which is divisible by 10 So, $100!\ mod\ 10 = 0 \quad \Rightarrow (2^{100} + 100!)mod\ 10 \equiv (6+0)mod10 = 6$ **OR**	**1** **1**
21 (B)	Obviously $\sqrt{6} + \sqrt{5} > \sqrt{3} + \sqrt{2} \Rightarrow \frac{(\sqrt{6}+\sqrt{5})(\sqrt{6}-\sqrt{5})}{(\sqrt{6}-\sqrt{5})} > \frac{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})}{(\sqrt{3}-\sqrt{2})}$ $\Rightarrow \frac{6-5}{(\sqrt{6}-\sqrt{5})} > \frac{3-2}{(\sqrt{3}-\sqrt{2})} \Rightarrow \frac{1}{(\sqrt{6}-\sqrt{5})} > \frac{1}{(\sqrt{3}-\sqrt{2})}$ $\Rightarrow \sqrt{6} - \sqrt{5} < \sqrt{3} - \sqrt{2} \quad \Rightarrow \sqrt{5} + \sqrt{3} > \sqrt{6} + \sqrt{2}$	½ **1** ½
22.	$P(X=1) + P(X=2) + P(X=3) + P(X=4) = 1$ $\Rightarrow 1 \times a + 2 \times a + 3 \times a + b = 1$ $\Rightarrow 6a + b = 1$ … (i) $E(X) = 1 \times a + 2 \times 2a + 3 \times 3a + 4 \times b = 2.8$ $\Rightarrow 14a + 4b = 2.8$ … (ii) Solving (i) and (ii), we get $a = 0.12$ and $b = 0.28$	½ ½ ½+½
23.	CAGR = $\left[\left(\frac{EV}{SV}\right)^{\frac{1}{n}} - 1\right] \times 100$ $\Rightarrow 5 = \left[\left(\frac{125000}{75000}\right)^{\frac{1}{n}} - 1\right] \times 100$ $\Rightarrow 1.05 = \left(\frac{5}{3}\right)^{\frac{1}{n}}$ $\Rightarrow \log(1.05) = \frac{1}{n}\log(1.67)$ $\Rightarrow n = \frac{0.223}{0.021} = 10.6 \approx 11$ ∴ required number of years = 11 years	**1** ½ ½
24 (A)	Here, $\lambda = 2$ Required probability = $P(X = 3/X \geq 1) = \frac{P(X=3 \cap X \geq 1)}{P(X \geq 1)} = \frac{P(X=3)}{P(X \geq 1)}$ $P(X=3) = \frac{2^3 e^{-2}}{3!} = 0.19$ $P(X \geq 1) = 1 - P(X=0) = 1 - \frac{2^0 e^{-2}}{0!} = 1 - 0.14 = 0.86$ $\therefore P(X = 3/X \geq 1) = \frac{0.19}{0.86} = 0.22$ **OR**	½ ½ ½ ½

24 (B)	$\lambda = \frac{2}{1000} \times 5000 = 10$ P(more than 1 failure) $= P(X > 1) = 1 - [P(X = 0) + P(X = 1)]$ $= 1 - \left[\frac{10^0 e^{-10}}{0!} + \frac{10^1 e^{-10}}{1!}\right]$ $= 1 - e^{-10}(1 + 10)$ $= 1 - 4.54 \times 10^{-5} \times 11$ $= 1 - 0.0004994 = 0.9995$ approx.	½ ½ ½ ½
25.	$D = \frac{C-S}{n}$ $\Rightarrow 2500 = \frac{25000-12500}{n}$ $\Rightarrow n = \frac{12500}{2500} = 5$ So, after 5 years the value of the machine will be half of its initial value. Value of machine after 6 years $= 25000 - 2500 \times 6 =$ ₹ $10{,}000$	**1** ½ ½
	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) 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 $= 8:3$	**1** **1** **1**
27 (A)	Given $y = px^3 + qx^2 \;\Rightarrow\; \frac{dy}{dx} = 3px^2 + 2qx$ (i) 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, $\frac{dy}{dx} = 0 \Rightarrow 6x^2 - 6x = 0 \Rightarrow 6x(x-1) = 0$ $\Rightarrow x = 0 \text{ or } 1$ Thus, the other critical point is $(0,0)$ **OR**	**1** ½ **1** ½
27 (B)	$AR(x) = \frac{R(x)}{x} = 15 + \frac{x}{3} - \frac{x^3}{36}$, Now $\frac{d}{dx}AR(x) = 0 \;\Rightarrow\; 0 + \frac{1}{3} - \frac{3x^2}{36} = 0$ $\Rightarrow\; x^2 = 4 \;\Rightarrow\; x = 2$ (as x is non negative) $\Rightarrow x = 2$ is the critical point of $AR(x)$. Now $\frac{d^2[AR(x)]}{dx^2} = 0 - \frac{6(2)}{36} < 0$ hence $AR(x)$ is maximum at $x = 2$ $AR(2) = 15 + \frac{2}{3} - \frac{8}{36} = 15 + \frac{4}{9}$ Now, $MR(x) = 15 + \frac{2x}{3} - \frac{4x^3}{36} \;\Rightarrow\; MR(2) = 15 + \frac{4}{3} - \frac{8}{9} = 15 + \frac{4}{9}$ $\therefore AR(2) = MR(2)$	½ ½ ½ ½ ½ ½

28 (A)	C = Face value or maturity value = ₹ 56,000, n = number of periodic interest payments = $4 \times 6 = 24$ Yield rate $(i) = \frac{9}{400} = 0.0225$ R = Coupon Payment = $\frac{7 \times 56000}{400} =$ ₹ 980 Purchase price of the bond $(V) = R\left[\frac{1-(1+i)^{-n}}{i}\right] + C\,(1+i)^{-n}$ $= 980\left[\frac{1-(1+0.0225)^{-24}}{0.0225}\right] + 56000(1+0.0225)^{-24}$ $= 980\left[\frac{1-0.58}{0.0225}\right] + 56000 \times 0.58$ = ₹ (18293.33 + 32480) = ₹ 50773.33 **OR**	½ ½ 1 ½ ½
28 (B)	Cost of new machine = ₹ (50,000 + 30% × 50,000) = ₹ 65,000 A = Amount required in sinking fund = ₹ (65,0000 − 6,000) = ₹ 59,000 $R\left[\frac{(1+i)^n-1}{i}\right] = A$ $R\left[\frac{(1.06)^8-1}{0.06}\right] = 59000$ $R\left[\frac{1.6-1}{0.06}\right] = 59000$ $\Rightarrow R = \frac{59000 \times 0.06}{0.6} =$ ₹ 5900 So, the required amount to be retained = ₹ 5900	½ ½ 1 1
29.	Let **t** minutes be the total time taken to fill the tank So according to the question, pipe A is open for (t – 10) minutes, pipe C is open for (t – 10) minutes, pipe B is open for 10 minutes. Using work done per minute, we get $\frac{t-10}{30} + \frac{10}{60} + \frac{t-10}{120} = 1 \Rightarrow \frac{5t-30}{120} = 1$ $\Rightarrow 5t = 150 \Rightarrow t = 30$ minutes. ∴ It will take 30 minutes to fill the tank.	1 1+½ ½
30.	$H_0: \mu = 1.84$ cm (machine is working properly) $H_1: \mu \neq 1.84$ cm (machine is not working properly) For sample: $\bar{x} = 1.85$ cm and $s = \sqrt{0.0064} = 0.08$ cm At $\alpha = 0.05$ and df = 15 $t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}} = \frac{1.85 - 1.84}{\frac{0.08}{\sqrt{16}}} = \frac{0.01}{0.08} \times 4 = 0.5$ $\lvert t_{cal} \rvert = 0.5 < t_{critical} = 2.131$ at $\alpha = 0.05$ and df = 15 ∴ null hypothesis is accepted, there is no significant difference between the sample mean and the population mean, hence machine is working properly.	½ ½ 1 ½ ½

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 — **½**

The objective is to **maximize the profit**, which is given by:

$$Z = 30\,x + 40\,y$$

subject to the following constraints: — **1**

$$4\,x + 6\,y \le 500$$
$$x \le 80$$
$$y \le 60$$
$$x \ge 0, y \ge 0$$

— **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 tables) X -prene and z number of strips (of 10 tablets) Relaxo. — **½**

We have the following information from the question

	Paingo	X-prene	Relaxo	Availability
A	$2x$	$4y$	z	16000
C	$3x$	y	$2z$	10000
D	x	$3y$	$3z$	16000

From the table we have

$2x + 4y + z = 16000$ (1)

$3x + y + 2z = 10000$ (2)

$x + 3y + 3z = 16000$ (3)

The matrices representation of above system of equations is

$$\begin{bmatrix} 2 & 4 & 1 \\ 3 & 1 & 2 \\ 1 & 3 & 3 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 16000 \\ 10000 \\ 16000 \end{bmatrix}$$

— **1**

or $AX = B$

Since, $|A| = 2(3-6) - 4(9-2) + 1(9-1)$

$= -6 - 28 + 8 = -26 \ne 0,$ — **½**

Thus A^{-1} exists, so that the unique solution of $AX = B$ is $X = A^{-1}B$.

Here, $\text{adj}\,A = \begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix}$ — **1**

$$A^{-1} = \frac{1}{|A|}(adj\ A) = \frac{1}{-26}\begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix}$$

— **½**

Now, $X = A^{-1}B = \frac{1}{-26}\begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix}\begin{bmatrix} 16000 \\ 10000 \\ 16000 \end{bmatrix} = \begin{bmatrix} 1000 \\ 3000 \\ 2000 \end{bmatrix}$

Hence, number of strips of Paingo, X -prene and Relaxo are 1000, 3000 and 2000 respectively — **1½**

OR

32 (B)

Under equilibrium condition,

For market A

$82 - 3p_A + p_B = -5 + 15p_A \implies 18p_A - p_B = 87$ **1½**

For market B

$92 + 2p_A - 4\,p_B = -6 + 32p_B \implies 2p_A - 36p_B = -98$ **1**

Now,

$|D| = -646$, $|D_A| = -3230,$ $|D_B| = -1938$ **1 ½**

$p_A = \frac{|D_A|}{|D|} = \frac{-3230}{-646} = 5$ **½**

$p_B = \frac{|D_B|}{|D|} = \frac{-1938}{-646} = 3$ **½**

33.

Profit = Revenue – Cost $\implies \frac{dP}{dx} = \frac{dR}{dx} - \frac{dC}{dx}$ **1**

$\implies \frac{dP}{dx} =$ MR – MC $\implies \frac{dP}{dx} = -81 + 36x - 3x^2$ **1**

For maximum profit $\frac{dP}{dx} = 0 \implies -81 + 36x - 3x^2 = 0 \implies x = 3\ or\ 9$ **½**

Now $\frac{d^2P}{dx^2} = 36 - 6x = 36 - 54 < 0$, at $x = 9$, so P is maximum at $x = 9$.

Since $\frac{dP}{dx} = -81 + 36x - 3x^2 \implies P = \int(-81 + 36x - 3x^2)dx + c$

$\implies P = -81x + 18x^2 - x^3 + c$ **1**

When $x = 0, P = 0 \implies c = 0$

$\implies P = -81x + 18x^2 - x^3$ and at $x = 9, P = -729 + 2(729) - 729 = 0$ **½**

∴ Total profit at profit maximizing output is 0. **1**

34 (A)

Take 2019 as the middle year, i.e., $A = 2019$

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	

3 marks for correct table

$a = \frac{\sum Y}{n} = \frac{53.2}{5} = 10.64$ **½**

$b = \frac{\sum XY}{\sum X^2} = \frac{6.2}{10} = 0.62$ **½**

∴The trend equation is $y = 10.64 + 0.62\,x$ **½**

For the year 2025; $y = 10.64 + 0.62(6) = 14.36$ million tonnes **½**

OR

34 (B)	<table><tr><th>Month</th><th>Number of vehicles (Thousands)</th><th>3-Month Moving Total</th><th>3-Month Moving Average</th></tr><tr><td>March</td><td>30</td><td>-</td><td>-</td></tr><tr><td>April</td><td>35</td><td>103</td><td>34.33</td></tr><tr><td>May</td><td>38</td><td>109</td><td>36.33</td></tr><tr><td>June</td><td>36</td><td>114</td><td>38.00</td></tr><tr><td>July</td><td>40</td><td>118</td><td>39.33</td></tr><tr><td>August</td><td>42</td><td>121</td><td>40.33</td></tr><tr><td>September</td><td>39</td><td>126</td><td>42.00</td></tr><tr><td>October</td><td>45</td><td>132</td><td>44.00</td></tr><tr><td>November</td><td>48</td><td>140</td><td>46.67</td></tr><tr><td>December</td><td>47</td><td>-</td><td>-</td></tr></table> Correct graph	**3 marks for correct table** **2**
35.	Loan amount = $P = ₹\ (10{,}00{,}000 - 2{,}00{,}000) = ₹\ 8{,}00{,}000$ $i = \frac{10}{12\times100} = 0.0083$ $n = 5 \times 12 = 60$ EMI $= \frac{P\times i\times(1+i)^n}{(1+i)^n-1}$ $= \frac{800000\times0.0083\times(1+0.0083)^{60}}{(1+0.0083)^{60}-1}$ $= \frac{800000\times0.0083\times1.64}{1.64-1} = ₹\ 17{,}015$ Total interest paid $= n \times EMI - P$ $= ₹\ (17{,}015 \times 60 - 8{,}00{,}000)$ $= ₹\ (10{,}20{,}900 - 8{,}00{,}000) = ₹\ 2{,}20{,}900$	½ ½ ½ 1 1½ 1

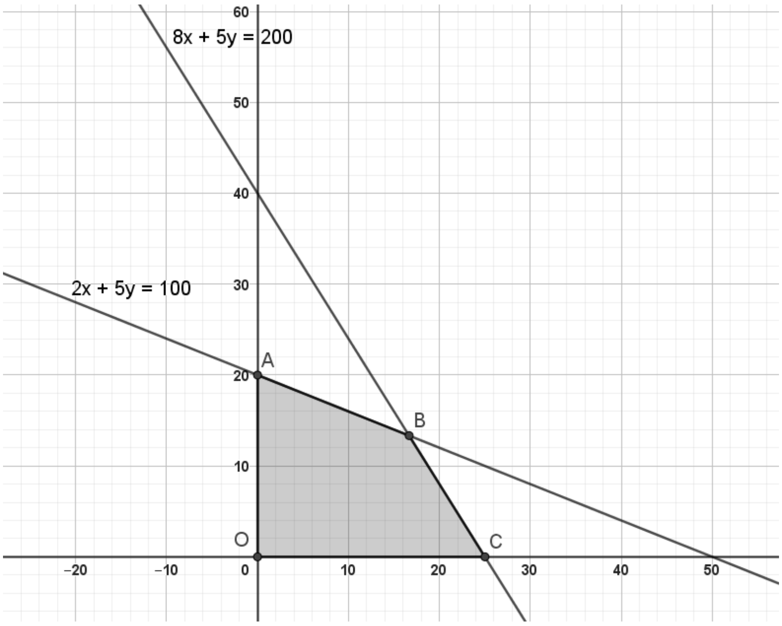
Section –E

[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.	Here, $\mu = 75, \sigma = 8, n = 500$ (i) For $X = 75, Z = \frac{X-\mu}{\sigma} = \frac{75-75}{8} = 0$ $P(X < 75) = P(Z < 0) = 0.5$ 50 % of students scored below 75 marks. (ii) For $X = 82, Z = \frac{82-75}{8} = 0.875$ $P((X > 82) = P(Z > 0.875) = 1 - P(Z < 0.875) = 1 - 0.8092 = 0.1908$ ∴ Required number of students $= 0.1908 \times 500 = 95.4 \approx 95$	½ ½ ½ ½

	(iii) (A) For $X = 67, Z = \frac{67-75}{8} = -1$ For $X = 83, Z = \frac{83-75}{8} = 1$ $P(67 < X < 83) = P(-1 < Z < 1)$ $= P(Z < 1) - P(Z < -1)$ $= 0.8413 - 0.1587 = 0.6826$ ∴ Required number of students $= 0.6826 \times 500 = 341.3 \approx 341$ **OR** (B) Top 10% corresponds to the 90th percentile. $\Rightarrow Z = \frac{X-\mu}{\sigma} = 1.28$ $\Rightarrow \frac{X-75}{8} = 1.28$ $\Rightarrow X = 85.24 \approx 85$ ∴ The minimum score required to qualify for the scholarship is 85 marks.	½ 1 ½ 1 1
37.	(i) $p_d = a + bx$ $\Rightarrow 20 = a + 400\,b$ … (i) and $25 = a + 200\,b$ … (ii) Solving (i) and (ii), we get $a = 30, b = -\frac{1}{40}$ ∴ $p_d = 30 - \frac{1}{40}x$ (ii) For equilibrium, $p_d = p_s$ $\Rightarrow 30 - \frac{1}{40}x = -15 + \frac{x}{20}$ ∴ $x = 600$ Equilibrium price $= 30 - \frac{1}{40} \times 600 =$ ₹ 15 (iii) (A) Consumer surplus $= \int_0^{600} \left(30 - \frac{1}{40}x\right) dx - 600 \times 15$ $= \left[30\,x - \frac{1}{80}x^2\right]_0^{600} - 9000$ $= 13500 - 90000 = 4500$ ∴ Consumer surplus = ₹ 4500 **OR** (B) Producer surplus $= 600 \times 15 - \int_0^{600} \left(-15 + \frac{x}{20}\right) dx$ $= 9000 - \left[-15\,x + \frac{1}{40}x^2\right]_0^{600}$ $= 9000 - (-9000 + 9000) = 9000$ ∴ Producer surplus = ₹ 9000	½ ½ ½ ½ 1 1 1 1
38.	(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 Linear programming problem is Objective function is to Maximize $Z = x + y$ Subject to the constraints: $\frac{x}{25} + \frac{y}{40} \leq 1$ i.e., $8x + 5y \leq 200$ $2x + 5y \leq 100$ $x \geq 0, y \geq 0$	½ ½ 1

	(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

1½

Thus, the maximum distance the man can travel within one hour is **30 km.** ½