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 ₹ 60 ₹ 65 Mean Price ₹ 62 3 2 ∴ 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)** $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at} = \frac{1}{t}$ $\Rightarrow \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{1}{t}\right) = -\frac{1}{t^2}\frac{dt}{dx} = -\frac{1}{t^2}\left(\frac{1}{2at}\right) = -\frac{1}{2at^3}$ $At\ t = 2, \frac{d^2y}{dx^2} = -\frac{1}{2a(2)^3} = -\frac{1}{16a}$	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)**	1
	$\frac{k-p}{m}$ will be largest when k is largest, p is smallest and m is smallest	
	So $\frac{k-p}{m} \leq \frac{21-9}{3} = \frac{12}{3} = 4$	
7.	**Answer: (A)**	1
	$A^2 = I$	
8.	**Answer: (C)**	1
	$x + 2 = \frac{1}{4}(4x + 6) + \frac{1}{2}$ so, $P = \frac{1}{4}$	
9.	**Answer: (A)**	1
	increases then sampling distribution must approach normal distribution	
10.	**Answer: (A)**	1
	Degree of freedom $= 12 + 10 - 2 = 20$	
11.	**Answer: (C)**	1
	$\lvert P \rvert = 1(12 - 12) - \alpha(4 - 6) + 3(4 - 6) = 2(\alpha - 3)$	
	Given $P = adj\, A \Rightarrow \lvert P \rvert = \lvert adj\, A \rvert = \lvert A \rvert^2$	
	$\Rightarrow 2(\alpha - 3) = 4^2 = 16 \Rightarrow 2\,\alpha = 16 + 6 = 22$	
	$\Rightarrow \alpha = 11$	
12.	**Answer: (A)**	1
	$\frac{d}{dx}\left[\left(\frac{dy}{dx}\right)^3\right] = 0 \Rightarrow 3\left(\frac{dy}{dx}\right)^2 \frac{d^2y}{dx^2} = 0$	
	Order of the differential equation $= 2$	
13.	**Answer: (C)**	1
	$P = \frac{R}{i}$	
	$\Longrightarrow 40000 = \frac{500}{i}$	
	$\Longrightarrow i = 0.0125$	
	$\Longrightarrow \frac{r}{4} = 0.0125$	
	$\therefore r = 0.0125 \times 4 = 0.05 = 5\,\%$ p.a.	

14.	**Answer: (B)**	1
	Given $B = -A^{-1}BA \Rightarrow AB = -BA$	
	$\therefore (A + B)^2 = (A + B)(A + B)$	
	$\qquad = A^2 + AB + BA + B^2 = A^2 - BA + BA + B^2 = A^2 + B^2$	
15.	**Answer: (D)**	1
	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.	
16.	**Answer: (C)**	1
	$P(X = k) = P(X = k + 2)$	
	$\Rightarrow 6_{C_k}\left(\frac{1}{2}\right)^{6-k}\left(\frac{1}{2}\right)^{k} = 6_{C_{k+2}}\left(\frac{1}{2}\right)^{6-k-2}\left(\frac{1}{2}\right)^{k+2}$	
	$\Rightarrow 6_{C_k} = 6_{C_{k+2}} \Rightarrow 2k + 2 = 6 \ (\because k \neq k + 2)$	
	$\Rightarrow k = 2$	
17.	**Answer: (D)**	1
	$\lvert 4A^2 B \rvert = 4^3 \lvert A \rvert^2 \lvert B \rvert = 4^3 \times 5^2 \times 4 = 6400$	
18.	**Answer: (B)**	1
	$n = 2\frac{1}{2}$ years $= 30$ months	
	$I = ₹\ 20000 \times \frac{8}{100} \times \frac{5}{2} = ₹\ 4000$	
	EMI $= \frac{P+I}{n}$	
	$= ₹\left(\frac{20000+4000}{30}\right) = ₹\ 800$	
19.	**Answer: (B)**	1
	$adj\ (adj\ A) = adj\left[\text{adj}\begin{pmatrix} a & b \\ c & d \end{pmatrix}\right] = adj\begin{pmatrix} d & -b \\ -c & a \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} = A$	
	So, assertion is true.	
	$\lvert adj\ A \rvert = da - b(-c) = ad - bc = \lvert A \rvert$	
	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).	
20.	**Answer: (D)**	1
	Since $0 \leq p \leq 1$, we have $0 \leq (1 - p) \leq 1$	
	$np(1 - p) \leq np \Rightarrow$ Variance $\leq$ Mean	
	$\therefore$ Assertion (A) is false and Reason (R) is true.	

21 (A)	Last digit can be obtained by division with 10.	
	required answer = $(2^{100} + 100!)\ mod\ 10$	
	$2^5 mod10 = 32 mod10 \equiv 2 mod10 \Rightarrow 2^5 \equiv 2\text{mod}10 \Rightarrow (2^5)^5 \equiv 2^5 mod10$	**1**
	$\hspace{8cm} \equiv 2\ mod10$	
	$\Rightarrow (2^{25})^4 \equiv 2^4 \text{mod}10 \equiv 16\ mod10 \equiv 6\ mod10 = 6$	
	Also $100! = 100 \times 99!$ which is divisible by 10	
	So, $100!\ mod\ 10 = 0 \Rightarrow (2^{100} + 100!)mod\ 10 \equiv (6+0)mod10 = 6$	**1**
	OR	
21 (B)	Obviously $\sqrt{6} + \sqrt{5} > \sqrt{3} + \sqrt{2} \Rightarrow \frac{(\sqrt{6}+\sqrt{5})(\sqrt{6}-\sqrt{5})}{(\sqrt{6}-\sqrt{5})} > \frac{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})}{(\sqrt{3}-\sqrt{2})}$	**½**
	$\Rightarrow \frac{6-5}{(\sqrt{6}-\sqrt{5})} > \frac{3-2}{(\sqrt{3}-\sqrt{2})} \Rightarrow \frac{1}{(\sqrt{6}-\sqrt{5})} > \frac{1}{(\sqrt{3}-\sqrt{2})}$	**1**
	$\Rightarrow \sqrt{6} - \sqrt{5} < \sqrt{3} - \sqrt{2} \Rightarrow \sqrt{5} + \sqrt{3} > \sqrt{6} + \sqrt{2}$	**½**
22.	$P(X = 1) + P(X = 2) + P(X = 3) + P(X = 4) = 1$	
	$\Rightarrow 1 \times a + 2 \times a + 3 \times a + b = 1$	**½**
	$\Rightarrow 6\ a + b = 1 \dots (i)$	
	$E(X) = 1 \times a + 2 \times 2a + 3 \times 3a + 4 \times b = 2.8$	**½**
	$\Rightarrow 14\ a + 4\ b = 2.8 \dots (ii)$	
	Solving (i) and (ii), we get	**½+½**
	$a = 0.12$ and $b = 0.28$	
23.	$\text{CAGR} = \left[\left(\frac{EV}{SV}\right)^{\frac{1}{n}} - 1\right] \times 100$	
	$\Rightarrow 5 = \left[\left(\frac{125000}{75000}\right)^{\frac{1}{n}} - 1\right] \times 100$	**1**
	$\Rightarrow 1.05 = \left(\frac{5}{3}\right)^{\frac{1}{n}}$	
	$\Rightarrow \log(1.05) = \frac{1}{n}\log(1.67)$	**½**
	$\Rightarrow n = \frac{0.223}{0.021} = 10.6 \approx 11$	**½**
	$\therefore$ required number of years $= 11$ years	
24 (A)	Here, $\lambda = 2$	**½**
	Required probability $= P(X = 3/X \geq 1) = \frac{P(X=3 \cap X\geq1)}{P(X\geq1)} = \frac{P(X=3)}{P(X\geq1)}$	**½**
	$P(X = 3) = \frac{2^3 e^{-2}}{3!} = 0.19$	**½**
	$P(X \geq 1) = 1 - P(X = 0) = 1 - \frac{2^0 e^{-2}}{0!} = 1 - 0.14 = 0.86$	**½**
	$\therefore P(X = 3/X \geq 1) = \frac{0.19}{0.86} = 0.22$	**½**
	OR	

24 (B)	$\lambda = \frac{2}{1000} \times 5000 = 10$	½
	$P(\text{more than 1 failure}) = P(X > 1) = 1 - [P(X = 0) + P(X = 1)]$	½
	$\qquad\qquad = 1 - \left[\frac{10^0 e^{-10}}{0!} + \frac{10^1 e^{-10}}{1!}\right]$	
	$\qquad\qquad = 1 - e^{-10}(1 + 10)$	½
	$\qquad\qquad = 1 - 4.54 \times 10^{-5} \times 11$	
	$\qquad\qquad = 1 - 0.0004994 = 0.9995$ approx.	½
25.	$D = \frac{C-S}{n}$	
	$\Rightarrow 2500 = \frac{25000 - 12500}{n}$	1
	$\Rightarrow n = \frac{12500}{2500} = 5$	½
	So, after 5 years the value of the machine will be half of its initial value.	
	Value of machine after 6 years $= 25000 - 2500 \times 6 = ₹\ 10,000$	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)	1
	Now, speed of boat : speed of stream $= \frac{x+y}{2} : \frac{y-x}{2}$	1
	(i) $\Rightarrow \frac{y+x}{y-x} = \frac{11+5}{11-5} \Rightarrow \frac{\frac{y+x}{2}}{\frac{y-x}{2}} = \frac{8}{3}$	1
	$\therefore$ speed of boat : speed of stream $= 8 : 3$	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)	1
	Also, curve passes through $(1, -1)$ so $-1 = p + q$ (iii)	
	Solving (ii) and (iii) we get, $p = 2$ and $q = -3$	½
	Using this in (i) we get $\frac{dy}{dx} = 6x^2 - 6x$	1
	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 $(0,0)$	½
	OR	
27 (B)	$AR(x) = \frac{R(x)}{x} = 15 + \frac{x}{3} - \frac{x^3}{36}$, Now $\frac{d}{dx} AR(x) = 0 \Rightarrow 0 + \frac{1}{3} - \frac{3x^2}{36} = 0$	½
	$\Rightarrow x^2 = 4 \Rightarrow x = 2$ (as x is non negative)	½
	$\Rightarrow x = 2$ is the critical point of $AR(x)$.	½
	Now $\frac{d^2[AR(x)]}{dx^2} = 0 - \frac{6(2)}{36} < 0$ hence $AR(x)$ is maximum at $x = 2$	½
	$AR(2) = 15 + \frac{2}{3} - \frac{8}{36} = 15 + \frac{4}{9}$	½
	Now, $MR(x) = 15 + \frac{2x}{3} - \frac{4x^3}{36} \Rightarrow MR(2) = 15 + \frac{4}{3} - \frac{8}{9} = 15 + \frac{4}{9}$	½
	$\therefore AR(2) = MR(2)$	

28 (A)	C = Face value or maturity value = ₹ 56,000,	½
	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	½
	Purchase price of the bond $(V) = R\left[\frac{1-(1+i)^{-n}}{i}\right] + C\,(1+i)^{-n}$	1
	$\qquad = 980\left[\frac{1-(1+0.0225)^{-24}}{0.0225}\right] + 56000(1+0.0225)^{-24}$	
	$\qquad = 980\left[\frac{1-0.58}{0.0225}\right] + 56000 \times 0.58$	½
	$\qquad = ₹\,(18293.33 + 32480) = ₹\,50773.33$	½

<div align="center">OR</div>

28 (B)	Cost of new machine = ₹ $(50{,}000 + 30\% \times 50{,}000)$ = ₹ 65,000	½
	A = Amount required in sinking fund = ₹ $(65{,}0000 - 6{,}000)$ = ₹ 59,000	½
	$R\left[\frac{(1+i)^n-1}{i}\right] = A$	
	$R\left[\frac{(1.06)^8-1}{0.06}\right] = 59000$	
	$R\left[\frac{1.6-1}{0.06}\right] = 59000$	1
	$\Rightarrow R = \frac{59000 \times 0.06}{0.6} = ₹\,5900$	
	So, the required amount to be retained = ₹ 5900	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.	1
	Using work done per minute, we get	
	$\frac{t-10}{30} + \frac{10}{60} + \frac{t-10}{120} = 1 \;\Rightarrow\; \frac{5t-30}{120} = 1$	1+½
	$\Rightarrow 5t = 150 \Rightarrow t = 30$ minutes.	½
	$\therefore$ It will take 30 minutes to fill the tank.	

30.	$H_0: \mu = 1.84$ cm (machine is working properly)	½
	$H_1: \mu \neq 1.84$ 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	½
	$t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}} = \frac{1.85-1.84}{\frac{0.08}{\sqrt{16}}} = \frac{0.01}{0.08} \times 4 = 0.5$	1
	$|t_{cal}| = 0.5 < t_{critical} = 2.131$ at $\alpha = 0.05$ and df = 15	½
	$\therefore$ null hypothesis is accepted, there is no significant difference between the sample mean and the population mean, hence machine is working properly.	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
	$$4\,x + 6\,y \le 500$$	
	$$x \le 80$$	1½
	$$y \le 60$$	
	$$x \ge 0,\, y \ge 0$$	

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

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

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

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

or $AX = B$ **1**

Since, $|A| = 2(3-6) - 4(9-2) + 1(9-1)$ **½**

$$= -6 - 28 + 8 \; = -26 \ne 0,$$

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**

$$A^{-1} = \frac{1}{|A|}(\text{adj}\,A) = \frac{1}{-26}\begin{bmatrix} -3 & -9 & 7 \\ -7 & 5 & -1 \\ 8 & -2 & -10 \end{bmatrix}$$ **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 $92 + 2p_A - 4p_B = -6 + 32p_B \implies 2p_A - 36p_B = -98$	1
	Now, $\|D\| = -646, \qquad \|D_A\| = -3230, \qquad \|D_B\| = -1938$	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 $\frac{dP}{dx} = 0 \implies -81 + 36x - 3x^2 = 0 \implies x = 3 \text{ or } 9$	
	Now $\frac{d^2P}{dx^2} = 36 - 6x = 36 - 54 < 0$, at $x = 9$, so P is maximum at $x = 9$.	½
	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
	$\therefore$ 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

$\therefore$ 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)				

Month	Number of vehicles (Thousands)	3-Month Moving Total	3-Month Moving Average	
March	30	-	-	**3 marks for correct table**
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.

Loan amount $= P = ₹ (10,00,000 - 2,00,000) = ₹ 8,00,000$ ½

$i = \frac{10}{12 \times 100} = 0.0083$ ½

½

$n = 5 \times 12 = 60$

$\text{EMI} = \frac{P \times i \times (1+i)^n}{(1+i)^n - 1}$

1

$= \frac{800000 \times 0.0083 \times (1+0.0083)^{60}}{(1+0.0083)^{60} - 1}$

$= \frac{800000 \times 0.0083 \times 1.64}{1.64 - 1} = ₹ 17,015$ **1½**

Total interest paid $= n \times EMI - P$

$= ₹ (17,015 \times 60 - 8,00,000)$

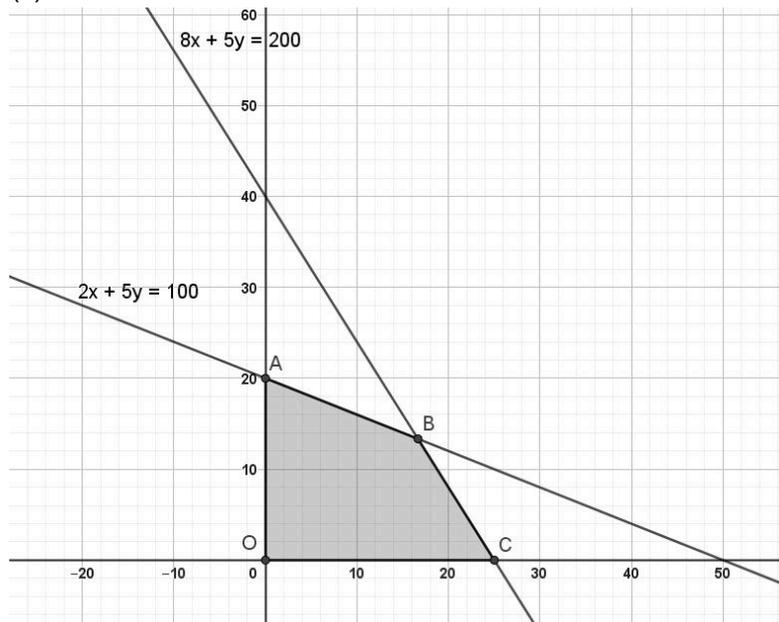$= ₹ (10,20,900 - 8,00,000) = ₹ 2,20,900$ **1**

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 $X = 75, Z = \frac{X-\mu}{\sigma} = \frac{75-75}{8} = 0$ ½

$P(X < 75) = P(Z < 0) = 0.5$

50 % of students scored below 75 marks. ½

(ii) For $X = 82, Z = \frac{82-75}{8} = 0.875$

½

$P((X > 82) = P(Z > 0.875) = 1 - P(Z < 0.875) = 1 - 0.8092 = 0.1908$ ½

∴ Required number of students $= 0.1908 \times 500 = 95.4 \approx 95$

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

(ii)

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

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

1½

½