Second PUC Annual Examination

April / May 2022

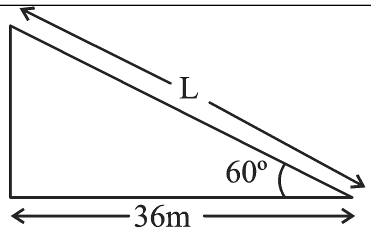
Sub: Basic Mathematics

Sub Code : 75(NS)

Scheme of valuation

Q. No.	PART – A	Marks
1.	$A+B=\begin{bmatrix}3 & 7\\0 & -2\end{bmatrix}$	1
2.	$x=\pm 6$	1
3.	$n = 8 + 12 = 20$	1
4.	P(A) = 0.35	1
5.	4 is not an even number and 7 is not a prime number.	1
6.	$4 \div 5 = 24 : x \Rightarrow x = 30$	1
7.	$\text{yield} = \frac{3}{125}\times 100 = 2.4\%$	1
8.	$y = ax^b$	1
9.	$\cos 2A = \frac{1}{2}$	1
10.	$k = \frac{1}{2}$	1
11.	$\underset{x\to t}{lt}\left[x^2+6x+4\right]=11$	1
12.	$2x+2y.\frac{dy}{dx}=0 \Rightarrow \frac{dy}{dx}=-\frac{x}{y}$	1
13.	$\frac{dy}{dx}=-\frac{1}{x^2}$	1
14.	$\frac{7x^3}{3}-4\tan x+c$	1
15.	$\left[\frac{x^2}{2}\right]_1^2 = 2-\frac{1}{2}=\frac{3}{2}$	1
	PART – B	
16.	Getting $A^1=\begin{bmatrix}2 & -1\\3 & 4\end{bmatrix}$	1
	$A^1B=\begin{bmatrix}0 & -6\\11 & 13\end{bmatrix}$	1

17.	Taking $R_2^1 \to R_2 + R_3$ to get $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ x+y+z & x+y+z & x+y+z \\ y+z & z+x & x+y \end{vmatrix}$ $\Rightarrow \Delta = x+y+z \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ y+z & z+x & x+y \end{vmatrix}$ $= (x+y+z)(0)$ $= 0$ Note: Any alternate transformation should be considered and given proportionate marks	1 1
18.	unit's place $\longleftarrow$ 5 places $\longrightarrow$ | 5 $\downarrow$ $\lfloor\!\underline{5}$ ways ; $\downarrow$ 1 way Final answer = $\lfloor\!\underline{5} \times 1 = 120$ ways	1 1
19.	$S = [HH, HT, TH, TT]$ (a) P(exactly 2 H) $= \frac{1}{4}$ (b) P(exactly 1 H) $= \frac{3}{4}$	1 1
20.	Converse : If it is cold then it is raining Inverse : If it is not raining then it is not cold	1 1
21.	Let x be added Writing $\frac{2+x}{3+x} = \frac{5}{6}$ Getting $x = 3$	 1 1
22.	$\frac{a}{b} = \frac{2}{3}, \frac{b}{c} = \frac{3}{5}, \frac{c}{d} = \frac{5}{7}$ $\therefore \frac{a}{b} \times \frac{b}{c} \times \frac{c}{d} = \frac{2}{3} \times \frac{3}{5} \times \frac{5}{7}$ $\Rightarrow a:d = 2:7$	 1 1
23.	Getting TD = ₹1200 Getting $F = \frac{BD \times TD}{BG} =$ ₹30,000	1 1
24.	Amount of stock purchased $= \frac{100 \times 4800}{96} =$ ₹5,000 Income obtained $= \frac{4800 \times 8}{96} =$ ₹400	1 1

25.	Let MP = x writing $17000 = x + 10\%x$ and Geting MP, $x =$ ₹15,454.54 $\Rightarrow$ ST = 17000 − 15454.54 = ₹1545.46	1 1
26.	 Taking $\cos 60^\circ = \frac{36}{L}$ Getting L = 72 m	1 1
27.	Writing $\text{LHS} = \sin 45^\circ . \cos A + \cos 45^\circ . \sin A$ $+ \cos 45^\circ . \cos A - \sin 45^\circ . \sin A$ Or writing $\text{LHS} = \frac{1}{\sqrt{2}} \cos A + \frac{1}{\sqrt{2}} \sin A + \frac{1}{\sqrt{2}} \cos A - \frac{1}{\sqrt{2}} \sin A$ $= \frac{2}{\sqrt{2}} \cos A = \sqrt{2} \cos A$	1 1
28.	Focus = (0, –4) Directrix : y = 4	1 1
29.	$\lim_{x \to 1} f(x) = f(1)$ $\Rightarrow \lim_{x \to 1} 4x + 3 = k + 1$ $7 = k + 1$ $k = 6$	1 1
30.	Writing $y = \sqrt{\tan x + y}$ $\Rightarrow y^2 = \tan x + y$ $2y \frac{dy}{dx} = \sec^2 x + \frac{dy}{dx} \quad \therefore \frac{dy}{dx} = \frac{\sec^2 x}{2y - 1}$	1 1
31.	$\frac{dr}{dt} = \frac{2}{3\pi} \text{cm / sec} \; ; \; r = 6 \text{ cm}$ $A = \pi r^2 \Rightarrow \frac{dA}{dt} = \pi . 2r \frac{dr}{dt}$	1

	Getting $\frac{dA}{dt} = 8\text{cm}^2/\text{sec}$	1
32.	MR = 300 – 2q, MC = 4 MR = MC $\Rightarrow$ 300 – 2q = 4 $\therefore$ q = 148 units	1 1
33.	$\int \log x dx = \int \log x.1dx$ $= \log x[x] - \int x \times \frac{1}{x} dx$ $= x \log x - x + c$	 1 1
	Part – C	
34.	Getting $A^2 = \begin{pmatrix} 9 & 8 & 8 \\ 8 & 9 & 8 \\ 8 & 8 & 9 \end{pmatrix}$ and $4A = \begin{pmatrix} 4 & 8 & 8 \\ 8 & 4 & 8 \\ 8 & 8 & 4 \end{pmatrix}$ Remaining simplification to get the result	1+1 1
35.	$\Delta = \begin{vmatrix} 2 & 3 \\ 1 & -1 \end{vmatrix} = -5$ Any 2 correct determinants $\Delta x = \begin{vmatrix} 11 & 3 \\ 3 & -1 \end{vmatrix} = -20$ $\boxed{x = 4}$ $\Delta y = \begin{vmatrix} 2 & 11 \\ 1 & 3 \end{vmatrix} = -4$ $\therefore \boxed{y = 1}$	1 1 1
36.	No of selections $= {}^4C_3 \times {}^2C_1 \times {}^{10}C_7$ $+ {}^4C_4 \times {}^2C_1 \times {}^{10}C_6$ $+ {}^4C_3 \times {}^2C_2 \times {}^{10}C_6$ $+ {}^4C_4 \times {}^2C_2 \times {}^{10}C_5$ $= 4 \times 2 \times 120 + 1 \times 2 \times 210 + 4 \times 1 \times 210$ $+ 4 \times 1 \times 120 + 1 \times 1 \times 252 = 2472$	1 1 1
37.	No of Sample points = 36 No of doublets = 6 (a) P(a doublet) = $\frac{6}{36} = \frac{1}{6}$ (b) P(sum as 11) = $\frac{2}{36} = \frac{1}{18}$ (c) P(Sun > 11) = $\frac{1}{36}$	 1 1 1
38.	$r = 7 \Rightarrow T_8 = {}^{10}C_7 \left(\frac{a}{2}\right)^3 \left(\frac{-3}{b}\right)^7$ Simplifying to get $T_8 = -32805.a^3 b^{-7}$	1 2

39.	$\frac{3x+1}{(x-4)(x-2)} = \frac{A}{x-4} + \frac{B}{x-2}$ Getting $A = \frac{13}{2}$, $B = \frac{-7}{2}$, and conclusion	1 2
40.	Getting truth value of p = T q = T r = F	1 1 1
41.	Getting A : B = 5 : 6 and B : C = 5 : 4 writing A : B : C = 25 : 30 : 24 A' share = $\frac{25}{79} \times 632 =$ ₹200 B' share = $\frac{30}{79} \times 632 =$ ₹240 C's share = $\frac{24}{79} \times 632 =$ ₹192	1 1 1
42.	Legally due date = 30 June 2015 G getting unexpired period, t = 73 days BD = F tr. BD = ₹49	1 1 1
43.	Amount obtained by selling 121 = $\frac{121 \times 2100}{100}$ = ₹2541 Income obtained = $\frac{2100 \times 3}{100}$ = ₹63 Income obtained in 5% stock = 63 + 14 = 77 Market price of 5% stock = $\frac{2541 \times 5}{77}$ = ₹165	1 1 1
44.	tan 4A = tan (3A + A) tan 4A = $\frac{\tan 3A + \tan A}{1 - \tan 3A . \tan A}$ tan 4A – tan 3A – tan A = tan 4A . tan 3A. tan A.	1 1 1
45.	Getting x = –1, y = 4 by solving the equation finding centre of $x^2 + y^2 - 4x + 2y - 1 = 0$ a s (2, –1) Radius of required circle, $r = \sqrt{34}$ Eq of required circle is $(x+1)^2 + (y-4)^2 = (\sqrt{34})^2$ $(x+1)^2 + (y-4)^2 = 34$	1 1 1

46.	$\underset{x\to 2}{lt}\dfrac{x^{10}-1024}{x^4-16}=\underset{x\to 2}{lt}\dfrac{\dfrac{x^{10}-2^{10}}{x-2}}{\dfrac{x^4-2^4}{x-2}}$ $=\dfrac{10\times 2^9}{4\times 2^3}=160$	2 1
47.	$x^y=e^{x-y}$ $y\log x=(x-y)\log e\Rightarrow y=\dfrac{x}{1+\log x}$ Differentiating to get $\dfrac{dy}{dx}=\dfrac{\log x}{(1+\log x)^2}$	1 2
48.	$\dfrac{dx}{dt}=2e^{2t},\dfrac{dy}{dt}=\dfrac{2}{2t+1}$ $\dfrac{dy}{dx}=\dfrac{1}{e^{2t}(2t+1)}$	1+1 1
49.	let the 2 natural numbers be x and y then, $x+y=48$, $y=48-x$ product, $p=xy$, $p=x(48-x)$ For product p to be max $\dfrac{dp}{dx}=0$ and $\dfrac{d^2p}{dx^2}<0$. $\dfrac{dp}{dx}=0\Rightarrow 48-2x=0$ $\quad x=24$ $\dfrac{d^2p}{dx^2}=-2<0$ at $x=24$ Hence the 2 numbers are 24, 24.	1 1 1
50.	$\int\dfrac{2x}{2x+3}dx=\int\dfrac{2x+3-3}{2x+3}dx$ $=\int\left(1-\dfrac{3}{2x+3}\right)dx=x-\dfrac{3\log(2x+3)}{2}+c$	1 2
51.	$\text{I}=\int_0^1(6x+1)\sqrt{3x^2+x+5}dx$ Substitute $3x^2+x+5=t$ $(6x+1)dx=dt$ X = 0 $\Rightarrow$ t = 5; x = 1 $\Rightarrow$ t = 9.	1

	$\text{I} = \int_5^9 t^{\frac{1}{2}} dt = \frac{2}{3}\left[t^{\frac{3}{2}} \right]_5^9$	1
	$= \frac{2}{3}\left(27 - 5\sqrt{5}\right)$	1
	PART - D	
52.	Getting LHS $A\left(B+C\right) = \begin{bmatrix} 1 & 2 & -3 \\ 1 & -4 & 2 \\ 0 & 5 & 3 \end{bmatrix}\begin{bmatrix} 8 & -1 & -1 \\ 2 & -1 & 0 \\ -1 & -2 & 7 \end{bmatrix}$ $\text{LHS} = \begin{bmatrix} 15 & 3 & -22 \\ -1 & 1 & 6 \\ 7 & -11 & 21 \end{bmatrix}$	1+1
	$AC = \begin{bmatrix} 7 & 16 & -8 \\ 3 & -14 & 2 \\ -3 & 6 & 17 \end{bmatrix}, \ AB = \begin{bmatrix} 8 & -13 & -14 \\ -4 & 15 & 4 \\ 10 & -17 & 4 \end{bmatrix},$	1+1
	Getting AB + AC = LHS	1
53.	Total number of arrangements = $\underline{\lvert 20}$ ways	1
	(a) $\underline{\lvert 13}\ \underline{\lvert 8}$ ways	1
	(b) $\underline{\lvert 13}\ {}^{14}P_7$ ways	1
	(c) $\underline{\lvert 3}\ \underline{\lvert 7}\ \underline{\lvert 8}\ \underline{\lvert 5}$ ways	1
	(d) $\underline{\lvert 9}\ \underline{\lvert 8}\ \underline{\lvert 5}$ ways	1
54.	$n = 19$	
	There are two middle terms T_{10} and T_{11}	1
	$r = 9$: $T_{10} = {}^{19}C_9 \left(\frac{x}{2}\right)^{10}\left(\frac{3}{x^2}\right)^9 = {}^{19}C_9 \frac{3^9}{2^9 x^8}$	1+1
	$r = 10$: $T_{11} = {}^{19}C_{10} \left(\frac{x}{2}\right)^{9}\left(\frac{3}{x^2}\right)^{10} = {}^{19}C_{10} \frac{3^{10}}{2^9 . x^{11}}$	1+1
55.	$\frac{3x+2}{(x-2)(x+3)^2} = \frac{A}{x-2} + \frac{B}{x+3} + \frac{C}{(x+3)^2}$	1
	Getting $A = \frac{8}{25}, \ B = \frac{-8}{25}, \ C = \frac{7}{5}$	3
	conclusion	1

56.

p	q	$p \vee q$	$\sim(p \vee q)$ Ⓐ	$\sim p$	$\sim q$	$\sim p \wedge \sim q$ Ⓑ	Ⓐ→Ⓑ
T	T	T	F	F	F	F	T
T	F	T	F	F	T	F	T
F	T	T	F	T	F	F	T
F	F	F	T	T	T	T	T

1M (columns p, q); 1M (columns $p \vee q$, $\sim(p \vee q)$); 1M (columns $\sim p$, $\sim q$); 1M (column $\sim p \wedge \sim q$); 1M (column Ⓐ→Ⓑ)

57.

Men	Hours	Days	Work
5	9	30	1
x	8	25	8

$8:9 \quad = 5:x$

$25:30 = 5:x$ — 3

$1:8 \quad = 5:x$

$9 \times 30 \times 8 \times 5 = 8 \times 25 \times 1 \times x$ — 1

Getting $x = 54$ — 1

58.

BD = F – DCV = ₹280 — 1

BD = Ftr $\Rightarrow$ 280 = 1460 × t × 0.2 — 1

$\Rightarrow$ t = 0.09589 years = 35 days

$\Rightarrow$ LDD = 35 days after 11 – 11 – 12 — 1+1

= 16 – 12 – 12

$\Rightarrow$ Date of Drawing

= 16 – 12 – 12

– 0 – 3 – 0 — 1

Ans – 3 – 0 – 0

= 13 – 9 – 12

59.

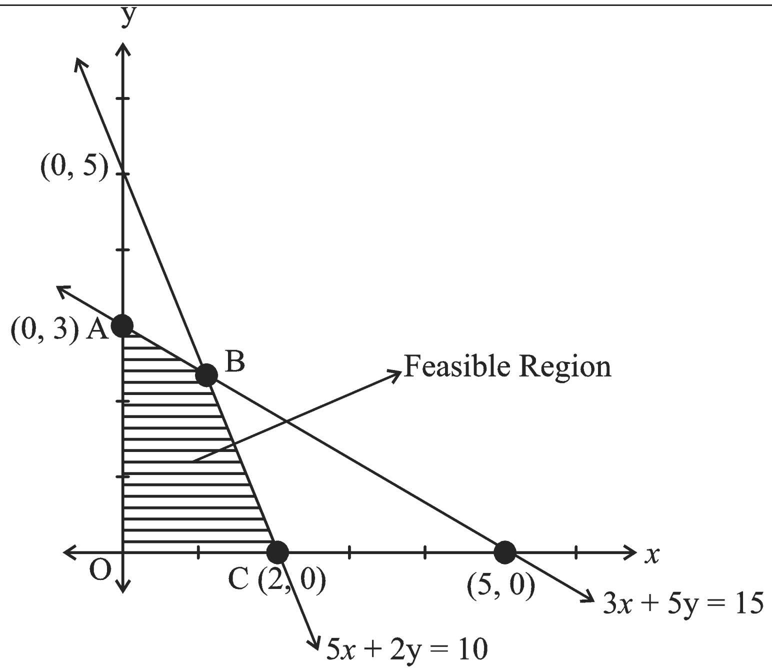
No of Units Produced	Total Output in Units	Cumulative Average time per unit in hours	Total Hours
1	1	1000	1000
1	2	800	1600
2	4	640	2560
4	8	512	4096

— 4

$\therefore$ Total labour hours = 4096

Total labour cost = ₹409, 600 — 1

60.



3

Corner Points	$Z = 5x + 3y$
O (0, 0)	Z = 0
A (0, 3)	Z = 9
B $\left(\frac{20}{19}, \frac{45}{19}\right)$	Z = 12.36
C (2, 0)	Z =10

1

Maximum Value of Z = 12.36

At $x = \frac{20}{19}, y = \frac{45}{19}$

1

61

$$\text{LHS} = \frac{(\cos 7x + \cos 3x) - (\cos 5x - \cos x)}{(\sin 7x - \sin 3x) - (\sin 5x - \sin x)}$$

4

$$= \frac{2\cos 5x.\cos 2x - 2\cos 3x.\cos 2x}{2\cos 5x.\sin 2x - 2\cos 3x.\sin 2x}$$

$$= \frac{\cos 2x}{\sin 2x}$$

1

$$= \cot 2x = \text{RHS}$$

62.

$y = a \cos(\log x) + b \sin(\log x)$

$$y_1 = -a \sin(\log x) \times \frac{1}{x} + b \cos(\log x)\ \frac{1}{x}$$

1

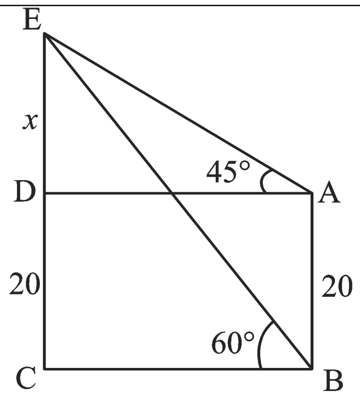
$$xy_1 = -a \sin(\log x) + b \cos(\log x)$$

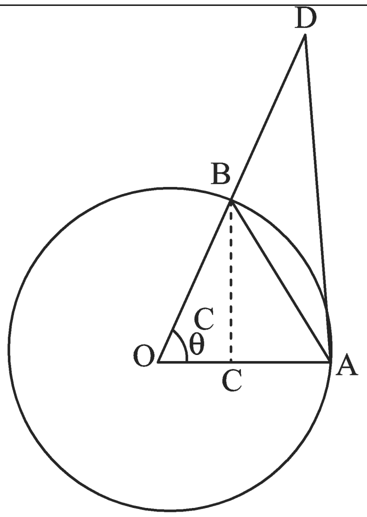
1

$$xy_2 + y_1 = -a \cos(\log x) \times \frac{1}{x} - b \sin(\log x) \times \frac{1}{x}$$

1

	$= -\frac{1}{x}\ (a\cos(\log x) + b\sin(\log x))$ $= -\frac{1}{x}y$	1
	$\therefore\ x^2 y_2 + xy_1 + y = 0$	1
63.	Solving $y^2 = 4x$ and $x - y = 0$ to get $x = 0, x = 4$	1
	Required area $= \int_0^4 \left[f(x) - g(x)\right] dx$	1
	$= \int_0^4 \left[2\sqrt{x} - x\right] dx$	
	$= \left[2.\frac{2}{3}x^{3/2} - \frac{x^2}{2}\right]_0^4$	2
	$= \frac{8}{3}$ sq units	1
	PART - D	
64(a).	$\begin{bmatrix} 3 & 1 & 2 \\ 2 & -3 & -1 \\ 1 & 2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ -3 \\ 4 \end{bmatrix}$ A X = B	
	$\lvert A \rvert = 8$	1
	Adjoint $A = \begin{bmatrix} -1 & 3 & 5 \\ -3 & 1 & 7 \\ 7 & -5 & -11 \end{bmatrix}$	2
	$X = A^{-1}B$ $= \frac{1}{\lvert A \rvert}(adj\,A)(B)$ $= \frac{1}{8}\begin{bmatrix} -1 & 3 & 5 \\ -3 & 1 & 7 \\ 7 & -5 & -11 \end{bmatrix} = \begin{bmatrix} 3 \\ -3 \\ 4 \end{bmatrix}$	1
	$= \frac{1}{8}\begin{bmatrix} 8 \\ 16 \\ -8 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$ $\quad \therefore \begin{matrix} x = 1 \\ y = 2 \\ z = 1 \end{matrix}$	1+1

64.(b)	$(1.2)^5 = (1+0.2)^5$ $= 1^5 + 5C_1(0.2) + 5C_2(0.2)^2 + 5C_3(0.2)^3 + 5C_4(0.2)^4 + 5C_5(0.2)^5$ $= 1 + 5(0.2) + 10(0.04) + 10(0.008) + 5(0.0016) + 1(0.00032)$ $= 1 + 1 + 0.4 + 0.08 + 0.008 + (0.00032)$ $= 2.48832$ $= 2.4883$	1 1 1 1
65.(a)	Let $x^2 + y^2 + 2gx + 2fy + C = 0$ be the equation of circle passing through the points (0, 0) (3, −1) and (3, −3). Finding Values of $\begin{cases} g = -1 \\ f = 2 \\ c = 0 \end{cases}$ Writing equation of circle as $x^2 + y^2 - 2x + 4y = 0$ Proving for concylic points.	1 1 1 1 1 1
65.(b)	 Writing $\tan 45° = \frac{x}{AD} \Rightarrow 1 = \frac{x}{AD}$ $\therefore x = AD$ and $\tan 60° = \frac{x+20}{x} \Rightarrow \sqrt{3} = \frac{x+20}{x}$ Solving for X: $x = \frac{20}{\sqrt{3}-1}$ $\therefore$ Height of the tower CE = $20 + x$ CE = $20 + \frac{20}{\sqrt{3}-1} m$	1 1 1 1

66.(a)		1
	Writing area of ΔAOB < area of sector AOB < area of ΔAOD	1
	Substituting respective areas in the above in equation.	1
	Getting $\sin\theta < \theta < \tan\theta$	1
	Dividing by $\sin\theta$ and applying lt to $\theta \to 0$	
	Get $\underset{\theta\to0}{lt}\, 1 > \underset{\theta\to0}{lt}\, \frac{\sin\theta}{\theta} > \underset{\theta\to0}{lt}\, \cos\theta$	1
	Hence, the result $\underset{\theta\to0}{lt}\, 1\frac{\sin\theta}{\theta} = 1$	1
66.(b)	Let X units of A and Y and units of B be produced.	
	Writing: Maximise : $z = 2x + 3y$	1
	Writing: With respect to the constraints	
	$x + y \le 6$	1
	$2x + y \le 10$	1
	and $x \ge 0, y \ge 0$	1

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