K.L.E. SOCIETY'S
P. C. JABIN SCIENCE COLLEGE
HUBBALLI
AUTONOMOUS

Semester 1st Sem.

B.Sc.	✓
B.C.A.	
M.Sc.	

Answer Booklet No. 38481

Theory Semester End Examination: ~~April/May 20~~ / ~~Nov./Dec. 20~~ — March 2022

Certified that the entries made by the candidate are found to be correct.

Signature of the Room Supervisor with Date 14/3/22

Exam. Reg. No.		1	2	1	C	M	0	0	2

Class :..... Subject : Algebra - I / Calculus - I Subject Code No. 17D5C01T

Paper :.....

11761001 A-I C-I

121CM002

IMPORTANT INSTRUCTIONS TO CANDIDATES

1) On the cover page of answer book compulsorily mention your Register Number, Subject, Course Code and required information.

2) Don't write your name or mark any signs, such answer scripts shall not be assessed and punished.

3) Write your answer from 1st page and don't leave any blank pages and blank space in between.

4) Last page is meant for rough work and on completion put cross mark (x)

5) The candidates are informed strictly to write their answer only with black ink & write on both sides of the answers sheets.

IMPORTANT INSTRUCTIONS TO CANDIDATES

6) Please mention the Question number in the margin. Answer's without Question number & also with wrong question number shall not be valued.

7) The students are informed to take compulsorily the signature of the room supervisor with date on the answer book.

8) The candidate should be present 20 minutes before the commencement of the examination. After that no students wil be allowed in the examination hall.

9) Use of any electronic gadgets in the examination hall is strictly prohibited.

10) After the last warning bell, no candidate is allowed to leave his/her seat.

11) Indulging in different ways and using different means that lead to malpractice is prohibited.

12) Don't fold the answers sheets & keep the answer sheets clean.

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Question No.

ಉತ್ತರವನ್ನು ಇಲ್ಲಿಂದ ಆರಂಭಿಸಿರಿ
START WRITING ANSWER FROM HERE BELOW

Unit – I

1) b)

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$$

$$A = IA$$

$$\Rightarrow \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$$

$$R_2 \longrightarrow R_2 - 3R_1$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & -4 & 0 \\ 1 & 1 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ -3 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$$

$$R_3 \longrightarrow R_3 - R_1$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & -4 & 0 \\ 0 & -1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ -3 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix} A$$

$$R_2 \longrightarrow R_2/-4$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 3/4 & -1/4 & 0 \\ -1 & 0 & 1 \end{bmatrix} A$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

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$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 3/4 & -1/4 & 0 \\ -1 & 0 & 1 \end{bmatrix} A$$

$$R_1 \to R_1 - 2R_2$$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} = \begin{bmatrix} -1/2 & 1/2 & 0 \\ 3/4 & -1/4 & 0 \\ -1 & 0 & 1 \end{bmatrix} A$$

$$R_3 \to R_3 + R_2$$

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} -1/2 & 1/2 & 0 \\ 3/4 & -1/4 & 0 \\ -1/4 & -1/4 & 1 \end{bmatrix} A$$

$$R_1 \to R_1 - R_3$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} -1/4 & 1/4 & -1 \\ 3/4 & -1/4 & 0 \\ -1/4 & -1/4 & 1 \end{bmatrix} A$$

$\therefore$ [redacted] $I = A^{-1}A$

$$\therefore A^{-1} = \begin{bmatrix} -1/4 & 1/4 & -1 \\ 3/4 & -1/4 & 0 \\ -1/4 & -1/4 & 1 \end{bmatrix}$$

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I) c) i)

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 4 \\ 6 & 9 & 12 \end{bmatrix}$$

$R_2 \longrightarrow R_2 - 2R_1$

$$= \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 6 & 9 & 12 \end{bmatrix}$$

$R_3 \longrightarrow R_3 - 6R_1$

$$= \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ 0 & 3 & 6 \end{bmatrix}$$

$R_1 \longrightarrow R_1 - R_2$

$$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & 3 & 6 \end{bmatrix}$$

$R_3 \longrightarrow R_3 - 3R_2$

$$= \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$\therefore \boxed{\rho(A) = 2}$ //

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Unit - II

3] a] The given curve is,

$r = a(1+\sin\theta)$

diff w.r.t x

$$\frac{dr}{d\theta} = a\cos\theta$$

$$\frac{d\theta}{dr} = \frac{1}{a\cos\theta}$$

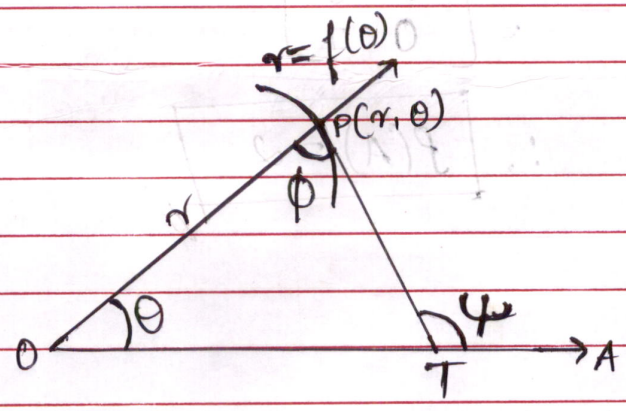
multiply 'r' on b.s.

$$r\frac{d\theta}{dr} = \frac{1 \cdot r}{a\cos\theta}$$

$$\tan\phi = \frac{a(1+\sin\theta)}{a\cos\theta}$$

$$\tan\phi = \frac{(1+\sin\theta)}{\cos\theta}$$

3] b]



Consider a curve with equation $r = f(\theta)$. let $P(r, \theta)$ be a point on the curve., let

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$\angle OPT = \phi$ be the angle b/w the radius vector and the tangent drawn to the curve. and $\angle POT = \theta$ be the angle of radius vector.

Now,

$x = f(\theta)\cos\theta$ — diff w.r.t θ

$y = f(\theta)\sin\theta$ — diff w.r.t θ

$$\frac{dx}{d\theta} = -f(\theta)\sin\theta + \cos\theta f'(\theta) \qquad \frac{dy}{d\theta} = f(\theta)\cos\theta + \sin\theta f'(\theta)$$

$$\Rightarrow \frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta} = \frac{f(\theta)\cos\theta + \sin\theta f'(\theta)}{-f(\theta)\sin\theta + \cos f'(\theta)}$$

$$\Rightarrow \frac{dy}{dx} = \frac{f(\theta)\cos\theta + \sin\theta f'(\theta)}{-f(\theta)\sin\theta + \cos\theta f'(\theta)}$$

$\div$ Nr & Dr of RHS by $\cos\theta f'(\theta)$ we get

$$= \frac{\frac{f(\theta)}{f'(\theta)} + \tan\theta}{1 - \tan\theta \frac{f(\theta)}{f'(\theta)}}$$

By comparing the equation we get

$$\tan\phi = \frac{f(\theta)}{f'(\theta)}$$

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W.K.T $r = f(\theta)$

diff w.r.t θ

$$\frac{dr}{d\theta} = f'(\theta) \Rightarrow \frac{1}{f'(\theta)} = \frac{d\theta}{dr}$$

$$\Rightarrow \tan\phi = f(\theta) \times \frac{1}{f'(\theta)}$$

$$\Rightarrow \boxed{\tan\phi = r\frac{d\theta}{dr}} \quad //$$

3) c) i) The given curve is at $\theta = \pi/6$.

$r = a\cos 2\theta$

diff w.r.t θ

$$\frac{dr}{d\theta} = -2a\sin 2\theta$$

$$\frac{d\theta}{dr} = \frac{1}{-2a\sin 2\theta}$$

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ii) The given curve is

$x^{2/3} + y^{2/3} = a^{2/3}$

diff w.r.t

Unit III

~~$\lim_{x \to 0} \frac{x - \sin x}{x^2}$~~

5) b)

$$f(x) = \begin{cases} 2+x & \text{for } x \geq 0 \\ 2-x & \text{for } x < 0 \end{cases}$$

Let $f(0) = 2 + x$

$= 2 + 0$

$= 2$ ✓

Now,

$LHL = \lim_{x \to 0^-} f(x)$

$= \lim_{x \to 0^-} 2 - x$

$= 2 - (-1)$

$= 2 + 1$

$= 3.$

$RHL = \lim_{x \to 0^+} f(x) = \lim_{x \to 0^+} 2 + x = 2 + 0 = 2$

$\therefore LHL \neq RHL$ ✓

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Unit - IV

7) b) $y = e^{ax} \sin(bx+c)$

diff w.r.t x.

$$\frac{dy}{dx} = e^{ax}\cos(bx+c) + \sin(bx+c)\, e^{ax} \cdot a$$

$$y_1 = \frac{dy}{dx} = e^{ax}\left(\cos(bx+c) + \sin(bx+c)\, a\right)$$

diff w.r.t x.

$$y_2 = e^{ax}\left(-\sin(bx+c) + \cos(bx+c)\, a + a\cos(bx+c)\right) + \left(\cos(bx+c) + \sin(bx+c)\, a\right) a \cdot e^{ax}$$

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$a^x \cdot e^{ax}$ $x \cdot a^x$ (u.v)

x^2 $a^x \cdots$ $x \cdot a^x$

2^x

$x \cdot 2^x$

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Rough work.

$r = a\sin\theta$

$\frac{dr}{d\theta} = a\cos\theta$

$r = a\cos\theta$

$\frac{dr}{d\theta} = -a\sin\theta$

$y = \cos(ax+b)$

$y_1 = -\sin(ax+b)$

$y_2 = -\cos(ax+b)$

$y_3 = \sin(ax+b)$

$+ \cdots$

$\begin{vmatrix} 2 & 1 \\ 0 & 1 \\ 0 & -1 \end{vmatrix}$

$\begin{vmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{vmatrix}$

$R_1 \to R_1 - 2R_2$

$\begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix} \times \begin{bmatrix} -1/4 & -1/4 & -1 \\ 5/4 & -1/4 & 0 \\ -1/4 & -1/4 & 1 \end{bmatrix}$

$R_3 \to R_3 + R_2$

$\begin{vmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$

$R_1 \to R_1 - R_3$

$\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$

$f(0)$

$1 - \frac{1}{2}\left(\frac{3}{4}\right)$

$1 - \frac{3}{8}$

$\frac{8-3}{8}$

e^{ax}

$x \cdot a^x$

$x \cdot x \cdot a^{x-1} + a^x \cdot 0$

$-1/2 - (-1/4)$

$\frac{-1^{x2}}{2x} + \frac{1^{x1}}{4^{x1}}$

$\frac{-2+1}{4}$

$-1/4$

$1/2$

$\frac{1^{x2}}{2x2} - \frac{1^{x1}}{4^{x1}}$

$\frac{2-1}{4}$

$1/4$

$0 - \frac{1}{2}\left(\frac{-1}{4}\right)$

$-(-1/2) + 1/2$

$-1/2 + (-1)$

$-1/2 - 1$

$-\frac{1}{2} - 1$

$\frac{-1-2}{2}$

$-1 + \frac{3}{4}$

$\frac{-4+3}{4}$

$-1/4$

$0 - 1/4$

$f(0)\cos\theta$ (u.v)

$-f(0)\sin\theta + \cos\theta f'(0)$

$\frac{f(0)+\tan\theta}{f'(0)}$

$1 - \tan\theta \frac{f(0)}{f'(0)}$

$\frac{f(0)\cos\theta + \sin\theta f'(0)}{-f(0)\sin\theta + \cos\theta f'(0)}$

$\frac{\frac{f(0)\cos\theta}{\cos\theta f(0)} + \frac{\sin\theta f'(0)}{\cos\theta f'(0)}}{\frac{-f(0)\sin\theta}{\cos\theta f'(0)} + \frac{\cos\theta f'(0)}{\cos\theta f'(0)}}$

$\frac{\frac{f(0)}{f'(0)} + \tan\theta}{-\tan\theta \frac{f(0)}{f'(0)} + 1}$