



Chhatrapati Shahu Ji Maharaj
University, Kanpur

Answer Script Details
Barcode 7470957

Roll No. 23071002365
Total Mark 45/75.00

Exam BACHELOR OF COMPUTER APPLICATION_DEC-2023
Subject BCA1005 - V MATHEMATICS I

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	4/5	4C	4/5				
1B	4/5	5A	NA/5				
1C	3/5	5B	NA/5				
1D	4/5	5C	NA/5				
1E	3/5	6A	NA/7				
1F	3/5	6B	NA/7				
1G	3/5	7A	NA/7				
1H	3/5	7B	0/7				
1I	2/5	8A	5/7				
2A	NA/5	8B	NA/7				
2B	NA/5	9A	NA/7				
2C	NA/5	9B	NA/7				
3A	NA/5						
3B	NA/5						
3C	NA/5						
4A	4/5						
4B	3/5						

Chhatrapati Shahu Ji Maharaj University Kanpur, Uttar Pradesh

PART-I

Date of Exam: 14/12/23 Shift: Evening Roll No. (G-03)

Paper Code: BCA1005 Subject: Mathematics I

Name of Candidate: Khyati Trivedi

Roll No. 23071002365

Signature of Candidate: *Khyati Trivedi*
Signature of Invigilator: *[Signature]*
COE Facsimile: *[Signature]*

PART-II

MARKS OBTAINED										
Q.	1	2	3	4	5	6	7	8	9	10
(a)										
(b)										
(c)										
(d)										
(e)										
(f)										
(g)										
(h)										
(i)										
(j)										
Total										
Total Marks in Figure										Max. Marks
Total Marks in Words										



BCA1005
Paper Code

Signature of Evaluator

PART-III

Course: BCA

Session: 2023-24 Year/Semester: I

Subject Name: Mathematics I

Medium: English Hindi

Paper Code: BCA1005

Exam Date: 14/12/2023

Name of Candidate: KHYATI TRIVEDI

Father's Name: J K TRIVEDI

संस्थान का कोड
College Code

KN162

A	A	0	0	0
E	B	1	1	1
F	0	2	2	2
H	J	3	3	3
K	4	4	4	4
L	L	5	5	5
R	M	6	6	6
S	7	7	7	7
U	T	8	8	8
U	9	9	9	9
W				

केंद्र का कोड
Exam Centre Code

KN162

A	A	0	0	0
E	B	1	1	1
F	0	2	2	2
H	J	3	3	3
K	4	4	4	4
L	L	5	5	5
R	M	6	6	6
S	7	7	7	7
U	T	8	8	8
U	9	9	9	9
W				

परीक्षा का प्रकार
Type of Exam

Regular Eng. Student
Private Back Paper Exam

ANSWER BOOKLET NO.

7470957

BCA1005
Paper Code



PART-IV

संस्था का कोड
Enrollment Number

C S J M A 23000129517

उम्मीदवार का कोड
Candidate's Roll Number

23071002365

परीक्षा का कोड
Paper Code

BCA1005

0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

A	0	0	0	0	0	N
1	1	1	1	1	1	P
C	2	2	2	2	2	R
E	3	3	3	3	3	T
F	4	4	4	4	4	
G	5	5	5	5	5	
Z	6	6	6	6	6	
W	7	7	7	7	7	
AM	8	8	8	8	8	
9	9	9	9	9	9	

Khyati Trivedi
Signature of Candidate

[Signature]
Signature of Invigilator

C S Facsimile

[Signature]
COE Facsimile

नोट: 1. परीक्षार्थी को निर्दिष्ट विवरण जितना है कि आवश्यक होने से पूर्व शेष पर अधिसूचना जारी निर्देशों को आवश्यकता पूर्णक पढ़ें।
2. अधिसूचना में उल्लिखित कानून प्रतिक्रियाओं वाली प्रश्नों से मुक्त हो जायें। 3. चोरी को करने या किसी भी प्रकार से चोरी करने से बचना।

INSTRUCTION TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTION TO THE CANDIDATE FOR FILLING PART-III

1. Use blue or black ball point pen for writing alphabets & numerals in boxes.
2. Carefully study the example before you start marking.
3. As shown in the example below, blacken the circles completely.



4. Make no Stray marks on this sheet.

5. DO NOT WRITE OR MARK ON THE BAR CODE.

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital/ diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/electronic/digital/ watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

अनुचित साधन से बचने हेतु :

1. उत्तर पुस्तिका के निर्दिष्ट स्थान को छेदकर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कभी और न किसी तरह कोई भी चिन्ह न बनाये क्योंकि यह अनुचित साधन प्रयोग की शक्ति में आता है।
2. उत्तर पुस्तिका के कारकोड अथवा उत्तर पुस्तिका संख्या पर छेद छाप करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में गिनत वस्तुएं साथ न लाये, जैसे गिन्ते हुए कागज के टुकड़े, मोबाइल, डिजिटल डायरी, डिजिटल वॉच, घड़ी, पुस्तक या सभी वस्तुएं जो अनुचित साधन की श्रेणी में आती हैं। कोला संशोधन प्रणाली में ही मेमोरी लेस सांख्यिकी कैलकुलेटर ले जाने की अनुमति होगी।
4. उत्तर पुस्तिकाओं में कपड़े न रखें न ही उत्तर पुस्तिका में लिपकपट्टी। ऐसा करना अनुचित साधन प्रयोग की शक्ति में आता है।

उत्तरपुस्तिकाओं को भरने का निर्देश

1. परीक्षा पत्र एवं उत्तर पुस्तिका पर छिपे बचे निर्देशों को पढ़ने से पढ़ें।
2. उत्तर पुस्तिका के पृष्ठों पर कोई भी चिन्ह न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर कोनों काटें।
4. उत्तर पुस्तिका पर अपने अनुक्रमांक को अधिलेखित सुझाव न लिखें।
5. उत्तर पत्र कोड एवं उत्तर पत्र ID सही ढंग से भरें।
6. अपनी विधि स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। उत्तर पुस्तिका में पृष्ठ (1-24) से कम है या फटे हुए हैं, तो परीक्षा शुरू होने से पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. उत्तरपत्र को देख, यदि उत्तरपत्र की विषय कोड, विषय का नाम तथा उत्तर पत्र कोड गलत है तो उसके परीक्षा होने से 30 मिनट के अन्दर क्या निर्देशों को तत्काल सूचित करें, उसके बाद विरामस्थान पर जाकर परीक्षा नहीं की जायेगी।
9. उत्तरों को उत्तर लिखने के लिये खंडित का प्रयोग न करें।
10. बी कोपी का अधिलेखित प्रारंभ नहीं किया जायेगा।

INSTRUCTION TO THE CANDIDATE

1. Read the instructions carefully given on the Question Paper, Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-24) or any other kind of damage in your answer script, if found then change the answer script immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g. Subject Code, S Name, and Question of the Question Paper during first THIRTY MINUTES of commencement of the exam, so that it can be corrected in TIME. After that no corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over papers should fill in status as Carry Over. Those appearing as Ex- Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided.

INSTRUCTION TO THE CANDIDATE FOR FILLING PART-IV

1. Use blue or black ball point pen for writing alphabets & numerals in boxes.
2. Use blue or black ball point pen for filling the circles.

	1	8	1	5	4	3	2	1	6	9
0	0	0	0	0	0	0	0	0	0	0
1	●	1	●	1	1	1	1	●	1	1
2	2	2	2	2	2	2	●	2	2	2
3	3	3	3	3	3	●	3	3	3	3
4	4	4	4	4	●	4	4	4	4	4
5	5	5	5	●	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	●	6
7	7	7	7	7	7	7	7	7	7	7
8	8	●	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	●

Note- If your Roll No. is of 10 digits. Please leave first three columns .



Paper Code

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1

SECTION-A

Question-1

A.

Product of

$$[1 \ 2 \ 3] \cdot \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

$$= [1 \ 2 \ 3] \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$$

$$= [a+2h+3g \quad h+2b+3f \quad g+2f+3c] \cdot \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

$$= [1(a+2h+3g) + 2(h+2b+3f) + 3(g+2f+3c)]$$

$$= [a+2h+3g + 2h+4b+6f + 3g+6f+9c]$$

$$= [a+4h+6g+4b+12f+9c]_{\text{or}}$$

B.

$$f(x) = x^4 + 5 \text{ in } [1, 2]$$

- $f(x) = x^4 + 5$ is a polynomial therefore it is continuous in $[1, 2]$
- $f(x) = x^4 + 5$ is polynomial therefore it is differentiable in $(1, 2)$.
now there exists at least one point $c \in (a, b)$ that $f(2) - f(1) = f'(c) \cdot (2-1)$



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$$f' = 4x^3$$
$$f'(c) = 4c^3$$

$$f(2) = 2^4 + 5$$
$$= 16 + 5$$
$$= 21$$

$$f(1) = 1^4 + 5$$
$$= 6$$

$$\frac{f(2) - f(1)}{2 - 1} = f'(c)$$

$$21 - 6 = 4c^3$$

$$15 = 4c^3$$

$$15 = c^3$$

$$\sqrt[3]{15}$$

$$3.7 = \sqrt[3]{15} \quad \text{OR} \quad c = \sqrt[3]{3.7}$$

$$c = 1.68 \dots \in (1, 2)$$

Lagrange's Mean value theorem

A function $f(x)$ such that

- it is continuous in a closed interval $[a, b]$.
- it is differentiable in the open interval (a, b) .
- then there exist a point $c \in (a, b)$ such that
$$\frac{f(b) - f(a)}{b - a} = f'(c)$$



C.

$$A = \begin{bmatrix} 1 & a & a^3 \\ 1 & b & b^3 \\ 1 & c & c^3 \end{bmatrix}$$

$$R_1 = R_1 - R_2, \quad R_3 = R_3 - R_2$$
$$= \begin{bmatrix} 0 & (a-b) & (a^3-b^3) \\ 1 & b & b^3 \\ 0 & (c-b) & (c^3-b^3) \end{bmatrix}$$

$$= \begin{bmatrix} 0 & (a-b) & (a-b) & (a^2+b^2+ab) \\ 1 & b & b & b^3 \\ 0 & (c-b) & (c-b) & (c^2+b^2+bc) \end{bmatrix}$$

Taking common $(a-b)$ & $(c-b)$.

$$= \begin{matrix} (a-b) \\ (c-b) \end{matrix} \begin{bmatrix} 0 & 1 & (a^2+b^2+ab) \\ 1 & b & b^3 \\ 0 & 1 & (c^2+b^2+bc) \end{bmatrix}$$

$$= (a-b)(c-b) \cdot \begin{bmatrix} c^2+b^2+bc - a^2-b^2-ab \\ 1 & b \\ 0 & 1 \end{bmatrix}$$

$$= (a-b)(c-b) - (c^2-a^2) + (bc-ab)$$

$$= (a-b)(c-b) - [(c-a)(c+a) + b(c-a)]$$

$$= (a-b)(c-b) - (c-a)(a+b+c)$$

$$= (a-b)(b-c)(c-a)(a+b+c)$$



D. Evaluate $\lim_{x \rightarrow 3} \frac{x^2 - 5^2}{x - 5}$

$$\lim_{x \rightarrow 3} \frac{(x+5)(x-5)}{(x-5)}$$

$$\text{LHL } \lim_{h \rightarrow 0} (3-h)$$

$$3-h+5$$

$$\boxed{\text{LHL } 3+5 = 8}$$

$$\text{RHL } \lim_{h \rightarrow 0} (3+h)$$

$$3+h+5$$

$$\boxed{\text{RHL } 3+5 = 8}$$

$$\lim_{x \rightarrow 3} \frac{x^2 - 5^2}{x - 5}$$

$$= \frac{3^2 - 5^2}{3 - 5}$$

$$= \frac{9 - 25}{3 - 5}$$

$$= \frac{-16}{-2}$$

$$= 8$$

$$\text{LHL } \lim_{h \rightarrow 0} f(3-h)$$

$$\lim_{h \rightarrow 0} \frac{(3-h)^2 - 5^2}{(3-h) - 5}$$

$$\lim_{h \rightarrow 0} \frac{9 + h^2 - 6h - 5^2}{(3-h) - 5}$$

$$\frac{9 - 25}{3 - 5} = \frac{-16}{-2} = 8$$

$$\text{RHL } \lim_{h \rightarrow 0} f(3+h)$$

$$\lim_{h \rightarrow 0} \frac{(3+h)^2 - 5^2}{(3+h) - 5}$$

$$\Rightarrow \lim_{x \rightarrow 3} \frac{(x+5)(x-5)}{(x-5)}$$

$$\Rightarrow \lim_{x \rightarrow 3} x + 5$$

$$\boxed{3 + 5 = 8}$$

$$E. \vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$$

$$\vec{b} = 3\hat{j} + 2\hat{k}$$

$$(\vec{a} \cdot \vec{b}) = (2\hat{i} + 2\hat{j} - \hat{k}) \cdot (3\hat{j} + 2\hat{k})$$

$$(\vec{a} \cdot \vec{b}) = 0 + 6 - 2$$

$$(\vec{a} \cdot \vec{b}) = 4$$

$$|\vec{a}| = \sqrt{a^2 + b^2 + c^2}$$

$$= \sqrt{2^2 + 2^2 + (-1)^2}$$

$$= \sqrt{9}$$

$$= 3$$

$$|\vec{b}| = \sqrt{(3)^2 + (2)^2}$$

$$= \sqrt{9 + 4}$$

$$= \sqrt{13}$$

Do Not Write anything in this Position



Paper Code

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5

$$(\vec{a} \cdot \vec{b}) = |\vec{a}| \cdot |\vec{b}| \cdot \cos \theta$$

$$\cos \theta = \frac{(\vec{a} \cdot \vec{b})}{|\vec{a}| \cdot |\vec{b}|}$$

$$\cos \theta = \frac{4}{3\sqrt{13}}$$

$$\theta = \cos^{-1} \left[\frac{4}{3\sqrt{13}} \right]$$

f. $y = (\log x)^3$

$$\frac{dy}{dx} = 3(\log x)^2 \cdot \frac{1}{x}$$

$$\boxed{\frac{dy}{dx} = \frac{3(\log x)^2}{x}}$$

OR

$$\log y = 3 \log \log x$$

$$\frac{1}{y} \frac{dy}{dx} = 3 \cdot 1 \cdot \frac{1}{\log x \cdot x}$$

$$\frac{dy}{dx} = \frac{(\log x)^3 \cdot 3}{x \log x}$$

$$\boxed{\frac{dy}{dx} = \frac{3(\log x)^2}{x}}$$



Paper Code

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6

$$\text{Q4. } \int \frac{1}{\sqrt{9+2x}} dx.$$

$$= \int \frac{1}{\sqrt{x^2+9}}$$

$$= \int \frac{1}{\sqrt{x^2+3^2}}$$

$$= \frac{1}{2 \times 3} \log \left| \frac{3+x}{3-x} \right|$$

$$= \frac{1}{6} \log \left| \frac{3+x}{3-x} \right| + c$$

$$\left[\frac{1}{a^2} \cdot \frac{1}{2a} \log \left| \frac{a+x}{a-x} \right| + c \right]$$

H. Let a matrix be A.

$$A = \frac{1}{2} A + \frac{1}{2} A$$

$$A = \frac{1}{2} A + \frac{1}{2} A^T - \frac{1}{2} A^T + \frac{1}{2} A^T$$

$$A = \left(\frac{1}{2} A + A^T \right) + \left[\frac{1}{2} A - \frac{1}{2} A^T \right]$$

$$= \frac{1}{2} [A + A^T] + \frac{1}{2} [A - A^T]$$

$$= P + Q.$$



Paper Code

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7

where, P is symmetric matrix
and Q is skew symmetric matrix.

Proof: $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 5 \\ 0 & 0 & 1 \end{bmatrix} = A$

$$A^T = \begin{bmatrix} 2 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 5 & 1 \end{bmatrix}$$

$$A + A^T = \begin{bmatrix} 4 & 1 & 1 \\ 1 & 2 & 5 \\ 1 & 5 & 2 \end{bmatrix}$$

$$A - A^T = \begin{bmatrix} 0 & 1 & 1 \\ -1 & 0 & 5 \\ -1 & -5 & 0 \end{bmatrix}$$

$$= \frac{1}{2} [(A + A^T) + (A - A^T)]$$

$$\frac{1}{2} \left[\begin{bmatrix} 4 & 1 & 1 \\ 1 & 2 & 5 \\ 1 & 5 & 2 \end{bmatrix} + \begin{bmatrix} 0 & 1 & 1 \\ -1 & 0 & 5 \\ -1 & -5 & 0 \end{bmatrix} \right]$$

$$= \frac{1}{2} \begin{bmatrix} 4 & 2 & 2 \\ 0 & 2 & 10 \\ 0 & 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 5 \\ 0 & 0 & 1 \end{bmatrix} = A$$

Hence proved.



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$$I. \vec{a} = 3\hat{i} + 2\hat{j} - \hat{k}$$

$$b = \hat{i} + \hat{j} - \hat{k}$$

$$c = 2\hat{i} - \hat{k}$$

$$\text{Volume} = (\vec{a} \times \vec{b} \cdot \vec{c})$$

$$\begin{array}{ccc} \hat{i} & \hat{j} & \hat{k} \\ 3 & 2 & -1 \\ 1 & 1 & -1 \\ 2 & 0 & -1 \end{array}$$

$$= 3(-1+1) - 2(-1+2) + 1[0-2]$$

$$= 0 - 2 + 2 - 2$$

$$= -2$$



$$i. \vec{a} \times \vec{b} = p \cdot v \cdot \hat{j} \cdot \hat{b} - p \cdot v \cdot \hat{j} \cdot \hat{a}$$

$$= \hat{i} + \hat{j} - \hat{k} - 3\hat{i} + 2\hat{j} + \hat{k}$$

$$= -2\hat{i} - \hat{j}$$

$$\vec{b} \times \vec{c} = p \cdot v \cdot \hat{j} \cdot \hat{c} - p \cdot v \cdot \hat{j} \cdot \hat{b}$$

$$= 2\hat{i} - \hat{k} - \hat{i} - \hat{j} + \hat{k}$$

$$= \hat{i} - \hat{j}$$

$$\vec{c} \times \vec{a} = p \cdot v \cdot \hat{j} \cdot \hat{a} - p \cdot v \cdot \hat{j} \cdot \hat{c}$$

$$= 3\hat{i} + 2\hat{j} - \hat{k} - 2\hat{i} + \hat{k}$$

$$= \hat{i} + 2\hat{j}$$

$$\text{Volume} = [\vec{a} \times \vec{b} \cdot \vec{c}] \cdot \vec{c}$$

$$= \begin{array}{ccc} \hat{i} & \hat{j} & \hat{k} \\ -2 & -1 & 0 \\ 1 & -1 & 0 \end{array}$$

$$i[0-1+1] + j[-2-0] + k[2+1]$$

$$= 2\hat{j} + 3\hat{k} \cdot \vec{c}$$

$$= (2\hat{j} + 3\hat{k}) \cdot (1 + 2\hat{j})$$

$$= \boxed{4 \text{ cubic cm}}$$



Paper Code

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9

SECTION-B

Question-2.

a). $\frac{d}{dx} (x)^x$

$$y = x^x$$

$$\log y = x \log x$$

$$\frac{1}{y} \frac{dy}{dx} = x \cdot \frac{1}{x} + \log x$$

$$\frac{dy}{dx} = y (1 + \log x)$$

$$\frac{dy}{dx} = x^x (1 + \log x)$$

b). $\lim_{x \rightarrow 0} \frac{x^2 \sin \frac{1}{x}}{e^x}$

at $x=0$ $\frac{0 \times \sin \frac{1}{0}}{e^0}$

$$e^0$$

$$\frac{0}{1} = 0$$

LHL $\lim_{h \rightarrow 0} f(0-h)$

$$= \lim_{h \rightarrow 0} \frac{(0-h)^2 \sin \frac{1}{0-h}}{e^{-h}}$$

$$= \lim_{h \rightarrow 0} \frac{(h)^2 \cdot \left[\frac{\sin \frac{1}{h}}{h} \right]}{e^{-h}} = \frac{0 \times \frac{\sin \frac{1}{0}}{0}}{1} = 0$$



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$$\lim_{h \rightarrow 0} f(0+h)$$

$$= \lim_{h \rightarrow 0} \frac{(0+h)^2 \sin \frac{1}{(0+h)}}{e^{0+h}}$$

$$= \frac{0 \cdot \sin \frac{1}{0}}{1} = 0$$

$$\boxed{LHL = RHL = 0}$$

Limit of the function evaluate to 0

$$c. f(x) = \begin{cases} x^n \sin \frac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

$$f(x) = 0$$

$$LHL \lim_{h \rightarrow 0} f(0-h)$$

$$= \lim_{h \rightarrow 0} \frac{(0-h)^n \sin \frac{1}{-h}}{-h}$$

$$= \lim_{h \rightarrow 0} (-h)^n \cdot \text{infinitely oscillating value}$$

$$= 0 \times \text{infinitely oscillating value}$$

$$= 0$$



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$$\text{R.H.L} \quad \lim_{h \rightarrow 0} f(0+h)$$

$$= \lim_{h \rightarrow 0} \frac{(0+h)^n \sin 1}{(0+h)}$$

$$= \lim_{h \rightarrow 0} h^n \sin 1$$

$$= 0 \times \sin 1$$

$$= 0 \times \text{infinitely oscillating value b/w } -1, 1.$$

$$= 0$$

$$\text{L.H.L} = \text{R.H.L} = f(x).$$

\therefore function is continuous at $x=0$.

SECTION-C

Question-7.

a) $\vec{a} = 3\hat{i} + \hat{j} + \hat{k}$

$$\vec{b} = 2\hat{i} - 2\hat{j} + \hat{k}$$

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 1 & 1 \\ 2 & -2 & 1 \end{vmatrix}$$

$$= \hat{i}(1+2) - \hat{j}(3-2) + \hat{k}(-6-2)$$

$$\vec{a} \times \vec{b} = 3\hat{i} - \hat{j} - 8\hat{k}$$



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$$|\vec{a} \times \vec{b}| = \sqrt{3^2 + 1 + 8^2}$$

$$= \sqrt{9 + 1 + 64}$$

$$= \sqrt{74}$$

$$\frac{2}{\sqrt{74}}$$

$$\frac{0}{37}$$

$$\vec{a} \times \vec{b} = |\vec{a} \times \vec{b}| \cdot \text{unit vector}$$

$$\text{unit vector} = \frac{\vec{a} \times \vec{b}}{|\vec{a} \times \vec{b}|}$$

$$= \frac{3\hat{i} - \hat{j} - 8\hat{k}}{\sqrt{74}}$$

$$\vec{c} = \frac{3}{\sqrt{74}}\hat{i} - \frac{1}{\sqrt{74}}\hat{j} - \frac{8}{\sqrt{74}}\hat{k}$$

let the vector be $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$

$$|\vec{c}| = \sqrt{c_1^2 + c_2^2 + c_3^2}$$

since it is perpendicular to \vec{a} & \vec{b}

$$\vec{a} \cdot \vec{c} = 0$$

$$\vec{b} \cdot \vec{c} = 0$$

$$a_1c_1 + a_2c_2 + a_3c_3 = 0$$

$$b_1c_1 + b_2c_2 + b_3c_3 = 0$$

let $c_1 = c_2 = c_3 = k$

$$1+2 \quad 2-3 \quad -6-2$$

$$c_1 = 3k$$

$$c_2 = -1k$$

$$c_3 = -8k$$

by cross multiplication method.



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$$\vec{c} = \frac{3}{\sqrt{74}}\hat{i} - \frac{1}{\sqrt{74}}\hat{j} + \frac{8}{\sqrt{74}}\hat{k}$$

Since it is unit vector $\therefore \sqrt{c_1^2 + c_2^2 + c_3^2} = 1$

$$\sqrt{(3)^2 + (-1)^2 + (8)^2} = 1$$

$$\sqrt{74}k = 1$$

$$k = \frac{1}{\sqrt{74}}$$

$$c_1 = \frac{3}{\sqrt{74}}$$

$$c_2 = \frac{-1}{\sqrt{74}}$$

$$c_3 = \frac{8}{\sqrt{74}}$$

$$\vec{c} = \frac{3}{\sqrt{74}}\hat{i} - \frac{1}{\sqrt{74}}\hat{j} + \frac{8}{\sqrt{74}}\hat{k}$$

b). $\int \frac{x^2 \sin x}{u = v} dx$

$$\int u \cdot v = u \int v - \int \frac{du}{dx} \int v + c$$

$$= x^2(-\cos x) - \int 2x \cdot (-\cos x)$$

$$= -x^2 \cos x + 2 \int \frac{x \cos x}{u \cdot v} \quad (\text{again using integration by part})$$



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$$= -x^2 \cos x + 2 \left[x (\sin x) - \int \sin x \right] .$$

$$= -x^2 \cos x + 2 \cdot [x \sin x + \cos x] + c .$$

$$= -x^2 \cos x + 2x \sin x + 2 \cos x + c .$$

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