Chhatrapati Shahu Ji Maharaj University, Kanpur

Answer Script Details
Barcode 4852222

Roll No. 23081000409
Total Mark 38/75.00

Exam BACHELOR OF SCIENCE_DEC-2023
Subject B030101T - DIFFERENTIAL CALCULUS AND INTEGRAI

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	0/6						
1B	0/6						
1C	3/6						
1D	3/6						
1E	3/6						
1F	0/6						
1G	0/6						
1H	3/6						
1I	0/6						
2	5/12						
3	0/12						
4	0/12						
5	7/12						
6	0/12						
7	7/12						
8	7/12						
9	0/12						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-II

Date of Exam 10/01/24 Shift morning Room No. 21
Paper Code: B030101T Subject: maths Year/Sem. 1st
Name of Candidate shivani prajapati
Roll No. 2 3 0 A 1 0 0 0 4 0 9

Signature of Candidate: शिवानी प्रजापति
Signature of Invigilator:
COE Facsimile:

MARKS OBTAINED										
Q.	1	2	3	4	5	6	7	8	9	10
(a)										
(b)										
(c)										
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(i)										
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Total										
Total Marks in Figures									Max. Marks	
Total Marks in Words										

B 0 3 0 1 0 1 T
Paper Code

Signature of Evaluator

Course B.Sc
Session 2023-24 Year/Semester 1st
Subject Name mathematics
Medium English ○ Hindi ●

Paper Code
B 0 3 0 1 0 1 T

Exam Date
1 0 0 1 2 0 2 4

Name of Candidate
S H I V A N I
P R A J A P A T I

Father's Name
S A N J A Y K U M A R

महाविद्यालय का कोड College Code: A U - 0 3
परीक्षा केन्द्र का कोड Exam Centre Code: A U - 0 3

परीक्षा का प्रकार Type of Exam
Regular ● Ex-Student ○
Private ○ Back Paper Exam ○

ANSWER BOOKLET NO.
4852222

B 0 3 0 1 0 1 T
Paper Code

नामांकन संख्या Enrollment Number: C S J M A 2 3 0 0 0 0 0 3 8 5 2

परीक्षार्थी अनुक्रमांक संख्या Candidate's Roll Number: 2 3 0 A 1 0 0 0 4 0 9

पेपर कोड Paper Code: B 0 3 0 1 0 1 T

शिवानी प्रजापति
Signature of Candidate

Signature of Invigilator

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नोट - 1. परीक्षार्थी को निर्देशित किया जाता है कि आवरण पत्रके पृष्ठ भाग पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. परीक्षा में भरी जाने वाली प्रविष्टियाँ स्याही से भरी जायें। 3. गोलों को काले या नीले बॉलपेन से भरा जायें।

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 AVOD 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 निर्देशित स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखे तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ छाड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में निम्न वस्तुएं साथ न लायें, जैसे लिखे हुए कागज के टुकड़ें, मोबाईल, डिजिटल डायरी, डिजिटल वॉच, कॉपी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल संबंधित प्रश्नपत्र में ही मेमोरी लेस साइंटिफिक कैलकुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रुपये न रखें न ही उत्तर पुस्तिका में चिपकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

परीक्षार्थियों के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र ID सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1-24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को ध्यान, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जावेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. की कोपी या अतिरिक्त ग्राफ नहीं दिया जावेगा।

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 than change the answer script immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g. Subject Code, Subje Name, and Question of the Question Paper during first THIRTY MINUTES of the 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

B 0 3 0 1 0 1 T

Section-A

Answer-1 (C). $\lim_{x\to 0}\left(\frac{1}{x^2}-\frac{1}{\sin^2 x}\right)$

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

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

$$\lim_{x\to 0}\frac{(\sin^2 x - x^2)}{x^4}\left(\frac{x^2}{\sin^2 x}\right)$$

$$\lim_{x\to 0}\left(\frac{\sin^2 x - x^2}{x^4}\right)\left(\frac{x}{\sin x}\right)^2$$

$$\Rightarrow \lim_{x\to 0}\frac{\sin^2 x - x^2}{x^4}\times 1 \qquad \because \lim_{x\to 0}\frac{x}{\sin x}=1$$

$$\Rightarrow \lim_{x\to 0}\frac{2\sin x\cos x - 2x}{4x^3} \qquad \because 2\sin x\cos x = \sin 2x$$

$$\Rightarrow \lim_{x\to 0}\frac{\sin 2x - 2x}{4x^3}$$

$$\Rightarrow \lim_{x\to 0}\frac{2\cos 2x - 2}{12x^2}$$

using L' Hospital Rule

$$\Rightarrow \lim_{x\to 0}\frac{-4\sin 2x}{24x}$$

$$\Rightarrow \lim_{x\to 0}\frac{-8\cos 2x}{24} \Rightarrow \frac{-8}{24} = \frac{-1}{3}$$ Ans

P.T.O.

Ans-1(2)

$u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{x}{y}\right)$.

show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$

partial diff w.r to x.

$$\frac{\partial u}{\partial x} = \frac{1}{\sqrt{1-\frac{x^2}{y^2}}} \times \frac{1}{y} + \frac{1}{1+\frac{x^2}{y^2}} \times \frac{1}{y}$$

$$\frac{\partial u}{\partial x} = \frac{1}{\sqrt{y^2-x^2}} + \frac{y}{x^2+y^2}$$

$$x\frac{\partial u}{\partial x} = \frac{x}{\sqrt{y^2-x^2}} + \frac{xy}{x^2+y^2} \quad \text{---(1)}$$

partial diff w.r. to y.

$$\frac{\partial u}{\partial y} = \frac{1}{\sqrt{1-\frac{x^2}{y^2}}} \times \frac{-x}{y^2} + \frac{1}{1+\frac{x^2}{y^2}} \times \frac{-x}{y^2}$$

$$\frac{\partial u}{\partial y} = \frac{-x}{y\sqrt{y^2-x^2}} - \frac{x}{(x^2+y^2)}$$

multiply with y.

$$y\frac{\partial u}{\partial y} = \frac{-xy}{\sqrt{y^2-x^2}} - \frac{xy}{(x^2+y^2)} \quad \text{---(2)}$$

equation (1) and (2).

$$x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{x}{\sqrt{y^2-x^2}}+\frac{xy}{x^2+y^2}-\frac{x}{\sqrt{y^2-x^2}}-\frac{xy}{x^2+y^2}$$

$$\boxed{x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0}$$

Ans-1 (E)

$$y^3+x^2y+2xy^2-y+1=0.$$

putting $y=m$, $x=1$

$$\phi_3(m)=m^3+m+2m^2$$
$$\phi_2(m)=0$$
$$\phi_1(m)=-m$$
$$\phi_3(m)=0$$
$$m^3+2m^2+m=0$$
$$m(m^2+2m+1)=0$$
$$m=0 \quad (m+1)^2=0$$
$$\boxed{m=0,-1,-1}$$

$$c=-\frac{\phi_2(m)}{\phi_3'(m)}=-\frac{0}{\phi_3'(m)}=0$$

$$\boxed{y=0}$$

$$\frac{1}{2!}c^2\phi_3''(m)+\frac{1}{1!}c\phi_2'(m)+\phi_1(m)=0$$

$$\frac{1}{2!}\times c^2\times(6m+4)+c\times 0+(-m)=0$$

$$\frac{1}{2}\times c^2(-6+4)+1=0$$

$$-c^2+1=0$$

$$c=1,-1$$

$$\boxed{y=-x+1} \qquad \boxed{y=-x-1}$$

P.T.O.

Ans-1(H). $\vec{r} = 5t^2\hat{i} + t\hat{j} - t^3\hat{k}$

show that $\int_1^2 \vec{r} \times \frac{d^2\vec{r}}{dt^2} \cdot dt = -14\hat{i} + 75\hat{j} - 15\hat{k}$

diff w.r. to t.

$\frac{d\vec{r}}{dt} = 10t\hat{i} + \hat{j} - 3t^2\hat{k}$

Again diff w.r. to t

$\frac{d^2\vec{r}}{dt^2} = 10\hat{i} - 6t\hat{k}$

$$\vec{r} \times \frac{d^2\vec{r}}{dt^2} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 5t^2 & t & -t^3 \\ 10 & 0 & -6t \end{vmatrix}$$

$\Rightarrow \hat{i}[-6t^2 - 0] + \hat{j}[-10t^3 + 30t^2) + \hat{k}(-10t)$

$\Rightarrow -6t^2\hat{i} + 20t^2\hat{j} - 10t\hat{k}$

$$\int_1^2 \vec{r} \times \frac{d^2\vec{r}}{dt^2} = \int_1^2 (-6t^2\hat{i} + 20t^3\hat{j} - 10t\hat{k})\,dt$$

$$\Rightarrow \left[\frac{-6t^3}{3}\right]_1^2 \hat{i} + \left[\frac{20t^4}{4}\right]_1^2 \hat{j} - \left[\frac{10t^2}{2}\right]_1^2 \hat{k}$$

$\Rightarrow -2(8-1)\hat{i} + 5(16-1)\hat{j} - 5(4-1)\hat{k}$

$= \underline{-14\hat{i} + 75\hat{j} - 15\hat{k}}$ Ans

Section- B.

Part-I

Ans-2(a). $x_n = \left(1+\frac{1}{n}\right)^n$

$\lim_{n\to\infty} x_n = \lim_{n\to\infty} \left(1+\frac{1}{n}\right)^n = e$

Hence x_n is convergent

$2 < e < 3$

x_n lies between 2 and 3.

(b). Absolutely convergent series =

A series Σu_n is said to be absolutely convergent series if the corresponding series $\Sigma|u_n|$ is convergent

Ex- $1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$

Conditionally convergent series =

A series Σu_n is said to be conditionally convergent if the Σu_n is convergent and $\Sigma|u_n|$ is divergent.

Part - II

Ans-5(a)

$$\int_0^\infty \frac{\sin x}{x}\,dx$$

Let $f(x) = \frac{\sin x}{x}$ Let $g(x) = \frac{1}{x}$

$|f(x)| \cdot |\frac{1}{x}| \geq |\frac{1}{x}|$

$|f(x)| \geq g(x)$

by compoeision test $\int_0^\infty \frac{\sin x}{x}\,dx$ is convergent.

For the absolutely convergent

$f(x) = \frac{\sin x}{x}$

$|f(x)| = |\frac{\sin x}{x}|$

$|f(x)| = |\frac{1}{x}|$ $n = 1$ = Divergent.

hence $\int_0^\infty \frac{\sin x}{x}$ is not absoluetly convergent.

Paper Code

B	0	3	0	1	0	1	T

Ans-5(b) $m > -1$ and

$$\int_0^{\pi/2} \sin^m\theta \cos^m\theta \, d\theta = \frac{\left\lceil\frac{m+1}{2}\right\rceil \left\lceil\frac{n+1}{2}\right\rceil}{2\left\lceil\frac{m+n+2}{2}\right\rceil}$$

Let- $\sin^2\theta = x$.

$x = \sin^2\theta$

$dx = 2\sin\theta\cos\theta \, d\theta$.

$d\theta = \frac{dx}{2x^{1/2}(1-x)^{1/2}}$

$$\int_0^{\pi/2} (\sin^2\theta)^{m/2} [\cos^2\theta]^{n/2} \, d\theta$$

$$\int_0^1 x^{m/2} (1-x)^{n/2} \frac{dx}{2x^{1/2}(1-x)^{1/2}}$$

$$\frac{1}{2}\int_0^1 x^{\frac{m-1}{2}} (1-x)^{\frac{n-1}{2}} \, dx$$

$$\frac{1}{2}\int_0^1 x^{\frac{m+1}{2}+1} (1-x)^{\frac{n+1}{2}} \, dx.$$

$$\frac{1}{2} \frac{\left\lceil\frac{n+1}{2}\right\rceil \left\lceil\frac{m+1}{2}\right\rceil}{\left\lceil\frac{m+n+2}{2}\right\rceil} = \frac{\left\lceil\frac{m+1}{2}\right\rceil \left\lceil\frac{n+1}{2}\right\rceil}{2\left\lceil\frac{m+n+2}{2}\right\rceil}$$

Hence Proved.

P.T.O.

Section -C.

Part -I.

Ans-6-(a). Lagrange's mean value theorem.

statement:- if f is a function such that-

(i) f is continuous in the closed interval.
(ii) f is differentiable in the open interval.

Prove:- Consider a function

$$\phi(x) = f(x) + kx \quad \forall\ [a,b].$$

$\phi(x)$ is continuous in the closed interval.

$\phi(x)$ is differentiable in the open interval.

$$\phi(a) = \phi(b)$$

$$f(a) + ka = f(b) + kb$$

$$k(a-b) = f(b) - f(a)$$

$$k = \frac{f(b) - f(a)}{b-a}$$

then there exist at least one point $c \in (a,b)$ such that

$$\phi'(c) = 0.$$

$f'(x) + k = 0$

$f'(c) = -$

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

Ans-6(b) $y^2(a+x) = x^2(a-x)$.

$y^2a + y^2x = x^2a - x^3 \Rightarrow y^2x + x^3 + y^2a - x^2a = 0$.

(i) symmetry = the curve is symmetrical about x-axis.

(ii) origin = the curve passes through origin.
$0 = 0$.

(iii) tangent at origin :- equating to zero the least degree term.

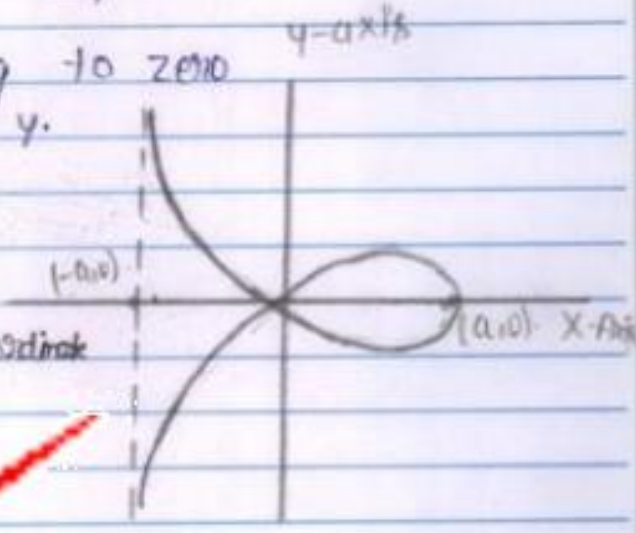
$y^2 \cdot a^2 - x^2 \cdot \cdot = 0$

$y \pm x$

(iv) asymptotes :- Equating to zero the highest powers of y.

$x + a = 0$

$x = -a$.



(v) intersection with co-ordinate Axis-

$y = 0 \quad x = a \quad x = 0$

$x = 0 \quad y = 0$.

P.T.O.

(vi) Region of existence:-

$$y = \pm x \sqrt{\frac{a-x}{a+x}}$$

put $x = -a$ $\quad y = \infty$

$x = a$ $\quad y = 0$.

Paper Code

B 0 3 0 1 0 1 T

11

Part-II

Ans-8(a). $r = a(1+\cos\theta)$.

Volume about the initial Line $= \frac{2\pi}{3}\int_0^{\pi} r^3 \cos\theta \sin\theta \, d\theta$

$V = \frac{2\pi}{3}\int_0^{\pi} a^3 (1+\cos\theta)^3 \sin\theta \, d\theta$.

$V = \frac{2\pi a^3}{3}\int_0^{\pi} (1+\cos\theta)^3 \sin\theta \, d\theta$.

$V = \frac{2\pi a^3}{3}\int_0^{\pi} \left(1+2\cos^2\frac{\theta}{2}-1\right)^3 2\sin\frac{\theta}{2}\cos\frac{\theta}{2} \, d\theta$

$V = \frac{2\pi a^3}{3}\int_0^{\pi} 16 \sin\frac{\theta}{2}\cos^7\frac{\theta}{2} \, d\theta$.

$V = \frac{32\pi a^3}{3}\int_0^{\pi} \sin\frac{\theta}{2}\cos^7\frac{\theta}{2} \, d\theta$

$\frac{\theta}{2} = t$

$d\theta = 2dt$

$V = 2\times\frac{32\pi a^3}{3}\int_0^{\pi/2} \sin t \cos^7 t \cdot dt$

$V = \frac{64}{3}\int_0^{\pi/2} \sin t \cdot \cos^7 t \cdot dt$

P.T.O.

$$V = \frac{64\pi a^3}{3} \int_0^{\pi/2} \sin t \cos^3 t \, dt$$

$$V = \frac{32}{64\pi} \cdot \frac{\lceil \frac{1+1}{2} \lceil \frac{3+1}{2}}{\lceil \frac{1+3+2}{2}}$$

$$V = \frac{32\pi a^3}{3} \cdot \frac{\lceil \frac{2}{2} \lceil \frac{4}{2}}{\lceil \frac{10}{2}}$$

$$V = \frac{32\pi a^3}{3} \times \frac{\lceil 4}{\lceil 5}$$

$$V = \frac{8}{3} \pi a^3 \times \frac{3 \times 2 \times 1}{4 \times 3 \times 2 \times 1}$$

$$\boxed{V = \frac{8\pi a^3}{3}}$$

Paper Code

B 0 S 0 1 0 1 T

13

Ans- B(b)

$$\iiint x^2 \, dx\,dy\,dz$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} \le 1$$

Let $\frac{x^2}{a^2} = u \qquad \frac{y^2}{b^2} = v \qquad \frac{z^2}{c^2} = w$

$x^2 = a^2u \qquad y^2 = b^2v \qquad z^2 = c^2w$

$x = au^{1/2} \qquad y = bv^{1/2} \qquad z = cw^{1/2}$

$dx = \frac{a}{2}u^{\frac{1}{2}-1}du \qquad dy = \frac{b}{2}v^{\frac{1}{2}-1}dv \qquad dz = \frac{c}{2}w^{\frac{1}{2}-1}dw$

$$\iiint a^2u \cdot \frac{a}{2}u^{\frac{1}{2}-1} \cdot \frac{b}{2}v^{\frac{1}{2}-1} \cdot \frac{c}{2}w^{\frac{1}{2}-1} \, du\,dv\,dw$$

$$\iiint \frac{a^3bc}{8} u^{\frac{3}{2}-1} v^{\frac{1}{2}-1} w^{\frac{1}{2}-1} \, du\,dv\,dw$$

$$\frac{a^3bc}{8} \frac{\Gamma\frac{1}{2}\,\Gamma\frac{1}{2}\,\Gamma\frac{1}{2}}{\Gamma\left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}\right)}$$

$$\frac{a^3bc}{8} \times \frac{\pi\,\Gamma\frac{1}{2}}{\Gamma\frac{3}{2}} = \frac{a^3bc}{8} \times \frac{\pi\,\Gamma\frac{1}{2}}{\frac{1}{2}\Gamma\frac{1}{2}}$$

$$\Rightarrow \frac{a^3bc\pi}{4} \quad \text{Ans}$$

$$\Rightarrow \frac{a^3bc}{8} \cdot \frac{\Gamma\frac{3}{2}\,\Gamma\frac{1}{2}\,\Gamma\frac{1}{2}}{\Gamma\frac{3}{2}+\frac{1}{2}+\frac{1}{2}}$$

$$= \frac{a^3bc}{8} \times \frac{1}{2}\pi \cdot \frac{\Gamma\frac{1}{2}}{\Gamma\frac{5}{2}}$$

$$= \frac{a^3bc}{8} \times \frac{\pi}{2} \times \frac{\Gamma\frac{1}{2}}{\frac{3}{2}\times\frac{1}{2}\Gamma\frac{1}{2}}$$

$$\Rightarrow \frac{2\pi a^3bc}{3 \times 4}$$

$$\Rightarrow \boxed{\frac{\pi a^3bc}{12}}$$

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