**SET-4**

**Series GBM**

कोड नं.
**Code No. 65(B)**

रोल नं.
Roll No.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

परीक्षार्थी कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **12** हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **29** प्रश्न हैं ।
- **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें ।**
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains **12** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **29** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

# गणित

## (केवल नेत्रहीन परीक्षार्थियों के लिए)

# MATHEMATICS

## (FOR BLIND CANDIDATES ONLY)

*निर्धारित समय : 3 घण्टे* | *अधिकतम अंक : 100*

*Time allowed : 3 hours* | *Maximum Marks : 100*

**सामान्य निर्देश :**

*(i)* **सभी** प्रश्न अनिवार्य हैं ।

*(ii)* इस प्रश्न–पत्र में **29** प्रश्न हैं ।

*(iii)* खण्ड अ के प्रश्न सं. **1 – 4** तक अति लघु-उत्तर वाले प्रश्न हैं और प्रत्येक प्रश्न के लिए **1** अंक निर्धारित है ।

*(iv)* खण्ड ब के प्रश्न सं. **5 – 12** तक लघु-उत्तर वाले प्रश्न हैं और प्रत्येक प्रश्न के लिए **2** अंक निर्धारित हैं ।

*(v)* खण्ड स के प्रश्न सं. **13 – 23** तक दीर्घ-उत्तर *I* प्रकार के प्रश्न हैं और प्रत्येक प्रश्न के लिए **4** अंक निर्धारित हैं ।

*(vi)* खण्ड द के प्रश्न सं. **24 – 29** तक दीर्घ-उत्तर *II* प्रकार के प्रश्न हैं और प्रत्येक प्रश्न के लिए **6** अंक निर्धारित हैं ।

**General Instructions :**

*(i)* ***All*** *questions are compulsory.*

*(ii)* *This question paper contains* ***29*** *questions.*

*(iii)* *Questions No.* ***1 – 4*** *in Section A are very short-answer type questions carrying* ***1*** *mark each.*

*(iv)* *Questions No.* ***5 – 12*** *in Section B are short-answer type questions carrying* ***2*** *marks each.*

*(v)* *Questions No.* ***13 – 23*** *in Section C are long-answer I type questions carrying* ***4*** *marks each.*

*(vi)* *Questions No.* ***24 – 29*** *in Section D are long-answer II type questions carrying* ***6*** *marks each.*

## खण्ड अ

## SECTION A

*प्रश्न संख्या 1 से 4 तक प्रत्येक प्रश्न का 1 अंक है ।*

*Question numbers 1 to 4 carry 1 mark each.*

**1.** किसी रेखा AB के कार्तीय समीकरण $\frac{2x-1}{\sqrt{3}} = \frac{y+2}{2} = \frac{3-z}{-3}$ हैं । रेखा AB के समांतर एक रेखा के दिक्-अनुपात ज्ञात कीजिए ।

The cartesian equations of a line AB are $\frac{2x-1}{\sqrt{3}} = \frac{y+2}{2} = \frac{3-z}{-3}$.
Find the direction ratios of a line parallel to AB.

**2.** x के सापेक्ष अवकलज ज्ञात कीजिए :

$$x^2 \cos x$$

Find the derivative w.r.t. x :

$$x^2 \cos x$$

**3.** वक्रों के कुल y = mx + c को निरूपित करने वाले अवकल समीकरण को ज्ञात कीजिए, जहाँ m तथा c स्वेच्छ अचर हैं ।

Find the differential equation representing the family of curves y = mx + c, where m and c are arbitrary constants.

**4.** आव्यूह $A = \begin{pmatrix} 1 & 5 \\ 6 & 7 \end{pmatrix}$ के लिए $(A - A')$ ज्ञात कीजिए ।

For the matrix $A = \begin{pmatrix} 1 & 5 \\ 6 & 7 \end{pmatrix}$, find $(A - A')$.

## खण्ड ब

## SECTION B

*प्रश्न संख्या 5 से 12 तक प्रत्येक प्रश्न के 2 अंक हैं ।*

*Question numbers 5 to 12 carry 2 marks each.*

**5.** एक घन का आयतन 9 सेमी$^3$/सेकण्ड की दर से बढ़ रहा है । जब उसकी भुजा की लम्बाई 10 सेमी हो, तो उसका पृष्ठीय क्षेत्रफल किस दर से बढ़ रहा है ?

The volume of a cube is increasing at the rate of 9 cm$^3$/second. How fast is its surface area increasing, when the length of the side is 10 cm ?

**6.** $\tan^{-1}\left(\frac{1-\cos x}{\sin x}\right)$ का x के सापेक्ष अवकलज ज्ञात कीजिए ।

Find the derivative of $\tan^{-1}\left(\frac{1-\cos x}{\sin x}\right)$ w.r.t. x.

**7.** आव्यूह $A = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$ का सहखंडज (adj) ज्ञात कीजिए तथा सत्यापित कीजिए कि A (adj A) = |A| I.

Find the adjoint of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$ and verify that A (adj A) = |A| I.

**8.** मूल-बिन्दु से रेखा $\frac{x-4}{-1} = \frac{y-1}{3} = \frac{z-3}{-2}$ पर डाले गए लंब के पाद के निर्देशांक ज्ञात कीजिए ।

Find the coordinates of the foot of the perpendicular drawn from the origin on the line $\frac{x-4}{-1} = \frac{y-1}{3} = \frac{z-3}{-2}$.

**9.** दर्शाइए कि फलन $f(x) = x^3 - 3x^2 + 9x + 5$, $\mathbb{R}$ पर निरंतर वर्धमान है ।

Show that the function $f(x) = x^3 - 3x^2 + 9x + 5$ is strictly increasing on $\mathbb{R}$.

**10.** ज्ञात कीजिए :

$$I = \int \frac{2}{2x^2 + 6x + 5} \, dx$$

Find :

$$I = \int \frac{2}{2x^2 + 6x + 5} \, dx$$

**11.** एक फर्नीचर का व्यापारी केवल मेज़ तथा कुर्सी बेचता है । उसके पास निवेश के लिए ₹ 50,000 हैं तथा 80 नगों को रखने के लिए स्थान है । वह एक मेज़ ₹ 800 में तथा एक कुर्सी ₹ 400 में खरीदता है । उसको एक मेज़ को बेचने पर ₹ 100 का लाभ होता है तथा एक कुर्सी को बेचने पर ₹ 50 का लाभ होता है । यह मानते हुए कि वह जो कुछ खरीदेगा, बेच लेगा, उपर्युक्त प्रश्न को एक रैखिक प्रोग्रामन समस्या बनाकर अधिकतम लाभ के लिए सूत्रबद्ध कीजिए ।

A furniture dealer sells only tables and chairs. He has ₹ 50,000 to invest and a storing capacity for 80 items. He buys a table for ₹ 800 and a chair for ₹ 400. He gets a profit of ₹ 100 on selling a table and ₹ 50 on selling a chair. Assuming that he can sell whatever he purchases, formulate the above as an LPP for maximum profit.

**12.** दो घटनाएँ A तथा B ऐसी हैं कि $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{5}$ तथा $P(B) = p$ है । p का मान ज्ञात कीजिए, यदि A तथा B स्वतंत्र घटनाएँ हैं ।

Two events A and B are such that $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{5}$ and $P(B) = p$. Find the value of p, if A and B are independent events.

## खण्ड स

## SECTION C

*प्रश्न संख्या 13 से 23 तक प्रत्येक प्रश्न के 4 अंक हैं ।*
*Question numbers 13 to 23 carry 4 marks each.*

**13.** ज्ञात कीजिए :

$$\int \frac{x^2 + x + 1}{(x-1)^3} \, dx$$

Find :

$$\int \frac{x^2 + x + 1}{(x-1)^3} \, dx$$

**14.** यदि x, y, z असमान हैं तथा $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$ है, तो दर्शाइए कि

$1 + xyz = 0$.

**अथवा**

आव्यूह $A = \begin{pmatrix} a & b \\ c & \dfrac{1+bc}{a} \end{pmatrix}$ का व्युत्क्रम ज्ञात कीजिए तथा दर्शाइए कि

$aA^{-1} = (a^2 + bc + 1)\, I - aA$.

If x, y, z are unequal and $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$, show that $1 + xyz = 0$.

**OR**

Find the inverse of the matrix $A = \begin{pmatrix} a & b \\ c & \dfrac{1+bc}{a} \end{pmatrix}$ and show that $aA^{-1} = (a^2 + bc + 1) I - aA$.

**15.** x के लिए हल कीजिए :

$$\tan^{-1}\frac{1}{4} + \tan^{-1}\frac{1}{6} + \tan^{-1}\frac{1}{x} = \frac{\pi}{4}$$

Solve for x :

$$\tan^{-1}\frac{1}{4} + \tan^{-1}\frac{1}{6} + \tan^{-1}\frac{1}{x} = \frac{\pi}{4}$$

**16.** निम्नलिखित का x के सापेक्ष अवकलन कीजिए :

$$y = (\log x)^{2x} + (2x)^{\log x}$$

**अथवा**

यदि $x = a(\cos\theta + \theta\sin\theta)$ तथा $y = a(\sin\theta - \theta\cos\theta)$ है, तो $\theta = \frac{\pi}{4}$ पर $\frac{d^2y}{dx^2}$ ज्ञात कीजिए ।

Differentiate the following w.r.t. x :

$$y = (\log x)^{2x} + (2x)^{\log x}$$

**OR**

If $x = a(\cos\theta + \theta\sin\theta)$ and $y = a(\sin\theta - \theta\cos\theta)$, find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{4}$.

**17.** अवकल समीकरण $x \cos\left(\frac{y}{x}\right) \frac{dy}{dx} = y \cos\left(\frac{y}{x}\right) + x$ का व्यापक हल ज्ञात कीजिए ।

Find the general solution of the differential equation

$$x \cos\left(\frac{y}{x}\right) \frac{dy}{dx} = y \cos\left(\frac{y}{x}\right) + x.$$

**18.** मूल्यांकन कीजिए :

$$\int_{\pi/6}^{\pi/3} \frac{dx}{1 + \cot^{3/2} x}$$

**अथवा**

$\int_{1}^{3} (x^2 + 1)\, dx$ का मान योगों की सीमा के रूप में ज्ञात कीजिए ।

Evaluate :

$$\int_{\pi/6}^{\pi/3} \frac{dx}{1 + \cot^{3/2} x}$$

**OR**

Evaluate $\int_{1}^{3} (x^2 + 1)\, dx$ as the limit of a sum.

**19.** यदि $\vec{a}$, $\vec{b}$ तथा $\vec{c}$ ऐसे सदिश हैं कि $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ तथा $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ तथा $\vec{a} \neq 0$ है, तो सिद्ध कीजिए कि $\vec{b} = \vec{c}$.

If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ and $\vec{a} \neq 0$, then prove that $\vec{b} = \vec{c}$.

**20.** यदि $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$ तथा $\vec{c} = \hat{i} + \hat{k}$ है, तो सदिश $\vec{b} + \vec{c}$ का सदिश $\vec{a}$ पर प्रक्षेप ज्ञात कीजिए ।

Find the projection of vector $\vec{b} + \vec{c}$ on vector $\vec{a}$, if $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{k}$.

**21.** एक निर्माता दो प्रकार के उत्पाद A तथा B बनाता है । उत्पाद A का एक नग बनाने में एक मशीन को $1\frac{1}{2}$ घंटे तथा एक शिल्पकार को 2 घंटे काम करना पड़ता है । उत्पाद B का एक नग बनाने में मशीन को 3 घंटे तथा शिल्पकार को 1 घंटे काम करना पड़ता है । A तथा B के एक नग को बेचने पर निर्माता को क्रमशः ₹ 10 तथा ₹ 8 का लाभ होता है । एक सप्ताह में 80 घंटे मशीन तथा 70 घंटे शिल्पकार का समय उपलब्ध है । यदि निर्माता जो कुछ बनाता है बेच लेता है, तो यह जानने के लिए कि अधिकतम लाभ के लिए A तथा B प्रत्येक के कितने नग प्रति सप्ताह बनाए जाएँ, उपर्युक्त को रैखिक प्रोग्रामन समस्या बनाकर सूत्रबद्ध कीजिए ।

यदि निर्माता बनाई गई वस्तुएँ आधे मूल्य पर समाज के आर्थिक रूप से कमज़ोर लोगों को बेचना चाहता है, तो इससे क्या मूल्य प्रदर्शित होता है ?

A manufacturer produces two types of items A and B. One unit of A requires $1\frac{1}{2}$ hours on a machine and 2 hours by a craftsman. The corresponding times for manufacturing one unit of B by the machine and the craftsman are 3 hours and 1 hour respectively. The profits on each unit of A and B are ₹ 10 and ₹ 8 respectively. In a week, the machine is available for 80 hours and the craftsman is available for 70 hours. If the manufacturer can sell all that he manufactures, to find that how many units each of A and B be made per week for maximum profit, formulate the above as an LPP.

If the manufacturer wants to sell his produce at half the rate to the economically weaker sections of the society, what value does it show ?

**22.** थैले I में 3 लाल तथा 4 काली गेंदें हैं जबकि थैले II में 5 लाल तथा 6 काली गेंदें हैं । किसी एक थैले में से एक गेंद यादृच्छया निकाली जाती है और वह लाल पाई जाती है । प्रायिकता ज्ञात कीजिए कि वह थैले II में से निकाली गई थी ।

Bag I contains 3 red and 4 black balls, while bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and is found to be red. Find the probability that it was drawn from bag II.

**23.** अच्छी प्रकार से फेंटी गई 52 पत्तों की ताश की गड्डी में से दो पत्ते उत्तरोत्तर प्रतिस्थापना सहित निकाले गए । इक्कों की संख्या का प्रायिकता बंटन ज्ञात कीजिए । अत: इस बंटन का माध्य ज्ञात कीजिए ।

Two cards are drawn successively with replacement from a well shuffled deck of 52 cards. Find the probability distribution of number of aces. Hence, find the mean of the distribution.

## खण्ड द

## SECTION D

*प्रश्न संख्या 24 से 29 तक प्रत्येक प्रश्न के 6 अंक हैं ।*

*Question numbers 24 to 29 carry 6 marks each.*

**24.** यदि $A = \begin{pmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 1 & -3 & 1 \end{pmatrix}$ है, तो $A^{-1}$ ज्ञात कीजिए । अत: समीकरण निकाय $x + 2y + z = 8,\ -x + y + z = 4,\ x - 3y + z = -2$ को हल कीजिए ।

If $A = \begin{pmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 1 & -3 & 1 \end{pmatrix}$, find $A^{-1}$. Hence solve the system of equations $x + 2y + z = 8,\ -x + y + z = 4,\ x - 3y + z = -2$.

**25.** मान लीजिए $A = \mathbb{R} - \{2\}$ तथा $B = \mathbb{R} - \{1\}$ । फलन $f : A \to B$ जो $f(x) = \dfrac{x-1}{x-2}$ द्वारा परिभाषित है, पर विचार कीजिए । सिद्ध कीजिए कि फलन f एकैकी तथा आच्छादक है । $f^{-1}(x)$ भी ज्ञात कीजिए । यदि $f^{-1}(x) = 7$ है, तो x ज्ञात कीजिए ।

**अथवा**

मान लीजिए $*$, $\mathbb{R} - \{-1\}$ पर एक द्विआधारी संक्रिया है जो $a * b = a + b + ab$ द्वारा, सभी $a, b \in \mathbb{R} - \{-1\}$, के लिए परिभाषित है । सिद्ध कीजिए कि संक्रिया $*$, $\mathbb{R} - \{-1\}$ पर क्रमविनिमेय तथा साहचर्य है । $\mathbb{R} - \{-1\}$ में $*$ का तत्समक अवयव ज्ञात कीजिए ।

Let $A = \mathbb{R} - \{2\}$ and $B = \mathbb{R} - \{1\}$. Consider the function $f : A \to B$ defined by $f(x) = \dfrac{x-1}{x-2}$. Prove that f is one-one and onto function. Also, find $f^{-1}(x)$. If $f^{-1}(x) = 7$, find x.

**OR**

Let $*$ be a binary operation on $\mathbb{R} - \{-1\}$, defined by

$a * b = a + b + ab$ for all $a, b \in \mathbb{R} - \{-1\}$. Prove that $*$ is commutative and associative on $\mathbb{R} - \{-1\}$. Find the identity element for $*$ on $\mathbb{R} - \{-1\}$.

**26.** एक वृत्त तथा एक वर्ग के परिमापों का योगफल k है, जहाँ k एक अचर है । सिद्ध कीजिए कि उनके क्षेत्रफलों का योगफल न्यूनतम है जबकि वर्ग की भुजा वृत्त की त्रिज्या की दुगुनी है ।

The sum of the perimeters of a circle and a square is k, where k is a constant. Prove that the sum of their areas is minimum, if the side of the square is double the radius of the circle.

27. समतलों $\vec{r} \cdot (\hat{i} + 2\hat{j} + 3\hat{k}) - 4 = 0$ तथा $\vec{r} \cdot (2\hat{i} + \hat{j} - \hat{k}) + 5 = 0$ की प्रतिच्छेदन रेखा को अंतर्विष्ट करने वाले तथा समतल $\vec{r} \cdot (5\hat{i} + 3\hat{j} - 6\hat{k}) + 8 = 0$ के लंबवत्, समतल का समीकरण ज्ञात कीजिए ।

**अथवा**

उस बिन्दु के निर्देशांक ज्ञात कीजिए जहाँ बिन्दुओं (5, 1, 6) तथा (3, 4, 1) में से होकर जाने वाली रेखा y-z समतल को काटती है ।

Find the equation of the plane which contains the line of intersection of the planes $\vec{r} \cdot (\hat{i} + 2\hat{j} + 3\hat{k}) - 4 = 0$ and $\vec{r} \cdot (2\hat{i} + \hat{j} - \hat{k}) + 5 = 0$ and which is perpendicular to the plane $\vec{r} \cdot (5\hat{i} + 3\hat{j} - 6\hat{k}) + 8 = 0$.

**OR**

Find the coordinates of the point where the line through the points (5, 1, 6) and (3, 4, 1) crosses the y-z plane.

28. अवकल समीकरण $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$ का विशिष्ट हल ज्ञात कीजिए, दिया गया है कि जब $x = 1$ है, तो $y = 0$ है ।

Find the particular solution of the differential equation $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$, given that $y = 0$ when $x = 1$.

29. समाकलों के प्रयोग से उस त्रिभुज के परिबद्ध क्षेत्र का क्षेत्रफल ज्ञात कीजिए जिसके शीर्ष (1, 0), (2, 2) तथा (3, 1) हैं ।

**अथवा**

दो वृत्तों $x^2 + y^2 = 4$ तथा $(x - 2)^2 + y^2 = 4$ के मध्यवर्ती क्षेत्र का क्षेत्रफल ज्ञात कीजिए ।

Using integration, find the area of the region bounded by the triangle whose vertices are (1, 0), (2, 2) and (3, 1).

**OR**

Find the area of the region enclosed between the two circles $x^2 + y^2 = 4$ and $(x - 2)^2 + y^2 = 4$.

*Strictly Confidential — (For Internal and Restricted Use Only)*

# Senior School Certificate Examination

## March 2017

### Marking Scheme — Mathematics 65(B)

***General Instructions:***

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.

2. Evaluation is to be done as per instructions provided in the marking scheme. It should not be done according to one's own interpretation or any other consideration — Marking Scheme should be strictly adhered to and religiously followed.

3. Alternative methods are accepted. Proportional marks are to be awarded.

4. In question (s) on differential equations, constant of integration has to be written.

5. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.

6. A full scale of marks - 0 to 100 has to be used. Please do not hesitate to award full marks if the answer deserves it.

7. Separate Marking Scheme for all the three sets has been given.

8. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All examiners/ Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

QUESTION PAPER CODE 65(B)

**EXPECTED ANSWER/VALUE POINTS**

## SECTION A

**1.** Given equation can be written as $\dfrac{x-1/2}{\frac{\sqrt{3}}{2}} = \dfrac{y+2}{2} = \dfrac{z-3}{3}$ $\quad \frac{1}{2}$

So, direction ratios of line parallel to AB are

$\dfrac{\sqrt{3}}{2}, 2, 3$ or $\sqrt{3}, 4, 6$ $\quad \frac{1}{2}$

**2.** Derivative of $x^2 \cos x$ is $-x^2 \sin x + 2x \cos x$ $\quad 1$

**3.** $y = mx + c \Rightarrow \dfrac{dy}{dx} = m$ $\quad \frac{1}{2}$

$\Rightarrow \dfrac{d^2y}{dx^2} = 0$ $\quad \frac{1}{2}$

**4.** $A' = \begin{pmatrix} 1 & 6 \\ 5 & 7 \end{pmatrix}$ $\quad \frac{1}{2}$

$A - A' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ $\quad \frac{1}{2}$

## SECTION B

**5.** Let V be the volume of cube then $\dfrac{dv}{dt} = 9$ cm$^3$/s

Surface area (S) of cube = $6x^2$, where x is the side

$V = x^3 \Rightarrow \dfrac{dv}{dt} = 3x^2 \dfrac{dx}{dt} \Rightarrow \dfrac{dx}{dt} = \dfrac{1}{3x^2} \dfrac{dv}{dt}$ $\quad 1$

$S = 6x^2 \Rightarrow \dfrac{dS}{dt} = 12x \dfrac{dx}{dt} = 12x \cdot \dfrac{1}{3x^2} \dfrac{dv}{dt}$ $\quad \frac{1}{2}$

$= \dfrac{4}{10} \times 9 = 3.6 \text{ cm}^2/\text{s}$ $\quad \frac{1}{2}$

**6.** $\tan^{-1}\left(\frac{1-\cos x}{\sin x}\right) = \tan^{-1}\frac{2\sin^2 x/2}{2\sin x/2\cos x/2}$ $\frac{1}{2}+\frac{1}{2}$

$= \tan^{-1}\tan\frac{x}{2} = \frac{x}{2}$ $\frac{1}{2}$

So required derivative is $\frac{1}{2}$ $\frac{1}{2}$

**7.** $\text{adj}A = \begin{bmatrix} -5 & -2 \\ -3 & 1 \end{bmatrix}$ $\frac{1}{2}$

$|A| = -11$ $\frac{1}{2}$

LHS

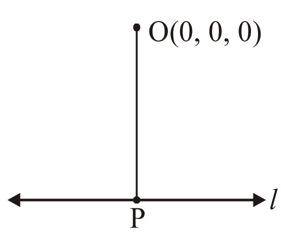
$\begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}\begin{bmatrix} -5 & -2 \\ -3 & 1 \end{bmatrix} = \begin{bmatrix} -11 & 0 \\ 0 & -11 \end{bmatrix}$ $\frac{1}{2}$

RHS

$-11\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} -11 & 0 \\ 0 & -11 \end{bmatrix}$ $\frac{1}{2}$

LHS = RHS hence verified.

**8.**




$\frac{x-4}{-1} = \frac{y-1}{3} = \frac{z-3}{-2} = \lambda(\text{say})$

Let P be foot of perpendicular from origin

So coordinates of P are $(-\lambda + 4, 3\lambda + 1, -2\lambda + 3)$ for some $\lambda$ $\frac{1}{2}$

So, dr's of OP are $(-\lambda + 4, 3\lambda + 1, -2\lambda + 3)$

As $OP \perp l$ $\therefore$ $(-\lambda + 4)(-1) + (3\lambda + 1)3 + (-2\lambda + 3)(-2) = 0$ $\frac{1}{2}$

Solving we get $\lambda = \frac{1}{2}$ $\frac{1}{2}$

$\therefore$ coordinate of P are $\left(\frac{7}{2}, \frac{5}{2}, 2\right)$ $\frac{1}{2}$

**9.** $f'(x) = 3x^2 - 6x + 9$ $\frac{1}{2}$

$= 3(x^2 - 2x + 3) = 3(x^2 - 2x + 1 + 2)$

$= 3[(x-1)^2 + 2]$ 1

Clearly $f'(x) > 0 \ \forall x \in R$

$\therefore$ f(x) is strictly increasing on R $\frac{1}{2}$

**10.** $I = \int \frac{2}{2\left(x^2 + 3x + \frac{5}{2}\right)} dx$

$= \int \frac{dx}{\left(x + \frac{3}{2}\right)^2 + \left(\frac{1}{2}\right)^2}$ 1

$= 2\tan^{-1}\left(\frac{x + 3/2}{1/2}\right) + C$ 1

or $2\tan^{-1}(2x + 3) + C$

**11.** Let number of tables be x

number of chairs be y

L.P.P. is maximize Z = 100x + 50y $\frac{1}{2}$

subject to constraints

$x + y \leq 80$

$800x + 400y \leq 50000$ $1\frac{1}{2}$

$x \geq 0, \ y \geq 0$

**12.** $P(A \cup B) = \frac{3}{5} \Rightarrow P(A) + P(B) - P(A \cap B) = \frac{3}{5}$ $\frac{1}{2}$

A & B are independent $\Rightarrow P(A) + P(B) - P(A) \cdot P(B) = \frac{3}{5}$ $\frac{1}{2}$

$\frac{1}{2} + p - \frac{p}{2} = \frac{3}{5}$ $\frac{1}{2}$

So $p = \frac{1}{5}$ $\frac{1}{2}$

## SECTION C

**13.** Let $I = \int \frac{x^2+x+1}{(x-1)^3}dx$

Let $\frac{x^2+x+1}{(x-1)^3} = \frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{C}{(x-1)^3}$ 1

$\therefore\ I = \int \frac{1}{x-1}dx + 3\int \frac{1}{(x-1)^2}dx + 3\int \frac{dx}{(x-1)^3}$ $1\frac{1}{2}$

$= \log|x-1| - \frac{3}{x-1} - \frac{3}{2(x-1)^2} + c$ $1\frac{1}{2}$

**14.** $\Delta = \begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} + \begin{vmatrix} x & x^2 & x^3 \\ y & y^2 & y^3 \\ z & z^2 & z^3 \end{vmatrix} = 0$ $\frac{1}{2}$

$= \begin{vmatrix} x & x^2 & 1 \\ y & y^2 & 1 \\ z & z^2 & 1 \end{vmatrix} + xyz \begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = 0$ $\frac{1}{2}$

Applying $C_1 \leftrightarrow C_3$, then $C_2 \leftrightarrow C_3$

$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} + xyz \begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = 0$

$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}(1+xyz) = 0$ 1

$R_2 \to R_2 - R_1$, $R_3 \to R_3 - R_1$

$\begin{vmatrix} 1 & x & x^2 \\ 0 & y-x & y^2-x^2 \\ 0 & z-x & z^2-x^2 \end{vmatrix}(1+xyz) = 0$

$(x-y)(y-z)(z-x)(1+xyz)=0$ 1

$\Rightarrow (x-y)(y-z)(z-x)(1+xyz)=0$

As x, y, z are unequal

$\therefore$ $1+xyz=0$ hence proved. 1

**OR**

$|A| = a\left(\frac{1+bc}{a}\right) - bc = 1 \neq 0$ $\frac{1}{2}$

$\text{adj}A = \begin{pmatrix} \frac{1+bc}{a} & -b \\ -c & a \end{pmatrix}$ $\frac{1}{2}$

So $A^{-1} = \frac{\text{adj}A}{|A|} = \begin{pmatrix} \frac{1+bc}{a} & -b \\ -c & a \end{pmatrix}$ 1

| LHS | RHS |
|---|---|
| $aA^{-1}$ | $(a^2+bc+1)\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - a\begin{pmatrix} a & b \\ c & \frac{1+bc}{a} \end{pmatrix}$ |
| $a\begin{pmatrix} \frac{1+bc}{a} & -b \\ -c & a \end{pmatrix}$ | $\begin{pmatrix} a^2+bc+1 & 0 \\ 0 & a^2+bc+1 \end{pmatrix} - \begin{pmatrix} a^2 & ab \\ ac & 1+bc \end{pmatrix}$ |
| $\begin{pmatrix} 1+bc & -ab \\ -ac & a^2 \end{pmatrix}$ | $\begin{pmatrix} bc+1 & -ab \\ -ac & a^2 \end{pmatrix}$ 1+1 |
| | LHS = RHS |

**15.** $\tan^{-1}\left(\dfrac{\frac{1}{4}+\frac{1}{6}}{1-\frac{1}{4}\cdot\frac{1}{6}}\right)+\tan^{-1}\dfrac{1}{x} = \dfrac{\pi}{4}$ 1

$\tan^{-1}\dfrac{10}{23}+\tan^{-1}\dfrac{1}{x} = \dfrac{\pi}{4}$ $\frac{1}{2}$

$\tan^{-1}\dfrac{1}{x} = \tan^{-1}1-\tan^{-1}\dfrac{10}{23}$ $\frac{1}{2}$

$\tan^{-1}\dfrac{1}{x} = \tan^{-1}\left(\dfrac{1-\frac{10}{23}}{1+1\cdot\frac{10}{23}}\right)$ 1

$\tan^{-1}\dfrac{1}{x} = \tan^{-1}\dfrac{13}{33}$

$x = \dfrac{33}{13}$ 1

**16.** $y = u + v$

$\dfrac{dy}{dx} = \dfrac{du}{dx} + \dfrac{dv}{dx}$ $\frac{1}{2}$

where $u = (\log x)^{2x}$, $v = (2x)^{\log x}$

$\log u = 2x \log(\log x)$, $\log v = \log x \cdot \log 2x$ 1

$\dfrac{1}{u}\dfrac{du}{dx} = \dfrac{2}{\log x}+2\log(\log x)$, $\dfrac{1}{v}\dfrac{dv}{dx} = \dfrac{\log 2x}{x}+\dfrac{\log x}{x}$

$\dfrac{du}{dx} = (\log x)^{2x}\left(\dfrac{2}{\log x}+2\log(\log x)\right)$, $\dfrac{dv}{dx} = (2x)^{\log x}\left(\dfrac{\log 2x+\log x}{x}\right)$ 1+1

$\therefore \dfrac{dy}{dx} = (\log x)^{2x}\left(\dfrac{2}{\log x}+2\log(\log x)\right)+(2x)^{\log x}\left(\dfrac{\log 2x+\log x}{x}\right)$ $\frac{1}{2}$

**OR**

$$\frac{dx}{d\theta} = a(-\sin\theta + \theta\cos\theta + \sin\theta) = a\theta\cos\theta$$ 1

$$\frac{dy}{d\theta} = a(\cos\theta + \theta\sin\theta - \cos\theta) = a\theta\sin\theta$$ 1

$$\frac{dy}{dx} = \frac{a\theta\sin\theta}{a\theta\cos\theta} = \tan\theta$$ $\frac{1}{2}$

$$\frac{d^2y}{dx^2} = \sec^2\theta\cdot\frac{d\theta}{dx} = \frac{\sec^3\theta}{a\theta}$$ 1

$$\left.\frac{d^2y}{dx^2}\right|_{\text{at }\theta=\pi/4} = \frac{8\sqrt{2}}{a\pi}$$ $\frac{1}{2}$

**17.** Given differential equation can be written as

$$\frac{dy}{dx} = \frac{y\cos\frac{y}{x} + x}{x\cos\frac{y}{x}} \quad \text{...(A)}$$ $\frac{1}{2}$

Let $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$ 1

(A) becomes

$$v + x\frac{dv}{dx} = \frac{v\cos v + 1}{\cos v}$$

$$x\frac{dv}{dx} = \frac{1}{\cos v}$$

$$\int \cos v\, dv = \int \frac{dx}{x}$$ 1

$\sin v = \log|x| + c$ 1

$$\sin\frac{y}{x} = \log|x| + c$$ $\frac{1}{2}$

**18.** Writing $I = \int_{\pi/6}^{\pi/3} \frac{\sin^{3/2} x}{\sin^{3/2} x + \cos^{3/2} x} dx$ ...(i) 1

Using property $x \to (\pi/6 + \pi/3 - x)$

$$I = \int_{\pi/6}^{\pi/3} \frac{\cos^{3/2} x}{\cos^{3/2} x + \sin^{3/2} x} dx \quad \text{...(ii)}$$ 1

Adding

$$2I = \int_{\pi/6}^{\pi/3} \frac{\sin^{3/2} x + \cos^{3/2} x}{\cos^{3/2} x + \sin^{3/2} x} dx$$

Integrating

$$2I = x \Big|_{\pi/6}^{\pi/3}$$ 1

$$I = \frac{\pi}{12}$$ 1

**OR**

$f(x) = x^2 + 1,\ a = 1,\ b = 3 \quad nh = 2$ $\frac{1}{2}$

$$\int_1^3 (x^2 + 1)\,dx = \lim_{h \to 0} h[f(1) + f(1+h) + \ldots + f(1 + \overline{n-1}h)]$$ 1

$$= \lim_{h \to 0} h[2 + (h^2 + 2h + 2) + \ldots + (n-1)^2 h^2 + 2(n-1)h + 2]$$ $\frac{1}{2}$

$$= \lim_{h \to 0} h[h^2 \Sigma(n-1)^2 + 2h\Sigma(n-1) + 2n]$$

$$= \lim_{h \to 0} h^3 \frac{(n-1)n(2n-1)}{6} + 2h^2 \frac{(n-1)n}{2} + 2nh$$

$$= \lim_{h \to 0} \frac{(nh-h)(nh)(2nh-h)}{6} + (nh-h)(nh) + 2nh$$ 1

$$= \frac{2 \times 2 \times 4}{6} + 2 \times 2 + 4$$

$$= \frac{32}{3}$$ 1

**19.** $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} \Rightarrow \vec{a} \cdot (\vec{b} - \vec{c}) = 0$ & $\vec{a} \neq 0$

$\Rightarrow \quad \vec{b} = \vec{c}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $1\frac{1}{2}$

$\vec{a} \times \vec{b} = \vec{a} \times \vec{c} \Rightarrow \vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ and $\vec{a} \neq 0$

$\Rightarrow \quad \vec{b} = \vec{c}$ or $\vec{a}$ & $\vec{b} - \vec{c}$ are parallel $1\frac{1}{2}$

$\vec{a} \perp (\vec{b} - \vec{c})$ and $\vec{a} \parallel (\vec{b} - \vec{c})$ are not possible sumultaneously 1

So $\quad \vec{b} = \vec{c} \quad$ Hence proved.

**20.** $\vec{b}+\vec{c} = 2\hat{i}+3\hat{j}+2\hat{k}, |\vec{a}| = \sqrt{6}$ 1+1

Projection of $\vec{b}+\vec{c}$ on $\vec{a} = \dfrac{(\vec{b}+\vec{c})\cdot\vec{a}}{|\vec{a}|}$

$= \dfrac{2+6+2}{\sqrt{6}}$ 1

$= \dfrac{10}{\sqrt{6}}$ or $\dfrac{5}{3}\sqrt{6}$ 1

**21.** Let number of units of type A = x $\frac{1}{2}$

number of units of type B = y

L.P.P. is Maximize profit Z = 10x + 8y 1

Subject to constraints

$\frac{3}{2}x + 3y \le 80$

$2x + y \le 70$ $1\frac{1}{2}$

$x, y \ge 0$

Value: Kindness or any other relevant value. 1

**22.** Let the events be

$E_1 \to$ Ball is drawn from Bag 1

$E_2 \to$ Ball is drawn from Bag 2 1

$A \to$ Ball drawn is Red

$P(E_1) = \frac{1}{2}, P(E_2) = \frac{1}{2}, P(A/E_1) = \frac{3}{7}, P(A/E_2) = \frac{5}{11}$ 1

$P(E_2/A) = \dfrac{P(E_2)\,P(A/E_2)}{P(E_1)\,P(A/E_1)+P(E_2)\,P(A/E_2)}$

$= \dfrac{\frac{1}{2}\times\frac{5}{11}}{\frac{1}{2}\times\frac{3}{7}+\frac{1}{2}\times\frac{5}{11}}$ 1

$= \dfrac{35}{68}$ 1

**23.** Let X denotes the number of aces

$p = \frac{1}{13},\ q = \frac{12}{13}$ 1

| X | P(x) | XP(x) |
|---|---|---|
| 0 | $\frac{144}{169}$ | 0 |
| 1 | $\frac{24}{169}$ | $\frac{24}{169}$ |
| 2 | $\frac{1}{169}$ | $\frac{2}{169}$ |

1+1

Mean $= 0 + \frac{24}{169} + \frac{2}{169} = \frac{2}{13}$ 1

## SECTION D

**24.** $A = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 1 & -3 & 1 \end{bmatrix} \Rightarrow |A| = 10 \neq 0$ 1

$A_{11} = 4 \quad A_{12} = 2 \quad A_{13} = 2$

$A_{21} = -5 \quad A_{22} = 0 \quad A_{23} = 5$

$A_{31} = 1 \quad A_{32} = -2 \quad A_{33} = 3$ 2

$A^{-1} = \frac{\text{Adj}A}{|A|} = \frac{1}{10}\begin{bmatrix} 4 & -5 & 1 \\ 2 & 0 & -2 \\ 2 & 5 & 3 \end{bmatrix}$ $\frac{1}{2}$

Given system of equations can be written as

$\begin{bmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 1 & -3 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 4 \\ -2 \end{bmatrix}$ i.e. $AX = B \Rightarrow X = A^{-1}B$ 1

$X = \frac{1}{10}\begin{bmatrix} 4 & -5 & 1 \\ 2 & 0 & -2 \\ 2 & 5 & 3 \end{bmatrix}\begin{bmatrix} 8 \\ 4 \\ -2 \end{bmatrix} = \frac{1}{10}\begin{bmatrix} 10 \\ 20 \\ 30 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$

$\therefore\ x = 1,\ y = 2,\ z = 3$ $1\frac{1}{2}$

**25.** For one-one

Let $x_1, x_2 \in A$ such that $f(x_1) = f(x_2)$

$$\Rightarrow \frac{x_1 - 1}{x_1 - 2} = \frac{x_2 - 1}{x_2 - 2}$$

$$\Rightarrow x_1 \cancel{x_2} - 2x_1 - x_2 + \cancel{2} = x_1 \cancel{x_2} - x_1 - 2x_2 + \cancel{2}$$

$$\Rightarrow -x_1 = -x_2 \Rightarrow x_1 = x_2$$

So f is one-one 2

For onto

Let $y \in B$

Let $f(x) = y$

i.e. $\frac{x-1}{x-2} = y$

$$\Rightarrow x - 1 = xy - 2y$$

$$\Rightarrow x - xy = 1 - 2y$$

$$\Rightarrow x = \frac{1-2y}{1-y} \in A \;\forall\; y \in B$$

$\therefore$ f is onto 2

So f is invertible & $f^{-1}: B \to A$ defined as

$f^{-1}(x) = \frac{1-2x}{1-x}$ 1

As $f^{-1}(x) = 7 \Rightarrow \frac{1-2x}{1-x} = 7$

$\Rightarrow x = \frac{6}{5}$ 1

**OR**

Let $a, b \in R - \{-1\}$

$a * b = a + b + ab$

$b * a = b + a + ba$

$\therefore$ $a * b = b * a \ \forall\ a, b \in R \sim \{-1\}$

$\therefore$ $*$ is commutative 2

Let $a, b, c \in R - \{-1\}$

$$
\begin{aligned}
a * (b * c) &= a * (b + c + bc) \\
&= a + b + c + bc + a(b + c + bc) \\
&= a + b + c + bc + ab + ac + abc \\
(a * b) * c &= (a + b + ab) * c \\
&= a + b + ab + c + (a + b + ab)c \\
&= a + b + ab + c + ac + bc + abc
\end{aligned}
$$

So $a * (b * c) = (a * b) * c$

$\therefore$ $*$ is associative 2

For identity

Let $e \in R - \{-1\}$ be identity element

$\therefore$ $a * e = a = e * a$

$a * e = a$

$\Rightarrow$ $a + e + ae = a$

$e(1 + a) = 0$

$e = 0$ as $1 + a \neq 0$

$\therefore$ 0 is the identity element 2

**26.** Let radius of circle be r

& side of square be a

So $2\pi r + 4a = k \Rightarrow a = \dfrac{k - 2\pi r}{4}$ 1

$A = \pi r^2 + a^2$

$$A = \pi r^2 + \frac{(k-2\pi r)^2}{16}$$ 1

$$\frac{dA}{dr} = 2\pi r - 4\pi\frac{(k-2\pi r)}{16}$$ 1

$$\frac{dA}{dr} = 0 \Rightarrow 2\pi r = \pi\frac{(k-2\pi r)}{4} \Rightarrow k = 8r + 2\pi r$$

So $a = \frac{8r + 2\pi r - 2\pi r}{4} = 2r$ $1\frac{1}{2}$

$$\frac{d^2A}{dr^2} = 2\pi + \frac{\pi^2}{2} > 0$$ 1

Thus area is minimum when a = 2r

i.e. side of square is double the radius of circle. $\frac{1}{2}$

**27.** Equation of required plane is

$$[\vec{r}\cdot(\hat{i}+2\hat{j}+3\hat{k})-4]+\lambda[\vec{r}\cdot(2\hat{i}+\hat{j}-\hat{k})+5] = 0$$ 1

$$\vec{r}\cdot[(1+2\lambda)\hat{i}+(2+\lambda)\hat{j}+(3-\lambda)\hat{k}] = 4 - 5\lambda$$ 1

Above plane is perpendicular to $\vec{r}\cdot(5\hat{i}+3\hat{j}-6\hat{k}) = -8$

$\therefore$ $(1 + 2\lambda)5 + (2 + \lambda)3 + (3 - \lambda)(-6) = 0$ 1

gives $\lambda = \frac{7}{19}$ 1

So required equation of plane is

$$\vec{r}\cdot\left(\frac{33}{19}\hat{i}+\frac{45}{19}\hat{j}+\frac{50}{19}\hat{k}\right) = \frac{41}{19}$$

or $\vec{r}\cdot(33\hat{i}+45\hat{j}+50\hat{k}) = 41$ 2

**OR**

Equation of line through (5, 1, 6) and (3, 4, 1)

is $\frac{x-5}{-2} = \frac{y-1}{3} = \frac{z-6}{-5} = \lambda$ say 2 required point on line is

$(-2\lambda + 5, 3\lambda + 1, -5\lambda + 6)$ for some $\lambda$ $1\frac{1}{2}$

As it lies on YZ plane

so $-2\lambda + 5 = 0 \Rightarrow \lambda = \frac{5}{2}$ 1

So required point is $\left(0, \frac{17}{2}, \frac{-13}{2}\right)$ $1\frac{1}{2}$

**28.** Given differential equation can be written as

$$\frac{dy}{dx} + \frac{y}{x \log x} = \frac{2}{x^2}$$ $\frac{1}{2}$

Integrating factor is $e^{\int \frac{1}{x \log x} dx} = e^{\log (\log x)} = \log x$ 1

Solution is

$$y \cdot \log x = \int \frac{2}{x^2} \log x \, dx + c$$ 1

$$= \log x \left(\frac{-2}{x}\right) - \int \frac{1}{x}\left(\frac{-2}{x}\right) dx + c$$

$$y \cdot \log x = \frac{-2 \log x}{x} - \frac{2}{x} + c$$ 2

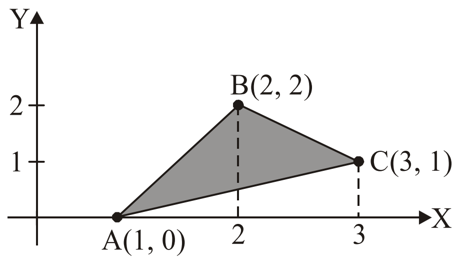
Putting $y = 0$, $x = 1$

$0 = 0 - 2 + c \Rightarrow c = 2$ 1

So particular solution is

$$y \cdot \log x = \frac{-2 \log x - 2}{x} + 2$$ $\frac{1}{2}$

**29.**




Equation of AB: $y = 2(x-1)$

Equation of BC: $y = 4 - x$

Equation of AC: $y = \frac{x-1}{2}$ Correct equation of lines: $1\frac{1}{2}$

Correct figure 1

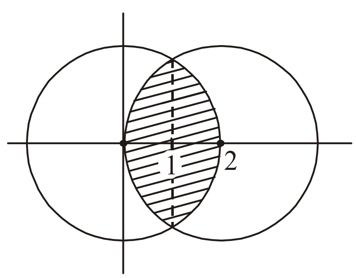
Required area $= \int_1^2 2(x-1)\,dx + \int_2^3 (4-x)\,dx - \int_1^3 \frac{(x-1)}{2}\,dx$ $1\frac{1}{2}$

$$= (x-1)^2\Big]_1^2 + \frac{(4-x)^2}{-2}\Big]_2^3 - \frac{(x-1)^2}{4}\Big|_1^3$$ 1

$$= 1 + \frac{3}{2} - 1$$

$$= \frac{3}{2}\text{ sq.units}$$ 1

**OR**




Correct figure 1

x coordinate of point of intersection is 1 1

Required area $= 2\left[\int_0^1 \sqrt{4-(x-2)^2}\,dx + \int_1^2 \sqrt{4-x^2}\,dx\right]$ 1

$$= 2\left[\frac{x-2}{2}\sqrt{4-(x-2)^2} + \frac{4}{2}\sin^{-1}\left(\frac{x-2}{2}\right)\Big|_0^1 + \frac{x}{2}\sqrt{4-x^2} + \frac{4}{2}\sin^{-1}\frac{x}{2}\Big|_1^2\right]$$ 2

$$= 2\left[\frac{-\sqrt{3}}{2} - \frac{\pi}{3} + \pi + \pi - \frac{\sqrt{3}}{2} - \frac{\pi}{3}\right]$$

$$= \frac{8\pi}{3} - 2\sqrt{3}\text{ square units}$$ 1