This Question Paper contains 20 printed pages.
(Part - A & Part - B)

Sl.No.

050 (E)

(MARCH, 2024)
(SCIENCE STREAM)
(CLASS - XII)

પ્રશ્ન પેપરનો સેટ નંબર જેની સામેનું વર્તુળ OMR શીટમાં ઘટ્ટ કરવાનું રહે છે.
Set No. of Question Paper, circle against which is to be darken in OMR sheet.

16

Part - A : Time : 1 Hour / Marks : 50
Part - B : Time : 2 Hours / Marks : 50

(Part - A)

Time : 1 Hour] ***[Maximum Marks : 50***

Instructions :

1) **There are 50 objective type (M.C.Q.) questions in Part - A and all questions are compulsory.**
2) **The questions are serially numbered from 1 to 50 and each carries 1 mark.**
3) **Read each question carefully, select proper alternative and answer in the OMR sheet.**
4) **The OMR sheet is given for answering the questions. The answer of each question is represented by (A) O, (B) O, (C) O and (D) O. Darken the circle ● of the correct answer with ball-pen.**
5) **Rough work is to be done in the space provided for this purpose in the Test Booklet only.**
6) Set No. of Question Paper printed on the upper- most right side of the Question Paper is to be written in the column provided in the OMR sheet.
7) Use of simple calculator and log table is allowed, if required.
8) Notations used in this question paper have proper meaning.

Rough Work

1) If the lines $\frac{1-x}{3}=\frac{y-2}{1}=\frac{z-1}{2}$ and $\frac{x-2}{p}=\frac{y-1}{2}=\frac{z-2}{1}$ are perpendicular to each other, then $p =$ ________.

(A) $-\frac{2}{3}$ (B) 0

(C) $\frac{4}{3}$ (D) $-\frac{4}{3}$

Rough Work

2) For linear programming problem, the objective function is $Z = 3x + 2y$. If the corner points of the bounded feasible region are $(12,0)$, $(4,2)$, $(1,5)$ and $(0,10)$, then the maximum value of Z is _______.

(A) • 36 (B) 46

(C) 13 (D) 56

3) Corner points of the feasible region determined by the system of linear constraints are $(0,3)$, $(1,1)$ and $(3,0)$. Let $Z = px + qy$, where $p, q > 0$. Condition on p and q so that the minimum value of Z occurs at (3, 0) and (1, 1) is _______.

(A) $p = 2q$ (B) • $p = \frac{q}{2}$

(C) $p = 3q$ (D) $p = q$

4) The probability of obtaining an even number on each die, when a pair of dice is rolled is _______.

(A) $\frac{1}{9}$ (B) $\frac{1}{2}$

(C) • $\frac{1}{4}$ (D) $\frac{1}{36}$

5) Given that events A and B are such that $P(A) = 0.5$, $P(A \cup B) = 0.6$, $P(B) = K$. If A and B are mutually exclusive events then K = _______.

(A) • 0.1 (B) 0.2

(C) 0.11 (D) 0

Rough Work

6) The relation $R = \{(a,b),(b,a)\}$ is defined on the set $\{a,b,c\}$, then R is _______.

(A) Reflexive, but not symmetric and transitive

(B) • Symmetric, but not reflexive and transitive

(C) Transitive, but not reflexive and symmetric

(D) An equivalence relation

7) Function defined as $f : N \rightarrow N$, $f(x) = x^6$, then _______.

(A) f is one-one and onto.

(B) f is many-one and onto.

(C) • f is one-one, but not onto.

(D) f is neither one-one nor onto.

8) Let $A = \{1,2,3\}$, then number of equivalence relations containing (1, 2) is _______.

(A) 4 (B) 3

(C) • 2 (D) 1

9) $\sin^{-1}\left(-\frac{1}{2}\right) + \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) =$ _______.

(A) $\frac{\pi}{2}$ (B) π

(C) $\frac{5\pi}{6}$ (D) • 0

Rough Work

10) $\tan^{-1}\left(\tan\frac{31\pi}{6}\right) =$ ______.

(A) $\frac{\pi}{6}$ (B) $\frac{5\pi}{6}$

(C) $\frac{31\pi}{6}$ (D) $-\frac{\pi}{6}$

11) If $\cos^{-1} x = y$, then ______.

(A) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

(B) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$

(C) $0 < y < \pi$

(D) $0 \le y \le \pi$

12) $\cos\left(\tan^{-1} x\right) =$ ______. $\left(|x| < 1\right)$.

(A) $\frac{x}{\sqrt{1-x^2}}$ (B) $\frac{1}{\sqrt{1-x^2}}$

(C) $\frac{1}{\sqrt{1+x^2}}$ (D) $\frac{x}{\sqrt{1+x^2}}$

13) The number of all possible matrices of order 3×2 with each entry 1 or 2 is ________.

(A) 512 (B) 64

(C) 32 (D) 128

Rough Work

14) If $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 \\ 1 & -2 \\ 0 & 3 \end{bmatrix}$, then AB = ________.

(A) $\begin{bmatrix} 4 & 0 \\ 1 & -2 \\ 0 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 4 & 0 \\ 1 & -2 \end{bmatrix}$ (D) not defined

15) If A is a square matrix such that $A^2 = A$, then $(I + A)^2 - 3A =$ ______.

(A) A (B) I − A

(C) I (D) 3A

16) If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then $A^{10} =$ ________.

(A) 1024A (B) 512A

(C) 10A (D) A

17) If $f(\theta) = \begin{vmatrix} \cos\theta & -\sin\theta \\ \sin\theta & -\cos\theta \end{vmatrix}$, then $f\left(\frac{\pi}{6}\right) =$ ______.

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$

(C) $\frac{\sqrt{3}}{2}$ (D) $-\frac{\sqrt{3}}{2}$

Rough Work

18) If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 3 \\ 1 & 0 & 1 \end{bmatrix}$, then $|adj\, A| =$ ________.

(A) 2

(B)• 4

(C) 8

(D) 6

19) If $A = \begin{bmatrix} 5 & -2 \\ 4 & 3 \end{bmatrix}$, then $A(adj\, A) =$ ________.

(A) I

(B) A

(C)• 23 I

(D) 23 A

20) If area of a triangle is 3 sq. units with the vertices $(3,5)$, $(2,2)$ and $(k,2)$, then $k =$ ________.

(A)• 0, 4

(B) 0, –4

(C) 3, 1

(D) –3, 1

21) If $f(x) = \begin{cases} kx+1, & x \le \frac{\pi}{2} \\ \sin x, & x > \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, then $k =$ ________.

(A) $-\frac{2}{\pi}$

(B) $\frac{2}{\pi}$

(C) 1

(D)• 0

Rough Work

22) If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots$, then $\frac{dy}{dx} =$ ________.

(A)• y (B) $y - 1$

(C) 0 (D) does not exist

23) Differentiation of $\sin^2 x$ w.r.t. $\cos^2 x$ is ________.

(A) $\tan^2 x$ (B) $-\tan^2 x$

(C)• -1 (D) 1

24) The rate of change of the volume of a sphere with respect to radius r, at $r = 3$ cm is ________ cm^3/s.

(A) 12π (B)• 36π

(C) 24π (D) 81π

25) The total revenue in Rupees received from the sale of x units of a product is given by, $R(x) = x^2 + 6x + 5$. The marginal revenue, when $x = 20$ is ₹ ________.

(A) 525 (B) 126

(C)• 46 (D) 96

26) The function given by $f(x) = x^2 - 6x + 10$ is an increasing in ________ interval.

(A)• $(3, \infty)$ (B) $(-\infty, 3)$

(C) $(-3, 3)$ (D) $(0, 6)$

Rough Work

27) The point on the curve $x^2 = 2y$ which is nearest to the point (0, 5) is ________.

(A) (2, 2) (B) (0, 0)

(C) $\left(2\sqrt{2},0\right)$ (D)• $\left(2\sqrt{2},4\right)$

28) $\int \frac{\operatorname{cosec}^2 x}{\sec^2 x} dx =$ ________ + C.

(A) $\tan x - x$

(B)• $-\cot x - x$

(C) $\cot x - x$

(D) $-\cot x + x$

29) $\int \frac{1}{x + x\log x} dx =$ ____________ + C.

(A) $1+\log x$ (B) $\log|\log x|$

(C)• $\log|\log ex|$ (D) $\frac{(1+\log x)^2}{2}$

30) $\int \frac{1}{e^x+1} dx =$ ________ + C.

(A)• $\log\left|\frac{e^x}{e^x+1}\right|$ (B) $\log\left|\frac{e^x+1}{e^x}\right|$

(C) $\log\left|\frac{1}{e^x+1}\right|$ (D) $\log\left|\frac{e^x-1}{e^x+1}\right|$

Rough Work

31) $\int \frac{dx}{x^2+2x+5} =$ ________ + C.

(A) $\tan^{-1}\left(\frac{x+1}{2}\right)$

(B) • $\frac{1}{2}\tan^{-1}\left(\frac{x+1}{2}\right)$

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

(D) $\frac{1}{2}\tan^{-1}(x+1)$

32) $\int_{-1}^{1} \sin^7 x \cdot \cos^6 x \, dx =$ ______.

(A) -1

(B) 2

(C)• 0

(D) 1

33) $\int e^x \tan x(1+\tan x)dx =$ ______ + C.

(A)• $e^x(\tan x - 1)$

(B) $e^x \tan x$

(C) $e^x \sec x$

(D) $e^x(\tan x + 1)$

34) $\int_{0}^{2\pi} \sin^3 x \ \cos^2 x \, dx =$ ________.

(A) 2π

(B) -1

(C) 1

(D) • 0

Rough Work

35) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\cos^{3/2} x}{\cos^{3/2} x + \sin^{3/2} x} dx =$ ________.

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{6}$

(C)• $\frac{\pi}{12}$

(D) $\frac{\pi}{2}$

36) The area bounded by the curve $y = \cos x$ between $x = \frac{\pi}{2}$ and $x = \frac{3\pi}{2}$ is ______.

(A) 1

(B)• 2

(C) 3

(D) 4

37) Area of the region bounded by the curve $y^2 = 4x$, y - axis and the line $y = 3$ is ________.

(A) $\frac{9}{2}$

(B) 3

(C)• $\frac{9}{4}$

(D) 2

38) The area bounded by the curve $y = x|x|$, x - axis and the ordinates $x = 0$ and $x = 1$ is given by ________.

(A) 0

(B)• $\frac{1}{3}$

(C) $\frac{2}{3}$

(D) $\frac{4}{3}$

Rough Work

39) The order of the differential equation

$$\left(\frac{d^3y}{dx^3}\right)^4+\left(\frac{d^2y}{dx^2}\right)^2+\sin\left(\frac{dy}{dx}\right)+1=0 \text{ is } \_\_\_\_\_\_\_\_.$$

(A)• 3 (B) 4

(C) 2 (D) undefined

40) The number of arbitrary constants in the particular solution of a differential equation of fourth order are ________.

(A)• 0 (B) 4

(C) 3 (D) 2

41) The integrating factor of the differential equation

$$x\frac{dy}{dx}+2y=x^2\,(x\neq 0) \text{ is } \_\_\_\_\_\_\_\_.$$

(A) $2\log x$ (B) $\log x$

(C) $\frac{2}{x}$ (D)• x^2

42) The general solution of a differential equation $\frac{ydx-xdy}{y}=0$ is ________.

(A) $y=Cx^2$ (B)• $y=Cx$

(C) $x=Cy^2$ (D) $xy=C$

Rough Work

43) The vector in the direction of a vector $\vec{a} = 4\hat{i} + 3\hat{j} - 2\hat{k}$, that has magnitude $2\sqrt{29}$ is ________.

(A) $\frac{4}{\sqrt{29}}\hat{i} + \frac{3}{\sqrt{29}}\hat{j} - \frac{2}{\sqrt{29}}\hat{k}$

(B) $4\hat{i} + 3\hat{j} - 2\hat{k}$

(C)• $8\hat{i} + 6\hat{j} - 4\hat{k}$

(D) $\frac{2}{\sqrt{29}}\hat{i} + \frac{3}{2\sqrt{29}}\hat{j} - \frac{1}{\sqrt{29}}\hat{k}$

44) The direction cosines of the vector joining the points $A(1,2,-3)$ and $B(-1,-2,1)$, directed from A to B is ______.

(A)• $-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

(B) $\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

(C) $\frac{1}{3}, \frac{2}{3}, -\frac{2}{3}$

(D) $\frac{1}{3}, -\frac{2}{3}, -\frac{2}{3}$

45) The angle between the vectors $\vec{a} = 6\hat{i} + 2\hat{j} - 8\hat{k}$ and $\vec{b} = 4\hat{i} - 4\hat{j} + 2\hat{k}$ is _______.

(A) $\frac{\pi}{3}$

(B)• $\frac{\pi}{2}$

(C) $\frac{\pi}{4}$

(D) 0

Rough Work

46) The projection of the vector $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$ on the vector $\vec{b} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is ______.

(A) $\frac{10}{\sqrt{6}}$

(B) $\frac{\sqrt{10}}{6}$

(C) $\frac{\sqrt{10}}{17}$

(D) $\frac{10}{\sqrt{17}}$

47) The area of a parallelogram whose adjacent sides are $\vec{a} = \hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j}$ is ________.

(A) $2\sqrt{21}$

(B) $\sqrt{42}$

(C) $\sqrt{21}$

(D) $\frac{1}{2}\sqrt{21}$

48) For the vectors $\vec{a}$ and $\vec{b}$, $|\vec{a}| = \frac{2}{3}$, $|\vec{b}| = 3$ and $|\vec{a} \times \vec{b}| = 1$, then the angle between $\vec{a}$ and $\vec{b}$ is ______.

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{3}$

(D) $\frac{\pi}{2}$

Rough Work

49) Cartesian equation of a line is $\frac{x-5}{3}=\frac{y+4}{7}=\frac{6-z}{2}$, then the vector equation of the line is _______.

(A) $\vec{r}=3\hat{i}+7\hat{j}-2\hat{k}+\lambda\left(5\hat{i}-4\hat{j}+6\hat{k}\right)$

(B) • $\vec{r}=5\hat{i}-4\hat{j}+6\hat{k}+\lambda\left(3\hat{i}+7\hat{j}-2\hat{k}\right)$

(C) $\vec{r}=3\hat{i}+7\hat{j}+2\hat{k}+\lambda\left(5\hat{i}-4\hat{j}+6\hat{k}\right)$

(D) $\vec{r}=5\hat{i}-4\hat{j}+6\hat{k}+\lambda\left(3\hat{i}+7\hat{j}+2\hat{k}\right)$

50) The angle between the pair of lines $\frac{x-3}{1}=\frac{y-2}{2}=\frac{z+4}{2}$ and $\frac{x-5}{3}=\frac{y+2}{2}=\frac{z}{6}$ is _______

(A) $\sin^{-1}\left(\frac{17}{21}\right)$

(B) $\cos^{-1}\left(\frac{17}{21}\right)$

(C) $\sin^{-1}\left(\frac{19}{21}\right)$

(D) • $\cos^{-1}\left(\frac{19}{21}\right)$

050 (E)

(MARCH, 2024)
(SCIENCE STREAM)
(CLASS - XII)

(Part - B)

Time : 2 Hours] *[Maximum Marks : 50*

Instructions :

1) Write in a clear legible handwriting.
2) There are three sections in Part - B of the question paper and total 1 to 27 questions are there.
3) All questions are compulsory. Internal options are given.
4) The numbers at right side represent the marks of the question.
5) Start new section on new page.
6) Maintain sequence.
7) Use of simple calculator and log table is allowed, if required.
8) Use the graph paper to solve the problem of L.P.

SECTION - A

■ From the following question no. 1 to 12 answer any 8 questions as directed. (Each carries 2 marks) [16]

1) Prove that : $\cos^{-1}\frac{4}{5}+\cos^{-1}\frac{12}{13}=\cos^{-1}\frac{33}{65}$. [2]

2) Prove that : $\sin^{-1}\left(2x\sqrt{1-x^2}\right)=2\sin^{-1}x$, where $-\frac{1}{\sqrt{2}}\le x\le\frac{1}{\sqrt{2}}$. [2]

3) If $x^y+y^x=1$, then find $\frac{dy}{dx}$. [2]

4) Obtain $\int\frac{dx}{\sqrt{8+3x-x^2}}$. [2]

5) Find the area of the region bounded by the ellipse $9x^2 + 16y^2 = 144$. [2]

6) Find the area of the region bounded by the line $y = 3x + 2$, the x - axis and the ordinates $x = -1$ and $x = 1$. [2]

7) Find the general solution of the differential equation : [2]

$$\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0.$$

8) If vertices of triangle are $A\left(2\hat{i} - \hat{j} + \hat{k}\right), B\left(\hat{i} - 3\hat{j} - 5\hat{k}\right)$ and $C\left(3\hat{i} - 4\hat{j} - 4\hat{k}\right)$, determine the type of triangle they form. [2]

9) Find the Cartesian equation of the line passing through the point (1, 2, –4) and perpendicular to the two lines : [2]

$$\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7} \text{ and } \frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$$

10) Find vector and the Cartesian equations of the line through the point (5, 2, –4) and which is parallel to the vector $3\hat{i} - 2\hat{j} + 8\hat{k}$. [2]

11) Given that A and B are events such that P(A) = 0.6, P(B) = 0.3, $P(A \cap B) = 0.2$. Find P(A|B) and P(B|A). [2]

12) An unbiased die is thrown twice. Let the event E be 'odd number on the first throw' and F the event 'odd number on the second throw'. Check the independence of events E and F. [2]

SECTION - B

■ **From the following question no. : 13 to 21 answer any 6 questions as directed. (Each carries 3 marks)** **[18]**

13) Check whether the relation R in R defined by $R = \{(a,b) : a \le b^3\}$ is reflexive, symmetric or transitive. [3]

14) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, prove that $A^3 = 6A^2 - 7A - 2I$. [3]

15) Using the cofactor of elements of third column, evaluate $\Delta = \begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix}$. [3]

16) If $y = (\tan^{-1} x)^2$, show that $(x^2+1)^2 \frac{d^2y}{dx^2} + 2x(x^2+1)\frac{dy}{dx} - 2 = 0$. [3]

17) Find the maximum value of $f(x) = 2x^3 - 24x + 107$ in the interval $x \in [1, 3]$. Find the maximum value of the same function in $x \in [-3, -1]$. [3]

18) The scalar product of the vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ. [3]

19) Find the shortest distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$. [3]

20) Solve the following Linear Programming problem graphically : [3]
For $Z = -3x + 4y$
Subject to $x + 2y \le 8,\ 3x + 2y \le 12,\ x \ge 0,\ y \ge 0$.
Find minimum and maximum values of Z.

21) In a factory which manufactures bolts, machines A, B and C manufacture respectively 25%, 35% and 40% of the bolts of their outputs, 5, 4 and 2 percent are respectively defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured by the machine B? [3]

SECTION - C

- **From the following question no. : 22 to 27 answer any 4 questions as directed. (Each carries 4 marks)** **[16]**

22) Find x, if $\begin{bmatrix} x & -5 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = 0$. **[4]**

23) Using matrix method, solve the system of equations: **[4]**

$$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=6,\ \frac{1}{y}+\frac{3}{z}=11,\ \frac{1}{x}-\frac{2}{y}+\frac{1}{z}=0$$

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24) If $x = a(\cos t + t\sin t)$ and $y = a(\sin t - t\cos t)$, then find $\left(\frac{d^2y}{dx^2}\right)_{t=\frac{\pi}{4}}$. **[4]**

25) Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$. **[4]**

26) Evaluate : $\int_0^{\frac{\pi}{4}} \log(1+\tan x)\,dx$. **[4]**

27) Find the particular solution of the differential equation **[4]**

$$2y\,e^{\frac{x}{y}}dx + \left(y - 2x\,e^{\frac{x}{y}}\right)dy = 0,$$

given that $x = 0$ when $y = 1$.

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