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

Sl.No. 1000065

050 (E)

(MAY, 2021)
SCIENCE STREAM
(CLASS - XII)
(New Course)

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.

10

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 O.M.R. 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.

1) $\int\sqrt{3-2x-x^2}\,dx =$ ________ + C.

(A) $\frac{1}{2}(x+1)\sqrt{3-2x-x^2} - 2\log\left|x+1+\sqrt{3-2x-x^2}\right|$

(B) $\frac{1}{2}(x+1)\sqrt{3-2x-x^2} + \sin^{-1}\left(\frac{x+1}{2}\right)$

(C) $\frac{1}{2}(x+1)\sqrt{3-2x-x^2} + 2\log\left|x+1+\sqrt{3-2x-x^2}\right|$

(D) $\frac{1}{2}(x+1)\sqrt{3-2x-x^2} + 2\sin^{-1}\left(\frac{x+1}{2}\right)$

Rough Work

Rough Work

2) $\int \log x^2 dx = \_\_\_\_\_\_ + C.$

(A) $x \log x - x$

(B) $2x (\log x + 1)$

(C) $2x (\log x^2 - 1)$

(D) $2x \log\left(\frac{x}{e}\right)$

3) $\int \frac{(x-3)}{(x-1)^3} e^x dx = \_\_\_\_\_\_ + C.$

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

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

(C) $\frac{e^x}{(x-1)^3}$

(D) $\frac{e^x}{(x-3)^2}$

4) $\int \frac{dx}{e^x + e^{-x}} = \_\_\_\_\_\_ + C.$

(A) $\log (e^x + e^{-x})$

(B) $\tan^{-1} (e^{-x})$

(C) $\log (e^x - e^{-x})$

(D) $\tan^{-1} (e^x)$

5) $\int_0^1 \sin^{-1} x \, dx = \_\_\_\_\_\_.$

(A) 0

(B) $\pi - 1$

(C) $\frac{\pi}{2} - 1$

(D) $1 - \frac{\pi}{2}$

Rough Work

6) $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^2 x\,dx =$ ____________.

(A) 0

(B) $\frac{\pi}{4}-\frac{1}{2}$

(C) $\frac{1}{2}-\frac{\pi}{4}$

(D) $\frac{\pi}{4}+\frac{1}{2}$

7) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\cot x}} =$ ____________.

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

(B) $\frac{\pi}{12}$

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

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

8) The area bounded by the curve $y = \cos x$ between $x = -\frac{\pi}{2}$ and $x = \pi$ is ____________ square unit.

(A) 3

(B) 2

(C) 1

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

9) The area of the region bounded by the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ is ____________ square unit.

(A) 144π

(B) 6π

(C) 12π

(D) 72π

16
×9
144

Rough Work

10) Area of the region bounded by the curve $y^2 = 4x$, Y-axis and the line $y = 3$ is __________ square units.

(A) 2

(B) $\frac{9}{13}$

(C) $\frac{9}{4}$

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

11) The degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^5 + \left(\frac{dy}{dx}\right)^2 + \cos\left(\frac{dy}{dx}\right) + 1 = 0 \text{ is } \_\_\_\_\_\_\_\_\_\_.$$

(A) 5

(B) 2

(C) 1

(D) not defined

12) For the differential equation $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$, the general solution is __________.

(A) $\tan x - \tan y = C$

(B) $\tan x \tan y = C$

(C) $\tan x + \tan y = C$

(D) $\tan x \cot y = C$

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

(A) 4

(B) 1

(C) 2

(D) 0

14) If $\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + \lambda\hat{j} + \mu\hat{k}\right) = 0$ then $\lambda + \mu =$ __________.

(A) $\frac{21}{2}$

(B) $\frac{33}{2}$

(C) $\frac{23}{2}$

(D) 33

$2 + 6\lambda + 2$

$6\lambda + 27\mu =$

$3(2\lambda + 9\mu)$

Rough Work

$\not{e}$

$\hat{i} + \hat{k}$

15) For given vectors, $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$, the vector whose magnitude $\sqrt{2}$ unit in the direction of the vector $\vec{a} + \vec{b}$ = __________.

(A) $\hat{i} + \hat{k}$ (B) $\hat{i} + 2\hat{j} + \hat{k}$

(C) $\hat{i} + \hat{j}$ (D) $\hat{i} - \hat{k}$

16) The angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively is ________, where $\vec{a} \cdot \vec{b} = 1$.

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{2}$

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

17) If $\vec{a}$ is a unit vector and $(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a}) = 8$ then $|\vec{x}|$ = ________.

(A) -3 (B) 9

(C) $\sqrt{7}$ (D) 3

18) The projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$ = _______.

(A) -1 (B) 0

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

Rough Work

19) Let $\vec{a}$ and $\vec{b}$ be two unit vectors and θ be the angle between them and $\vec{a}-\vec{b}$ be a unit vector. Then θ = ________.

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$

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

20) If the lines $\frac{1-x}{3}=\frac{7y-14}{2p}=\frac{z-3}{2}$ and $\frac{7-7x}{3p}=\frac{y-5}{1}=\frac{6-z}{5}$ are perpendicular then p = ________.

(A) $\frac{70}{11}$ (B) 10

(C) $-\frac{70}{11}$ (D) -10

21) The cartesian equation of the plane which passes through the point (5,2,–4) and perpendicular to the line with direction ratios 2,3,–1 is ________.

(A) $2x-3y+z=12$ (B) $2x+3y-z=20$

(C) $2x+3y-z=12$ (D) $2x+3y+z=20$

22) The equation of the plane passing through (a,b,c) and parallel to the plane $\vec{r}\cdot\left(\hat{i}+\hat{j}+\hat{k}\right)=2$ is ________.

(A) $x+y+z=0$

(B) $x+y+z=abc$

(C) $x+y+z=a+b+c$

(D) $bcx+acy+abz=3abc$

Rough Work

23) If for a linear programming problem feasible region is bounded, then the objective function has ______.

(A) only maximum value

(B) only minimum value

(C) both maximum and minimum value

(D) neither maximum nor minimum value

24) 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 of Z occurs at (3,0) and (1,1) is ______.

(A) $p = 2q$

(B) $p = 3q$

(C) $p = \frac{q}{2}$

(D) $p = q$

25) For LPP problem if $Z = 4x + 3y$ and corner points of the bounded feasible region are (0,0), (25,5), (16,16), (5,24) then maximum value of Z occurs at the point ______.

(A) (0,0)

(B) (16,16)

(C) (25,5)

(D) (5,24)

26) For independent events A and B if $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{5}$, then $P(B) =$ ______.

(A) 0.01

(B) 0.2

(C) 0.1

(D) 0.5

Rough Work

27) If $2P(A) = P(B) = \frac{5}{13}$ and $P(A/B) = \frac{2}{5}$ then $P(A \cup B) =$ ________.

(A) $\frac{11}{26}$ (B) $\frac{19}{26}$

(C) $\frac{11}{13}$ (D) $\frac{2}{13}$

28) If A and B are two independent events, then $P(A \cup B) =$ ________.

(A) $1 - P(A')P(B')$ (B) $1 - P(A)\,P(B)$

(C) $P(A) + P(B)$ (D) $P(A)\,P(B)$

29) The relation S in the set R of real numbers, defined as $S = \{(a,b) : a \leq b^2\}$ is a ________ relation.

(A) reflexive

(B) transitive

(C) symmetric

(D) not an equivalence

30) $f : N \rightarrow N$, $f(x) = x^3$ is ________.

(A) one-one and onto function

(B) one-one but not onto

(C) not one-one and not onto function

(D) not one-one but onto

Rough Work

31) Let $*$ be the binary operation on Z^+ defined by $a * b = 2^{ab}$ then $(2 * 3) * 4 =$ ________.

(A) 2^{64}

(B) 2^{128}

(C) 2^{256}

(D) 2^{512}

32) If $\operatorname{cosec}^{-1} x = y$, then $y \in$ ________.

(A) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(B) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$

(C) $[0, \pi] - \left\{\frac{\pi}{2}\right\}$

(D) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right) - \{0\}$

33) The principal value of $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right) =$ ________.

(A) $\frac{2\pi}{3}$

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

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

(D) $-\frac{\pi}{3}$

Rough Work

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

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$

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

35) $\sin^{-1}\left[\cos\left(\sin^{-1}\frac{\sqrt{3}}{2}\right)\right] =$ ________

(A) $\frac{\pi}{3}$ (B) $-\frac{\pi}{6}$

(C) $\frac{\pi}{6}$ (D) $-\frac{\pi}{3}$

36) For matrices A and B if $A' = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $B' = \begin{bmatrix} 4 & 3 & 2 \end{bmatrix}$ then $(BA)'$ is a ________.

(A) square matrix

(B) row matrix

(C) column matrix

(D) not defined

Rough Work

37) If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and A + A′ = I, then value of α is ____________.

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

(B) π

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

(D) $\frac{3\pi}{2}$

38) If the matrix A is both symmetric and skew symmetric, then ____________.

(A) A is a diagonal matrix

(B) A is a square matrix

(C) A is a zero matrix

(D) A is a Identity matrix

39) For matrices X and Y if $X + Y = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$ and $X - Y = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$, then 2X = ____________.

(A) $\begin{bmatrix} 10 & 0 \\ 2 & 8 \end{bmatrix}$

(B) $\begin{bmatrix} 5 & 0 \\ 1 & 4 \end{bmatrix}$

(C) $\begin{bmatrix} 4 & 0 \\ 2 & 2 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}$

Rough Work

40) $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ = ________.

(A) $x+y-z$ (B) $z+x-y$

(C) $y+z-x$ (D) 0

41) If $A = \begin{bmatrix} 2 & -2 \\ 4 & 3 \end{bmatrix}$ then A^{-1} = ________.

(A) $-\frac{1}{14}\begin{bmatrix} 3 & -2 \\ 4 & 2 \end{bmatrix}$ (B) $\frac{1}{14}\begin{bmatrix} -3 & 2 \\ -4 & -2 \end{bmatrix}$

(C) $-\frac{1}{14}\begin{bmatrix} 3 & 2 \\ -4 & 2 \end{bmatrix}$ (D) $\frac{1}{14}\begin{bmatrix} 3 & 2 \\ -4 & 2 \end{bmatrix}$

42) If $(k,0)$, $(4,0)$, $(0,2)$ be the vertices of triangle and area of triangle is 4 sq.unit then k = ________.

(A) 0, 8 (B) 0, 16

(C) 0, –8 (D) 0, –16

43) $f(x) = \begin{cases} \dfrac{k\cos x}{\pi - 2x} & \text{if } x \neq \dfrac{\pi}{2} \\ \dfrac{1}{2} & \text{if } x = \dfrac{\pi}{2} \end{cases}$

If f is continuous at $x = \frac{\pi}{2}$, then the value of k = ________.

(A) –1 (B) $\frac{1}{4}$

(C) 1 (D) 4

Rough Work

44) $\frac{d}{dx}\left(\frac{2\tan x}{1+\tan^2 x}\right) =$ ________.

(A) $2\cos 2x$

(B) $\sin 2x$

(C) $\cos 2x$

(D) $2\sin 2x$

45) If $x = a(1-\cos\theta)$ and $y = a(\theta+\sin\theta)$ then $\frac{dy}{dx} =$ ________.

(A) $\cot\theta$

(B) $\tan\theta$

(C) $\cot\frac{\theta}{2}$

(D) $\tan\frac{\theta}{2}$

46) The point on the curve $y = x^3$ at which the slope of tangent is equal to the y-coordinate of the point other then origin is ________.

(A) (1, 1)

(B) (3, 27)

(C) (2, 8)

(D) (4, 64)

47) $f(x) = 10 - 6x - 2x^2$ is strictly increasing in ________ interval.

(A) $\left(-\infty, -\frac{3}{2}\right)$

(B) $\left(-\infty, \frac{3}{2}\right)$

(C) $\left(-\frac{3}{2}, \infty\right)$

(D) $\left(-\infty, -\frac{3}{2}\right]$

Rough Work

48) The normal at the point (1,1) on the curve $2y + x^2 = 3$ is ______.

(A) $x - y = 1$
(B) $x - y = 0$
(C) $x + y + 1 = 0$
(D) $x + y = 0$

49) For the curve $y = x^2$ the equation of normal at (0,0) is ______.

(A) $x = 0$
(B) $x = y$
(C) $y = 0$
(D) $x = -y$

50) $\int \frac{1}{2x^2 + 3} dx$ = ________ + C.

(A) $\frac{1}{\sqrt{3}} \tan^{-1}\left(\frac{\sqrt{2}x}{\sqrt{3}}\right)$

(B) $\frac{1}{6} \tan^{-1}\left(\frac{\sqrt{2}x}{\sqrt{3}}\right)$

(C) $\frac{1}{\sqrt{6}} \tan^{-1}\left(\frac{\sqrt{2}x}{\sqrt{3}}\right)$

(D) $\frac{1}{6} \tan^{-1}\left(\frac{2x}{3}\right)$

050 (E)

(MAY, 2021)

SCIENCE STREAM

(CLASS - XII)

(New Course)

(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 the Sections are compulsory and general options are given in each Section.
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

■ **Answer any eight questions from question number 1 to 12. (Each of 2 marks) [16]**

1) Prove that

$$\tan^{-1}\left[\frac{a\cos x - b\sin x}{b\cos x + a\sin x}\right] = \tan^{-1}\frac{a}{b} - x\text{, where } \frac{a}{b}\tan x > -1.$$ [2]

2) Find value of $\sin\left(2\tan^{-1}\frac{2}{3}\right) + \cos\left(\tan^{-1}\sqrt{3}\right)$. [2]

3) If $x^y = e^{x-y}$, prove that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$. [2]

4) $\int \frac{1}{\sqrt{(x-1)(x-2)}}dx$ evaluate this. [2]

5) Find the area of the region bounded by $x^2 = 4y$, $y = 2$, $y = 4$ and Y-axis in the first quadrant. **[2]**

6) Using Integration, find the area enclosed by the circle $x^2 + y^2 = 16$. **[2]**

7) Find the slope of the normal to the curve $x = 1 - a\sin\theta$, $y = b\cos^2\theta$ at $\theta = \frac{\pi}{2}$. **[2]**

8) Find the area of the triangle with vertices A(1,1,2), B(2,3,5) and C(1,5,5). **[2]**

9) Find the vector equation of the line passing through the point (1,2,–4) and perpendicular to the two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$. **[2]**

10) Find the equation of the plane through the Intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and point (2,2,1). **[2]**

11) Given that the two numbers appearing on throwing two dice are different find the probability of the event 'the sum of numbers on the dice is 4'. **[2]**

12) Prove that if A and B are independent events, then so are the events A and B′. **[2]**

SECTION - B

■ **Answer any six questions from question number 13 to 21. (Each of 3 marks) [18]**

13) Show that if $f : R - \left\{\frac{7}{5}\right\} \to R - \left\{\frac{3}{5}\right\}$ is defined by $f(x) = \frac{3x+4}{5x-7}$ and $g : R - \left\{\frac{3}{5}\right\} \to R - \left\{\frac{7}{5}\right\}$ is defined by $g(x) = \frac{7x+4}{5x-3}$ then $f \circ g = I_A$ and $g \circ f = I_B$ where $A = R - \left\{\frac{3}{5}\right\}$, $B = R - \left\{\frac{7}{5}\right\}$. **[3]**

14) Find the matrix X so that $X\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{bmatrix}=\begin{bmatrix}-7 & -8 & -9\\ 2 & 4 & 6\end{bmatrix}$. [3]

15) If $F(x)=\begin{bmatrix}\cos x & -\sin x & 0\\ \sin x & \cos x & 0\\ 0 & 0 & 1\end{bmatrix}$ show that $F(x)\cdot F(y)=F(x+y)$. [3]

16) Find $\frac{dy}{dx}$ if $x^y + y^x = 1$. [3]

17) Find the equation of the tangent line to the curve $y = x^2 - 2x + 7$ which is parallel to the line $2x - y + 9 = 0$. [3]

18) For given three vectors $\vec{a},\vec{b},\vec{c}$ it is given that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and if $|\vec{a}|=1$, $|\vec{b}|=4$, $|\vec{c}|=2$ then find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$. [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]

Minimise $Z = 200x + 500y$

Subject to the constraints

$x + 2y \geq 10$

$3x + 4y \leq 24$

$x \geq 0, y \geq 0$

21) Two dice are thrown together. Let A be the event getting 6 on the first die and B be the event getting 2 on the second die. Check whether the events A and B are independent. [3]

SECTION - C

■ **Answer any four questions from question number 22 to 27. (Each of 4 marks)** [16]

22) If $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$, find $A^2 - 5A + 6I$. [4]

23) Prove that $\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix} = 2(x+y+z)^3$ [4]

24) If $\cos y = x\cos(a+y)$ with $\cos a \neq \pm 1$, prove that $\dfrac{dy}{dx} = \dfrac{\cos^2(a+y)}{\sin a}$. [4]

25) Find local maximum and local minimum values of the function f given by $f(x) = 3x^4 + 4x^3 - 12x^2 + 12$. [4]

26) Find $\displaystyle\int \frac{5x}{(x+1)(x^2+9)}\,dx$. [4]

27) Find the particular solution of the differential equation :

$\dfrac{dy}{dx} - \dfrac{y}{x} + \operatorname{cosec}\left(\dfrac{y}{x}\right) = 0$, $y = 0$ when $x = 1$. [4]

◆ ◆ ◆