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

Sl.No.

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.
17

050 (E)

(JULY 2022)
(SCIENCE STREAM)
(CLASS - XII)

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) The projection of vector $\vec{i} - 2\vec{j} + 3\vec{k}$ on $3\vec{i} - 2\vec{j} + \vec{k}$ is ______.

(A) $\frac{5}{7}\vec{i} - \frac{10}{7}\vec{j} + \frac{15}{7}\vec{k}$

(B) $\frac{15}{7}\vec{i} + \frac{10}{7}\vec{j} + \frac{5}{7}\vec{k}$

(C) $\frac{15}{7}\vec{i} - \frac{10}{7}\vec{j} + \frac{5}{7}\vec{k}$

(D) $-\frac{5}{7}\vec{i} - \frac{10}{7}\vec{j} + \frac{15}{7}\vec{k}$

Rough Work

$3\hat{i} - 4\hat{j} + 3\hat{k}$

$\sqrt{9+16+9}$

$= \sqrt{34}$

2) For unit vector $\vec{a}$ if $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a})=15$ then $|\vec{x}|=$ ______.

(A) $\sqrt{16}$ (B) $\sqrt{15}$

(C) $\sqrt{14}$ (D) $\sqrt{17}$

3) If $\vec{a}=2\vec{i}-\vec{j}-3\vec{k}, \vec{b}=\vec{i}-2\vec{j}+\vec{k}, \vec{c}=3\vec{i}-\vec{j}+2\vec{k}$ then $\vec{a}\cdot(\vec{b}\times\vec{c})=$ ______.

(A) -20 (B) 22

(C) -22 (D) -8

4) If $\vec{a}=\vec{i}-\vec{j}+\vec{k}, \vec{b}=\vec{i}+2\vec{j}-3\vec{k}$ then find unit vector perpendicular to both $\vec{a}-\vec{b}$ and $\vec{a}+\vec{b}$ is ______.

(A) $\frac{1}{\sqrt{26}}\vec{i}+\frac{4}{\sqrt{26}}\vec{j}-\frac{3}{\sqrt{26}}\vec{k}$

(B) $\frac{1}{\sqrt{26}}\vec{i}-\frac{4}{\sqrt{26}}\vec{j}+\frac{3}{\sqrt{26}}\vec{k}$

(C) $\frac{1}{\sqrt{26}}\vec{i}+\frac{4}{\sqrt{26}}\vec{j}+\frac{3}{\sqrt{26}}\vec{k}$

(D) $-\frac{1}{\sqrt{26}}\vec{i}+\frac{4}{\sqrt{26}}\vec{j}-\frac{3}{\sqrt{26}}\vec{k}$

Rough Work

$(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a})=15$

$x^2+xa+a^2=15$

$x^2-a^2=15$

$x^2=15-a^2$

$x=\sqrt{15-a^2}$

$x^2=15-a$

$2\vec{i}-\vec{j}-3\vec{k}\cdot(\vec{b}\times\vec{c})$

$\begin{vmatrix} 1 & -2 & 1 \\ 3 & -1 & 2 \end{vmatrix}$

$= [\cancel{1(2-2)}]$

$=[1(-4-(-1))-2(2-3)+1(-1-(-6))]$

$=[1(-3)-2+-5]$

$=-3-2-5$

$=-10$

Rough Work

$a_1 = -1,\ b_1 = 2,\ c_1 = 4$

$a_2 = -2,\ b_2 = 3,\ c_2 = -2.$

$|\vec{a}| = \sqrt{1+4+16}$

$= \sqrt{21}.$

$|\vec{a}_1| :$

$-3+5+2 = 4.$

अ. $6\vec{i}+3\vec{j}-2\vec{k}-5=0.$

$(1, 2, -3)$

5) Angle between the lines $\dfrac{x+2}{-1} = \dfrac{y+3}{2} = \dfrac{z+4}{4}$ and $\dfrac{x+1}{-2} = \dfrac{y+4}{3} = \dfrac{z+5}{-2}$ is ______.

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

(C) $\dfrac{\pi}{3}$ (D) 0

6) The distance of the point $(1,2,-3)$ from the plane $\vec{r} \cdot \left(6\vec{i} + 3\vec{j} - 2\vec{k}\right) = 5$ is ______.

(A) $\dfrac{23}{\sqrt{14}}$ (B) $\dfrac{13}{7}$

(C) $\dfrac{23}{7}$ (D) $\dfrac{13}{\sqrt{14}}$

7) The angle between the line $\dfrac{x+3}{2} = \dfrac{-y}{3} = \dfrac{z+5}{-6}$ and the plane $10x - 2y + 11z = -5$ is ______.

(A) $\pi - \cos^{-1}\left(\dfrac{8}{21}\right)$ (B) $\sin^{-1}\left(\dfrac{8}{21}\right)$?

(C) $\sin^{-1}\left(-\dfrac{8}{21}\right)$ (D) $\cos^{-1}\left(\dfrac{8}{21}\right)$

8) Value of the objective function $Z = -50x + 20y$ subject to the constraints $2x - y \geq -5$, $3x + y \geq 3$, $2x - 3y \leq 12$, $x \geq 0$, $y \geq 0$ whose corner points of region of the probable solution are $(0,5),(0,3),(1,0)$ and $(6,0)$. Value of Z is minimum at the point ________.

(A) $(0,3)$ (B) $(6,0)$

(C) $(0,5)$ (D) $(1,0)$

9) For the objective function $Z = 4x + y$ subject to the constraints $x + y \leq 50$, $3x + y \leq 90$, $x \geq 0$, $y \geq 0$ whose corner points of region of the probable solution are $(0,0)$, $(30,0)$, $(20,30)$, $(0,50)$ then the maximum value of Z is ______.

(A) 150 (B) 200

(C) 130 (D) 120

10) The corner points of the feasible region determined by the following system of linear inequalities $2x + y \leq 10$, $x + 3y \leq 15$, $x, y \geq 0$ are $(0,0)$, $(5,0)$, $(3,4)$ and $(0,5)$. Let $Z = qx + py$, $p, q > 0$ condition on p & q so that the maximum of Z occurs at both (3, 4) and (0, 5) is _______.

(A) $p = 3q$ (B) $2q = 3p$

(C) $q = 3p$ (D) $2p = 3q$

11) $3P(A) = P(B) = \frac{5}{13}$ and $P\left(\frac{A}{B}\right) = \frac{3}{5}$ then $P(A \cup B) =$ ______.

(A) $\frac{15}{39}$ (B) $\frac{11}{39}$ 9

(C) $\frac{17}{39}$ (D) $\frac{13}{39}$

Rough Work

$-50x+2y$.
$-50(0)+2(5)$
A $0+10 = 10$
B $(0)+6 = 6$
C $= -50+0 = -50$
D $= -50(6)+20(0)$
$= -300+0$
$= -300$.

A $(30,0)$
$4(30)+0 = Z$
$120 = Z$
B $(20,30)$
$4(20)+30 = Z$
$80+30 = Z$
$110 = Z$
$4(0)+50 = Z$
$50 = Z$.

Rough Work

$\frac{2}{1}$, 2

f. A→B.
g→ B→G
G.o f. A→C

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

(A) $\frac{1}{20}$ (B) $\frac{2}{5}$?

(C) $\frac{1}{10}$ (D) $\frac{1}{5}$

13) For events A and B, $P(B) \neq 0$ and $P(A/B)=1$ then ______ is true.

(A) $A=B$ (B) $B \subset A$

(C) $A \subset B$ (D) $A=\varnothing$

14) If $f: A \rightarrow B$ and $g: B \rightarrow C$ are one - one then $g \circ f: A \rightarrow C$ is ______.

(A) onto

(B) many-one

(C) one-one

(D) neither one-one nor onto

15) Let $A=\{1,2,3\}$. Then the number of relations containing (1, 2) and (1, 3) which are reflexive and symmetric but not transitive is ______.

(A) 3 (B) 2

(C) 1 (D) 4

Rough Work

16) Number of binary operations on the set $\{a, b\}$ are ______.

(A) 20 (B) 16

(C) 10 (D) 8

17) Principal value of $\cot^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is ______.

(A) $\frac{4\pi}{3}$ (B) $\frac{2\pi}{3}$

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

18) $\sin^{-1}(1-x)-2\sin^{-1}x=\frac{\pi}{2}$, then x is equal to ______.

(A) 0 (B) $1, \frac{1}{2}$

(C) $0, \frac{1}{2}$ (D) $\frac{1}{2}$

19) Value of $\cos\left[\sec^{-1}x+\operatorname{cosec}^{-1}x\right]; |x|\geq 1$ is ______.

(A) 0 (B) -1

(C) $\frac{\pi}{2}$ (D) π

Rough Work

20) Principal value of the expression $\cos^{-1}\left[\cos\left(-680^\circ\right)\right]$ is ________.

(A) $\frac{34\pi}{9}$ (B) $-\frac{2\pi}{9}$

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

21) The number of all possible matrices of order 3 × 3 with each entry 0 or 1 is ______.

(A) 81 (B) 18

(C) 27 (D) 512

22) Let X be $2 \times n$ and Z be $2 \times p$ matrices. If $n = p$, then the order of the matrix $7X - 5Z$ is ________.

(A) $n \times 3$ (B) $2 \times n$

(C) $p \times 2$ (D) $p \times n$

Assume $n = 1$
$p = 2$

$2 \times 1 = 2$
$2 \times 2 = 4$
$2 = 4$ ($\because n = p$).

$7 \times 2 - 5 \times 4$
$14 - 20$
$= -6$.

$14 - 15$
21

23) $A' = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and $A + A' = I$ then the value of α is ________.

(A) π (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{6}$ (D) $\frac{3\pi}{2}$ α

Rough Work

24) $A = \frac{1}{\pi}\begin{bmatrix} \sin^{-1}(\pi x) & \tan^{-1}\left(\frac{x}{\pi}\right) \\ \sin^{-1}\left(\frac{x}{\pi}\right) & \cot^{-1}(\pi x) \end{bmatrix}$

$B = \frac{1}{\pi}\begin{bmatrix} -\cos^{-1}(\pi x) & \tan^{-1}\left(\frac{x}{\pi}\right) \\ \sin^{-1}\left(\frac{x}{\pi}\right) & -\tan^{-1}(\pi x) \end{bmatrix}$

then $A - B$ is equal to ________.

(A) 2I

(B) 0

(C) 1

(D) $\frac{1}{2}I$

$3x = 6$
$x = \frac{6}{3} 2$
$x = 2$
$2(1) = 4$
$1x = 4$
$x = \frac{1}{4}$

25) If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$, then the value of x is ______.

(A) ± 1

(B) ± 2

(C) 2

(D) $\pm 2\sqrt{2}$

26) Which of the following is correct?

(A) Determinant is a square matrix

9

(B) Determinant is a number associated to a matrix

(C) Determinant is a number associated to a square matrix

(D) None of these

ESO72(17)

Rough Work

27) If a, b, c are in A.P. then the determinant

$$\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix} \text{ is } \_\_\_\_\_\_\_\_.$$

(A) x (B) 1

(C) 0 (D) $2x$

4k if 2≤2.

28) $f(x) = \begin{cases} kx^2 & \text{if} \quad x \le 2 \\ 3 & \text{if} \quad x > 2 \end{cases}$

If f is continuous at x =2, then the value of k is ________.

(A) 4 (B) $\frac{3}{4}$

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

9

29) If $f(x) = \tan^{-1} x$, then $f'(0) =$ ________.

(A) 1 (B) $\frac{1}{3}$

(C) $\frac{1}{2}$ (D) 0

30) For the function $f(x) = x + \frac{1}{x}, x \in [1,3]$ the value of c for mean value theorem is ________.

(A) $\sqrt{3}$ (B) 1

(C) 2 (D) none of these

Rough Work

31) For what value of a the function $f(x) = x^2 + ax + 1$ is increasing on $[1, 2]$ ________.

(A) 1 (B) 2

(C) -2 (D) 3

32) If the slope of the tangent to the curve $y = x^2 - 4x + 8$ is 6 then $x =$ ________.

(A) 5 (B) 3

(C) 2 (D) 1

33) The normal to the curve $x^2 = 4y$ passing through (2, 1) is ________.

(A) $x - y = 3$ (B) $x + y = 1$

(C) $x - y = 1$. (D) $x + y = 3$

34) The approximate change in the volume V of the cube of side x meters caused by increasing the side by 2% is ________.

(A) 6% (B) $0.6x^3m^3$

(C) $0.02x^3m^3$ (D) $0.006x^3m^3$.

35) $\int \tan^8 x \sec^4 x \, dx =$ ______.

(A) $\dfrac{\tan^{11} x}{11} + \dfrac{\sec^5 x}{5} + C$

(B) $\dfrac{\tan^9 x}{9} + \dfrac{\tan^{10} x}{10} + C$

(C) $\dfrac{\tan^{11} x}{11} + \dfrac{\tan^9 x}{9} + C$

(D) $\dfrac{\tan^9 x}{9} + \dfrac{\sec^5 x}{5} + C$

$4-4x+8=6$
$12-4x=6$
$-4x=6-12$
$-4x=-6$
$x=\frac{6}{4}=\frac{3}{2}$

$4-4x+8$
$-4x+12$
$12=4x$
$x=\frac{12}{4}=3$

$4-4$.
$25-4x+8$
$33-4x$
$9-4x+8$
$12-4x=6$.
$25-4x$.
$4=4$.

36) The general solution of the differential equation $\dfrac{y\,dx - x\,dy}{y} = 0$ is ______.

Rough Work

(A) $y = cx$ (B) $x = cy^2$

(C) $xy = c$ (D) $y = cx^2$

37) $\int \left(\dfrac{x^2+1}{(x+1)^2} \right) e^x \, dx =$ ______.

(A) $\left(\dfrac{x-1}{x+1} \right) e^x + C$ (B) $\left(\dfrac{x^2+1}{x+1} \right) e^x + C$

(C) $\left(\dfrac{x+1}{x-1} \right) e^x + C$ (D) $\left(\dfrac{x^2-1}{x^2+1} \right) e^x + C$

38) $\int_2^3 \dfrac{x}{x^2+1} dx =$ ______.

$\dfrac{2}{4+1} = \dfrac{2}{5} - \dfrac{3}{9+1}$

$\dfrac{2}{5} - \dfrac{3}{10}$

$\dfrac{4-3}{10} = \dfrac{1}{10}.$

(A) $\dfrac{1}{2}\log(5)$ (B) $\dfrac{1}{2}\log(2)$

(C) $\log(x^2+1)$ (D) $\dfrac{1}{2}\log\left(\dfrac{3}{2}\right)$

39) $\int_{\frac{1}{3}}^{1} \dfrac{(x - x^3)^{\frac{1}{3}}}{x^4} dx =$ ______.

(A) 4 (B) 3

(C) 0 (D) 6

Rough Work

40) If $\int_0^1 \frac{e^t}{1+t}dt = a$ then $\int_0^1 \frac{e^t}{(1+t)^2}dt$ is equal to ______.

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

(B) $a+1-\frac{e}{2}$

(C) $a+1+\frac{e}{2}$

(D) $a-1+\frac{e}{2}$

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

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

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

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

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

42) $\int \frac{(x^4-x)^{\frac{1}{4}}}{x^5}dx =$ ______ $+ C.$

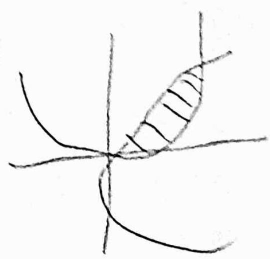
(A) $\frac{4}{15}\left(1+\frac{1}{x^3}\right)^{\frac{5}{4}}$

(B) $\frac{4}{15}\left(1+\frac{1}{x^3}\right)^{\frac{4}{5}}$

(C) $\frac{4}{15}\left(1-\frac{1}{x^2}\right)^{\frac{5}{4}}$

(D) $\frac{4}{15}\left(1-\frac{1}{x^3}\right)^{\frac{5}{4}}$

43) Area of the region bounded by two parabolas $y=x^2$ and $y^2=x$ is ______.



(A) $\frac{1}{5}$

(B) $\frac{1}{4}$

(C) $\frac{1}{3}$

(D) $\frac{1}{6}$

Rough Work

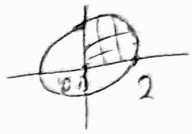
44) Area bounded by the curve $y = \cos x$ between $x = 0$ and $x = 2\pi$ is __________.

(A) 4 (B) π

(C) 2 (D) 2π

$C = (0, 0)$

$r = 2$



45) Area lying in the first quadrant and bounded by the circle $x^2 + y^2 = 4$ and the lines $x = 0$ and $x = 2$ is _____.

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

(C) π (D) $\frac{\pi}{4}$

$y^2 = 4 - x^2$

$y = \sqrt{4 - x^2}$

$= \left[\frac{x}{2}\sqrt{4-x^2} + \frac{4}{2}\sin^{-1}\frac{x}{2}\right]$

$[0 + 2\sin^{-1}\frac{x}{2}]$

46) The differential equation representing the family of curves $y = a\cos(x + b)$, (a, b are arbitrary constants) is ________.

(A) $\frac{d^2y}{dx^2} + x = 0$ (B) $\frac{d^2y}{dx^2} - y = 0$

(C) $\frac{d^2y}{dx^2} + y = 0$ (D) $\frac{d^2y}{dx^2} - x = 0$

47) The integrating factor of the differential equation $(1 - x^2)\frac{dy}{dx} + xy = kx$ $(-1 < x < 1)$ is _______.

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

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

Rough Work

48) Order and degree of the differential equation $\sqrt[3]{\frac{d^2y}{dx^2}} = \sqrt{\frac{d^3y}{dx^3}}$ are ________ and ________.

(A) 2, 2 (B) 2, 3

(C) 3, 2 (D) 3, 3

49) Consider two points P and Q with position vectors $\overrightarrow{OP} = 2\vec{a} - 3\vec{b}$ and $\overrightarrow{OQ} = \vec{a} + 2\vec{b}$. Find the position vector of point R which divides line joining P and Q in the ratio 2 : 1 externally is ________.

$\frac{2(2a) - 1(3b)}{2+1}$

$= \frac{4a-3b}{2+1}, \frac{4a-3b}{3}.$

$4\ \frac{2a+2b}{3}$

$= 4a$

(A) $4\vec{b} + \vec{a}$ (B) $\frac{5\vec{a} - \vec{b}}{3}$

(C) $4\vec{b} - \vec{a}$ (D) $7\vec{b}$

50) If for vectors $\vec{a}$ and $\vec{b}$, $|\vec{a}| = 3, |\vec{b}| = 4$ and $\vec{a} \cdot \vec{b} = 5$ then $|\vec{a} + \vec{b}| =$ ________.

$\frac{5}{|3+4|}$

$= \frac{5}{7}.$

(A) 35 (B) 30

(C) 15 (D) 20

050 (E)

(JULY 2022)
(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 the Sections are compulsory and general options are given in each Section.
4) The numbers at right side represent the marks of the questions.
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) Show that $\sin^{-1}\frac{3}{5} - \sin^{-1}\frac{8}{17} = \cos^{-1}\frac{84}{85}$. [2]

2) Solve $\tan^{-1}2x + \tan^{-1}3x = \frac{\pi}{4}$. [2]

3) For $y = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right), -\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}}$, find $\frac{dy}{dx}$. [2]

4) Obtain $\int e^x\left(\frac{1+\sin x}{1+\cos x}\right)dx$. [2]

5) Find the area bounded by the curve $x^2 = 4y$ and the line $x = 4y - 2$. [2]

6) Find the area of the region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ using integration. [2]

7) For the differential equation $y\,dx + \left(x - y^2\right)dy = 0$ find the general solution. [2]

8) If the vertices A, B, C of a triangle ABC are $(1,2,3)$, $(-1,0,0)$ and $(0,1,2)$ respectively then find $\angle ABC$. [2]

$\left[\angle ABC \text{ is the angle between vectors } \overrightarrow{BA} \ \& \ \overrightarrow{BC}\right]$

9) Find the shortest distance between the lines $\vec{r} = \left(\hat{i} + 2\hat{j} + \hat{k}\right) + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right)$ and $\vec{r} = 2\hat{i} - \hat{j} - \hat{k} + \mu\left(2\hat{i} + \hat{j} + 2\hat{k}\right)$. [2]

10) Find the equation of the planes that pass through the points $(1,1,-1)$, $(6,4,-5)$ and $(-4,-2,-3)$. [2]

11) Find the mean number of heads in three tosses of a fair coin. [2]

12) Find the probability of getting 5 exactly twice in 7 throws of a dice. [2]

SECTION - B

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

13) Consider $f : \mathrm{R} \to [-5, \infty)$ given by $f(x) = 9x^2 + 6x - 5$. Show that f is invertible with $f^{-1}(y) = \left(\frac{\left(\sqrt{y+6}\right) - 1}{3}\right)$. [3]

14) If $A = \begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix of order 2 show that

$x \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

$$I + A = (I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}.$$ [3]

15) Show that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$. [3]

16) For $y = x^{x\cos x} + \frac{x^2+1}{x^2-1}$, find $\frac{dy}{dx}$. [3]

17) Find the equation of lines having slope 2 and being tangent to the curve $y + \frac{2}{x-3} = 0$. [3]

18) Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 15$. [3]

1+a 1 1

19) Find the vector equation of the plane passing through the intersection of the planes $\vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 6$ and $\vec{r} \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = 5$ and the point $(1,1,1)$. [3]

$3 + \frac{1}{a}$

20) Solve the following linear programming problem graphically. [3]

Maximize $Z = 5x + 3y$

Subject to $3x + 5y \leq 15$, $5x + 2y \leq 10$, $x \geq 0$, $y \geq 0$.

21) A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag. [3]

SECTION - C

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

22) Obtain the inverse of the following matrix using elementary operations. **[4]**

$$A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$$

23) Solve system of linear equations using matrix method. **[4]**

$$2x - 3y + 5z = 11$$
$$3x + 2y - 4z = -5$$
$$x + y - 2z = -3$$

24) If $(x-a)^2 + (y-b)^2 = c^2$ for some $c > 0$ prove that $\dfrac{\left[1 + \left(\dfrac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\dfrac{d^2y}{dx^2}}$ is a constant independent of a & b. **[4]**

25) If length of three sides of a trapezium other than base are equal to 10 cm, then find the area of the trapezium when it is maximum. **[4]**

26) Obtain $\displaystyle\int \frac{\sin^{-1}\sqrt{x} - \cos^{-1}\sqrt{x}}{\sin^{-1}\sqrt{x} + \cos^{-1}\sqrt{x}}\, dx,\ x \in [0,1]$. **[4]**

27) Show that the differential equation $2ye^{\frac{x}{y}}dx + \left(y - 2xe^{\frac{x}{y}}\right)dy = 0$ is homogeneous and find its particular solution given that $x = 0$ when $y = 1$. **[4]**

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