

**SEE 2078(2022)****Subject:** Additional Mathematics**Time:** 3: 00 hrs**F.M.:** 100

Attempt all the questions. All the working must be shown.

**Group 'A'** $[5 \times (1 + 1) = 10]$ 

- If  $g : A \rightarrow B$  and  $f : B \rightarrow C$ , then how the function defined from  $A$  to  $C$  is denoted? Write it.
  - What is the geometric mean between two positive numbers  $a$  and  $b$ ? Write it.
- Write the meaning of  $\lim_{x \rightarrow a^+} f(x)$
  - In which condition the inverse of a matrix can not be defined? Write it.
- In which condition the pair of lines represented by  $ax^2 + 2hxy + by^2 = 0$  are coincident to each other? Write it.
  - What is called the geometrical shape formed when a cone is intersected by a plane surface which is parallel to the generator of the cone? Write it.
- Express  $\cos 2A$  in terms of  $\tan A$ .
  - Express  $\sin C + \sin D$  in the form of product of sine or cosine.
- If  $\vec{a} = (x_1, y_1)$  and  $\vec{b} = (x_2, y_2)$ , then what is the scalar product of  $\vec{a} \cdot \vec{b}$ ? Write it.
  - In an inversion transformation  $A'$  is image of  $A$  and  $r$  is radius of inversion circle with centre  $O$ , then write the relation among  $OA, OA'$  and  $r$ .

**Group 'B'** $[13 \times 2 = 26]$ 

- If  $f^{-1}(x) = \frac{x-5}{2}$ , find  $f(x)$ .

- If  $f(x) = 3x + 5$  and  $g(x) = 2x - 3$  then find the value of  $fg(x)$  and  $fg(2)$ .
- Find the co-ordinates of the vertex of a quadratic function  $y = x^2 + 2x - 3$ .

- If the inverse matrix of a matrix  $\begin{bmatrix} 2 & 3 \\ 3 & 6 \end{bmatrix}$  is  $\begin{bmatrix} 2 & -1 \\ -1 & k \end{bmatrix}$ , what will be the value of  $k$ ? Find it.
  - If the matrix  $A = \begin{bmatrix} 6 & a \\ 4 & 5 \end{bmatrix}$  and determinant of  $A$  is 18, find the value of  $a$ .
- If the pair of lines represented by  $7x^2 + 10xy - (p+1)y^2 = 0$  are perpendicular to each other, find the value of  $p$ .
  - Find the single equation which represents the lines  $x+2y = 0$  and  $3x - y = 0$ .
- Prove that:  $\operatorname{cosec} A + \cot A = \cot \frac{A}{2}$
  - Find the value of  $2 \cos 75^\circ \cdot \cos 15^\circ$  without using table or calculator.
  - Solve:  $\sin \theta - \tan \theta = 0$  ( $0^\circ \leq \theta \leq 180^\circ$ ).
- If  $|\vec{a}| = 4, |\vec{b}| = 5$  and  $\vec{a} \cdot \vec{b} = 10$  then find the angle between  $\vec{a}$  and  $\vec{b}$ .
  - The position vectors of the points  $A$  and  $B$  are  $3\vec{i} + 2\vec{j}$  and  $\vec{i} - 3\vec{j}$  respectively. If point  $P$  divides  $AB$  in the ratio  $2 : 3$  then find the position vector of  $P$ .
  - If the first quartile of any data is 43 and the quartile deviation is 6.5, find the coefficient of the quartile deviation.

**Group 'C'** $[11 \times 4 = 44]$ 

- Solve by using factor theorem:  $2x^3 + 13x^2 + 13x - 10 = 0$
- Maximize the objective function  $W = 2x + 3y$  under the given constraints

$$x + 2y \leq 10, x - y \leq 4, x \geq 0 \text{ and } y \geq 0$$

13. If

$$f(x) = \begin{cases} x + 4 & \text{for } x < 2 \\ 4x - 2 & \text{for } x \geq 2 \end{cases} \text{ at } x = 2$$

is defined, is the function  $f(x)$  continuous at  $x = 2$ ? Give reasons.

14. Solve by Cramer's rule

$$4x - 3y = 11 \text{ and } 3x + y = 5$$

15. Find the equation of the circle passing through the point (3,4) and having equations of two of its diameters  $x + y - 14 = 0$  and  $2x - y - 4 = 0$ .

16. Prove that:  $4(\cos^6 \theta - \sin^6 \theta) - \cos^3 2\theta = 3 \cos 2\theta$

17. If  $A + B + C = 180^\circ$ , then prove that:

$$\sin^2 \frac{A}{2} + \sin^2 \frac{B}{2} + \sin^2 \frac{C}{2} = 1 - 2 \sin \frac{A}{2} \cdot \sin \frac{B}{2} \cdot \sin \frac{C}{2}$$

18. From the top of a view tower 50 m high, a man observes two taxies on the ground, both due east on the same line at angles of depression of  $45^\circ$  and  $60^\circ$  respectively. Find the distance between two taxies.

19. A square  $PQRS$  with vertices  $P(2,0), Q(5,1), R(4,4)$  and  $S(1,3)$  is mapped onto a parallelogram  $P'Q'R'S'$  by a  $2 \times 2$  matrix so that the vertices of parallelogram are  $P'(2,2), Q'(7,3), R'(12,-4)$  and  $S'(7,-5)$ . Find the  $2 \times 2$  transformation matrix.

20. Calculate the mean deviation of the data given below from the median.

Marks obtained	45 - 55	55 - 65	65 - 75	75 - 85	85 - 95
No. of students	2	5	3	6	4

21. Find the standard deviation from the given data.

Marks obtained	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
No. of students	5	15	25	35	45

22. One student surveys the number of pens which are sold in two stationary shops. The pens of both shops are sold in a week. In the first shop, 60 pens are sold in the first day and 6 pens are sold more in everyday as comparison of previous day. Similarly, in the second shop, 5 pens are sold in the first day and the double number of pens are sold in everyday as comparison of previous day. Now in which shop, how many pens are sold more? Find it.

23. In  $\Delta XYZ, XY = XZ$  and  $\angle YXZ = 90^\circ$ . If the equation of  $YZ$  is  $2x - 3y + 10 = 0$  and coordinates of the point  $X$  are  $(2, -1)$ , find the equation of equal sides.

24. Prove by vector method that the line segment joining mid-points of two sides of any triangle is parallel to the third side of the triangle and also equal to half of the length of the third side.

25.  $E$  denotes the enlargement about the centre  $(-1,0)$  with a scale factor of  $-2$  and  $R$  denotes the rotation about the origin through  $-90^\circ$ . Find the combined transformation  $E \circ R$ . Find the image of a  $\Delta PQR$  having the vertices  $P(3,1), Q(1,3)$  and  $R(2,-1)$  under the combined transformation  $E \circ R$ . Also draw both figures  $\Delta PQR$  and its image on the same graph paper.

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