Paper – 1.

Que : 1.

(A)

1. Obtain the necessary and sufficient condition for $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$to be collinear. **(3)**
2. If the points (p+1, 1), (2p+1, 3) and (2p+2, 2p) are collinear then prove that p = 2 or p = –½ . **(1)**

(B) Answer any Two. **(4)**

1. Find the points which divide the line segments joining (1, 2) & (2, 1) into n – equal parts.
2. If A, B, C and P are distinct non-collinear points of the plane, prove that Area of ΔPAB + Area of ΔPBC + Area of ΔPCA ≥ Area of ΔABC.
3. For points A(6, 3), B(3, 6), C(4, 2) and P(x, y) show that $\frac{area\ of\ \Delta PBC}{area\ of\ \Delta ABC} = \frac{|4x+y-18|}{9}$.

(C) Answer any Two. **(4)**

1. Find the equation of the line which passes through (3, 4) and which makes an angle of $\frac{\pi}{4}$ with the line $3x+4y=2$.
2. Find the equation of the line passing through (1, 4) and making intercepts a and b on X and Y-axes respectively. If the area of the triangle formed by the line and the co-ordinate axes in the first quadrant is 8 units.
3. Find the equation of a line through (2, 6) if the length of the perpendicular segment to it from the origin is 2.

(D) Prove that the graph of a linear equation in R^2 is a line. **(3)**

Paper – 2.

Que : 1.

(A)

1. Obtain the area of a triangle whose vertices are $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$. **(3)**
2. Find a and b if (3, –1) is the centroid of the triangle with vertices at (1, 3), (a, –8), (3, b). **(1)**

(B) Answer any Two. **(4)**

1. If G is the centroid of ΔABC then prove that $AB^2 + BC^2 + CA^2 = 3(GA^2 + GB^2 + GC^2)$.
2. Points B(4, 1) and C(2, 5) are given. If P is a point in the plane such that $m\angle BPC = \frac{\pi}{2}$. Find the set of all such points P.
3. Prove that points A(–2, 5), B(4, –1), C(9, 1) and D(3, 7) are the vertices of parallelogram of area 42 units. Also prove that if E divides $\overline{AC}$ in the ratio 2 : 1 from A and if M is the mid point of $\overline{BC}$, then D, E and M are collinear.

(C) Answer any Two. **(4)**

1. An adjacent pair of vertices of a square is (–1, 3) and (2, –1). Find the remaining vertices.
2. Prove that the points (3, 4) and (–2, 1) are on the opposite sides of the line $3x - y + 6 = 0$.
3. Line $x\cos\alpha + y\sin\alpha = p$ meets the co-ordinate axes in A and B. Prove that the equation of the set of mid point of $\overline{AB}$ is $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$.

(D) Obtain the Cartesian equation of a line passing through $A(x_1, y_1)$, $B(x_2, y_2)$. **(3)**

Paper – 3.

Que : 1.

(A)

1. Obtain area of a triangle having vertices $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$. **(3)**
2. Using division of a line segment, show that (1, –1), (4, 5) & (2, 1) are collinear. **(1)**

(B) Answer any Two. **(4)**

1. Prove that, in any parallelogram ABCD,
   $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2$.
2. If the mid-points of the sides of a triangle are (3, 2), (4, 5) and (2, 3) then find vertices of the triangle.
3. Find the co-ordinates of the centroid, circumcentre and incentre of the triangle whose vertices are P(3, 4), Q(0, 4) and R(3, 0).

(C) Answer any Two. **(4)**

1. Obtain the equation of a line which makes an angle of 30° with Y-axis and which makes intercept 5 on X-axis.
2. Equation of two sides of a parallelogram are $3x - y - 2 = 0$ and $x - y - 1 = 0$ and one of its vertices is (2, 3). Find the equations of the remaining sides of the parallelogram.
3. Area of ΔABC is 4. Co-ordinates of A and B are respectively A(2, 1) & B(4, 3). Find the co-ordinates of C if it lies on the line $3x - y - 1 = 0$.

(D) Obtain length of a perpendicular segment from the origin to the line $ax + by + c = 0$, $a^2 + b^2 = 0$. **(3)**

Paper – 4.

Que : 1.

(A)

1. Obtain the necessary and sufficient condition for three points $A(x_1, y_1)$, $B(x_2,y_2)$, $C(x_3, y_3) \in R^2$ to be collinear. **(3)**

2. Find the points of trisection of $\overline{AB}$ if A(–2, –1) and B(7, 8). **(1)**

(B) Answer any Two. **(4)**

1. Points A, B, C have co-ordinates respectively $A(x_1, x_1\tan\theta_1)$, $B(x_2, x_2\tan\theta_2)$, $C(x_3, x_3\tan\theta_3)$. If the circumcentre of ΔABC is the origin and its centroid is (x, y), prove that $\frac{x}{y}=\frac{\cos\theta_1+\cos\theta_2+\cos\theta_3}{\sin\theta_1+\sin\theta_2+\sin\theta_3}$; $\left(0<\theta_1,\theta_2,\theta_3<\frac{\pi}{2}\right)$.

2. If the centroid of a triangle whose vertices are A(2, 7), B(–1, k) and c(h, –1) is (1, 3) find its circumcentre.

3. Prove that the area of ΔABC having vertices at $A(a\cos\alpha, b\sin\alpha)$, $B(a\cos\beta, b\sin\beta)$, $C(a\cos\gamma, b\sin\gamma)$ is $\left|2ab\sin\left(\frac{\alpha-\beta}{2}\right)\sin\left(\frac{\beta-\gamma}{2}\right)\sin\left(\frac{\gamma-\alpha}{2}\right)\right|$.

(C) Answer any Two. **(4)**

1. Find the equation of the line which passes through (3, –2) and which makes an angle of $\frac{\pi}{3}$ with the line $\sqrt{3}x+y=1$.

2. Three concurrent lines passing through the vertices of ΔABC intersect the lines containing $\overline{BC}$, $\overline{CA}$ and $\overline{AB}$ in D, E and F respectively prove that $\frac{BD}{DC}\cdot\frac{CE}{EA}\cdot\frac{AF}{FB}=1$.

3. The perpendicular this through the origin intersect the lines $\frac{x}{a}+\frac{y}{b}=1$ $(a,b\neq0)$ at A, B prove that $\frac{1}{OA^2}+\frac{1}{OB^2}=\frac{1}{a^2}+\frac{1}{b^2}$.

(D) Obtain angle between two intersecting lines. **(3)**

Paper – 5.

Que : 1.

(A)

1. Define distance function in R^2. State and prove the properties of distance function in R^2. **(3)**
2. If a + b = ab then prove that the points (a, 0), (0, b) and (1, 1) are collinear. **(1)**

(B) Answer any Two. **(4)**

1. Prove that the equation of the set of points such that SP + S'P = 2a, where S(ae, 0) and S'(–ae, 0) is $\frac{x^2}{a^2}+\frac{y^2}{a^2(1-e^2)}=1$.
2. If D is the midpoint of $\overline{BC}$ of ΔABC then prove that $AB^2 + AC^2 = 2(AD^2 + BD^2)$.
3. Prove that the area of ΔABC having vertices at $A(at_1^2, 2at_1)$, $B(at_2^2, 2at_2)$, $C(at_3^2, 2at_3)$ is $a^2 |(t_1 - t_2)(t_2 - t_3)(t_3 - t_1)|$.

(C) Answer any Two. **(4)**

1. Area of ΔABC is 4. Co-ordinates of A and B are respectively A(2, 1) and B(4, 3). Find the co-ordinates of C, if it lies on the line 3x – y – 1 = 0.
2. A line passes through $(\sqrt{3}, -1)$ and the length of the segment perpendicular to it from the origin is $\sqrt{2}$. Find the equation of the line.
3. The line 2x – y + 8 = 0 meets the X-axis at A and Y-axis at B. If the point P divides $\overline{AB}$ in the ratio 3 : 1 from A. Find the equation of the line passing through P and perpendicular to $\overleftrightarrow{AB}$.

(D) Find ***the necessary and sufficient condition for the lines ℓ_1 and ℓ_2 to be*** (i) parallel, and (ii) perpendicular. **(3)**

Paper – 6.

Que : 1.

(A)

1. Find the area of the ΔABC if the co-ordinates of its vertices are $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$. **(3)**
2. If P(2, 7) divides the line segment joining A(–1, 1) and B in the ratio 3 : 2, find the co-ordinates of B. **(1)**

(B) Attempt any Two. **(4)**

1. A(3, 4), B(0, –5), C(3, –1) are the vertices of ΔABC. Determine the length of the altitude from A on $\overleftrightarrow{BC}$.
2. If P is a variable point on the circumcircle of an equilateral ΔABC, prove that the value of $AP^2 + BP^2 + CP^2$ is independent of the position of the point P.
3. If $(x_i \cos\theta_i, x_i)$, where i = 1, 2, 3 are vertices of a triangle whose circumcenter is at origin and whose centroid (x, y), prove that $x\sum_{i=1}^{3}\sin\theta_i = y\sum_{i=1}^{3}\cos\theta_i \quad \left(0 < \theta_i < \frac{\pi}{2},\ x_i > 0,\ i = 1, 2, 3\right)$.

(C) Solve any Two. **(4)**

1. Find the equation of the line which passes through (3, –2) and which makes an angle of 60° with the line $\sqrt{3}\,x + y = 1$.
2. A line passes through $(\sqrt{3}, -1)$ and the length of the segment perpendicular to it from the origin is $\sqrt{2}$. Find the equation of the line.
3. If A(2, 2), B(0, 4) and C(3, 3) are vertices of ΔABC, find the equations of the lines containing altitude $\overline{AD}$ and the bisector of ∠BAC.

(D) Define the slope of a line. Obtain the formula for measure of angle between two intersecting lines. **(3)**

Paper – 7.

Que : 1.

(A)

1. Obtain the co-ordinates of the point dividing $\overline{AB}$ joining $A(x_1, y_1)$ and $B(x_2, y_2)$ in the ratio $\lambda : 1$ from $A(\lambda \neq -1)$ and if $\lambda = 1$, then find its co-ordinates. Discuss the meaning of this result. **(3)**
2. Prove that A(4, 2), B(7, 5) and C(9, 7) are collinear, determine which of the three points is between the other two. **(1)**

(B) Answer any Two. **(4)**

1. Points B(2, 3) and C(3, 2) are given. Find the equation of the set of all points A in the plane such that the area of ΔABC is 3 units.
2. If P(1, 2) and Q(5, 6) divides $\overline{AB}$ from A in the ratios 2 : 1 and –2 : 1, find the co-ordinates of A and B.
3. Prove that the two lines joining the mid points of the pairs of opposite sides and the line joining the mid-point of the diagonals of a quadrilateral are concurrent.

(C) Solve any Two. **(4)**

1. Show that the centroid of ΔABC lies on the line $21x + 27y - 74 = 0$, if C lies on $7x + 9y - 10 = 0$ and A and B have co-ordinates (6, 3) and (–2, 1).
2. $A(x_1, y_1)$ and $B(x_2, y_2)$ are points of the plane. If the line $ax + by + c = 0$, divides $\overline{AB}$, find the ratio in which it divides $\overline{AB}$ from A. And hence prove that the points (3, 4) and (–2, 1) are on the opposite sides of the line $3x - 4y + 6 = 0$.
3. Find the points on $2x + y = 1$ which are at a distance 2 from (1, 1).

(D)

1. Obtain the p–α form of the equation of a line. **(2)**
2. Obtain the equation of a line in the form $\frac{y - y_1}{\sin\theta} = \frac{x - x_1}{\cos\theta}$. **(1)**

Paper – 8.

Que : 1.

(A)

1. Obtain the co-ordinates of centroid of ΔABC, where A(x_1, y_1), B(x_2, y_2) and C(x_3, y_3). **(3)**
2. If $\frac{1}{a}+\frac{1}{b}=1$ then prove that the points $(a, 0)$, $(0, b)$ and (1, 1) are collinear. **(1)**

(B) Answer any Two. **(4)**

1. If the lines $3x+y+4=0$, $3x+4y-15=0$ and $24x-7y-3=0$ contain the sides of a triangle, prove that the triangle is isosceles.
2. If A, B, C and P are distinct non-collinear points of the plane, prove that Area of ΔPAB + Area of ΔPBC + Area of ΔPCA ≥ Area of ΔABC.
3. For A(6, 3), B(–3, 5) and C(4, –2) and P(x, y) show that $\frac{\Delta PBC}{\Delta ABC}=\frac{|x+y-2|}{7}$.

(C) Answer any Two. **(4)**

1. Find the equation of the line which passes through (3, 4) and which makes an angle of $\frac{\pi}{4}$ with the line $3x+4y=2$.
2. $A(x_1, y_1)$ and $B(x_2, y_2)$ are point of the plane. If the line $ax+by+c=0$, divides $\overline{AB}$, find the ratio in which it divides $\overline{AB}$ from A.
3. If x = 2, x = –3, y = 4 and y = 6 are the equations of the sides of rectangle, find the equations of its diagonals.

(D) Obtain equation of line (i) having slope m & passing through (x_1, y_1), (ii) having slope m & the y-intercept is c, (iii) making intercepts a & b on the axes. **(3)**

Paper – 9.

Que : 1.

(A)

1. Derive the incentre of a triangle whose vertices are $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$. If ΔABC is equilateral, then obtain its incentre. State the meaning of this result. **(3)**
2. If the area of the triangle with vertices (a, 3), (4, 5) and (3, 1) is 8 units, find a. **(1)**

(B) Attempt any Two. **(4)**

1. A(K, 2) and B(3, 5) are given points. If the point (m, m) divides $\overline{AB}$ in the ratio K from A, then find the value of K. Also find the co-ordinates of a point that divides $\overline{AB}$ from B in the ratio K : 1.
2. If G is centroid of ΔABC, prove that $AB^2 + BC^2 + AC^2 = 3(GA^2 + GB^2 + GC^2)$.
3. Find the points which divide the line-segment joining (1, 2) and (c, d) into n-equal parts.

(C) Attempt any Two. **(4)**

1. Find the equation of the line which passes through (–2, 5) and which make an angle of $\frac{\pi}{4}$ with the line $6x + 8y = 5$.
2. Equation of two of the sides of a parallelograms are $3x - y - 2 = 0$ and $x - y - 1 = 0$ and one of its vertices is (2, 3). Find the equations of the remaining sides of the parallelogram.
3. Find the co-ordinates of the point at a distance of 10 units from the point (4, –3) on the line perpendicular to $3x + 4y = 0$

(D) If the Ray starting from the origin and containing the perpendicular segment from the origin to the line $ax + by + c = 0$, $a^2 + b^2 \neq 0$ intersects the unit circle in P(α), then find the length of the perpendicular segment and α. **(3)**

Paper – 10.

Que : 1.

(A)

1. Obtain the formulae of the transformation of the co-ordinates of a point on shifting the origin (without changing the directions of the axes). **(3)**
2. Prove that P(a, b+c), Q(b, c+a) and R(c, a+b) are collinear. **(1)**

(B) Answer any Two. **(4)**

1. Find the points which divide the line segment joining (a, b) and (0, 0) into n equal parts.
2. If A, B, C and P are distinct non collinear points of the plane then prove that Area of the $\Delta ABC \leq$ Area of the ΔPAB + Area of the ΔPBC + Area of the ΔPCA.
3. Obtain $C \in \overleftrightarrow{AB}$ such that AC = 5AB where A(3, –3) and B(6, –1).

(C) Answer any Two. **(4)**

1. Show that the centroid of ΔABC lies on the line $21x + 27y - 74 = 0$ if C lies on $7x + 9y - 10 = 0$ and A and B have co-ordinates (6, 3) and (–2, 1).
2. A line intersects the X and Y-axes at A and B respectively. If (2, 1) divides $\overline{AB}$ from A in the ratio 2 : 1, find the equation of $\overleftrightarrow{AB}$.
3. Show that the equation of the line passing through ($a\cos^3\theta$, $a\sin^3\theta$) and perpendicular to $x\sec\theta + y\,\mathrm{cosec}\,\theta = a$ is $x\cos\theta - y\sin\theta = a\cos 2\theta$.

(D)

1. Obtain equation of the line in p–α form. **(2)**
2. Obtain the equation of the line in the intercept form. **(1)**

Paper – 11.

Que : 1.

(A)

1. Obtain the co-ordinate of incentre of the ΔABC, if $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$. **(3)**
2. (3, –1) is centroid of ΔABC, A(1, 3). Find the mid point of $\overline{BC}$. **(1)**

(B) Answer any Two. **(4)**

1. Two of the vertices of a triangle are (2, 3) and (–1, 4) and its area is 10 units. If the third vertex is on the X-axis, find its co-ordinates.
2. If D and G are respectively the mid-point of $\overline{BC}$ and the centroid in ΔABC, prove that (i) $AB^2 + AC^2 = 2(AD^2 + BD^2)$.
   (ii) $AB^2 + BC^2 + AC^2 = 3(GA^2 + GB^2 + GC^2)$.
3. A(–3, 0) and B(3, 0). Prove that the equation of the set of points P such that AP + PB = 8is $\frac{x^2}{16}+\frac{y^2}{7}=1$.

(C) Answer any Two. **(4)**

1. Prove that A(2, –3), B(0, 1), C(–8, –3), and D(–6, –7) are the vertices of a rectangle.
2. Area of ΔABC is 4. Co-ordinates of A and B are respectively A(2, 1) and B(4, 3). Find the co-ordinates of C, if it lies on the line $3x - y - 1 = 0$.
3. If three concurrent lines passing through the vertices of ΔABC meet the opposite sides $\overline{BC}$, $\overline{CA}$, $\overline{AB}$ in D, E, F respectively then prove that $\frac{BD}{DC}\cdot\frac{CE}{EA}\cdot\frac{AF}{FB}=1$.

(D) Define angle between two intersecting lines and obtain the angle between the two intersecting lines. **(3)**

Paper – 12.

Que : 1.

(A)

1. Obtain the co-ordinates of the point dividing $\overline{AB}$ from A in the ratio λ, if $A(x_1, y_1)$ and $B(x_2, y_2)$. **(3)**
2. If d[(2, –3), (5, b)] = 5 then find b. **(1)**

(B) Answer any Two. **(4)**

1. Points A, B, C have co-ordinates respectively, $A(x_1, x_1 \tan\theta_1)$, $B(x_2, x_2 \tan\theta_2)$, $C(x_3, x_3 \tan\theta_3)$. If the circumcentre of ΔABC is the origin and its centroid is (x, y), prove that $\frac{x}{y} = \frac{\cos\theta_1 + \cos\theta_2 + \cos\theta_3}{\sin\theta_1 + \sin\theta_2 + \sin\theta_3}$. $\left(0 < \theta_1, \theta_2, \theta_3 < \frac{\pi}{2}\right)$.
2. A(3, 4), B(0, –5), C(3, –1) are the vertices of ΔABC. Determine the length of the altitude from A on $\overleftrightarrow{BC}$.
3. If P is a point on the segment joining A(3, 5)and B(–5, 1) such that the area of ΔPOQ is 6 units where O is the origin and Q is the point (–2, 4) then find co-ordinates of P.

(C) Answer any Two. **(4)**

1. A line passes through $(\sqrt{3}, -1)$ and the length of the segment perpendicular to it from the origin is $\sqrt{2}$. Find the equation of the line.
2. Find the equation of the line which passes through (3, –2) and which makes an angle of $\frac{\pi}{3}$ with the line $\sqrt{3}x + y = 1$.
3. The perpendicular st. lines through the origin intersect the st. line $\frac{x}{a} + \frac{y}{b} = 1$ $(a, b \neq 0)$ at A, B. Prove that $\frac{1}{OA^2} + \frac{1}{OB^2} = \frac{1}{a^2} + \frac{1}{b^2}$.

(D) Define slope of a line and prove that the slope of the line does not depend on the choice of the line. **(3)**

Paper – 13.

Que : 1.

(A)

1. Obtain distance formula in R^2 and state its properties. **(3)**
2. Using distance formula, prove that (–2, 3), (1, 2) and (7, 0) are collinear. **(1)**

(B) Answer any Two. **(4)**

1. Prove that the two lines joining the mid-points of the pairs of opposite sides and the line joining the mid-point of the diagonals of a quadrilateral are concurrent.
2. Points B(4, 1) and C(2, 5) are given. If P is a point in the plane such that $m\angle BPC = \frac{\pi}{2}$. Find the set of all such points P.
3. If (–4, 3), (10, 5) and (12, –9) are three vertices of a square, find the co-ordinates of fourth vertex.

(C) Answer any Two. **(4)**

1. A line intersects X and Y axes at A and B respectively. If AB = 10 and 30A = 40B then find the equation of the line.
2. Find the points on $2x + y = 1$ which are at a distance $\sqrt{5}$ from (1, –1).
3. Find the equation of a line passing through (2, 3) and which contains a segment of length 2 between the lines $2x + y = 5$ and $2x + y - 3 = 0$.

(D) Obtain the cartesian equation of a line passing through $A(x_1, y_1)$ and $B(x_2, y_2) \in R^2$. **(3)**

Paper – 14.

Que : 1.

(A)

1. Obtain the co-ordinate of the point dividing $\overline{AB}$ from A in the ratio λ if $A(x_1, y_1)$ and $B(x_2, y_2)$. If P is the midpoint of $\overline{AB}$ obtain the co-ordinate of P. $(\lambda \neq -1)$. **(3)**
2. If the area of the triangle with vertices (a, 3), (4, 5) and (3, 1) is 6 units, find a. **(1)**

(B) Answer any Two. **(4)**

1. If A(0, 1) and B(2, 9) are given, find C on $\overleftrightarrow{AB}$ such that AB = 3AC.
2. If A, B, C and P are distinct non-collinear points of the plane, prove that, area of ΔPAB + area of ΔPBC + area of ΔPCA $\geq$ area of ΔABC.
3. Obtain equation of the set of points P such that |PA – PB| = 4 where A(5, 0) and B (–5, 0).

(C) Answer any Two. **(4)**

1. Find the equations of the lines passing through (4, 5) and parallel to and perpendicular to $2x + y = 1$
2. The perpendicular st. lines through the origin intersect the st. line $\frac{x}{a} + \frac{y}{b} = 1$, (a, b $\neq$ 0) at A, B. Prove that $\frac{1}{OA^2} + \frac{1}{OB^2} = \frac{1}{a^2} + \frac{1}{b^2}$.
3. Find the equation of the line which passes through (3, 4) and which makes an angle of 45° with the line 3x + 4y = 2.

(D) Prove that the graph of a linear equation in R^2 is a line. **(3)**

Paper – 15.

Que : 1.

(A)

1. Define Metric space and centroid. Obtain the co-ordinate of Incentre of the ΔABC if $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$. **(3)**
2. Find the point on Y-axis which is at a distance 13 units from (12, 11). **(1)**

(B) Answer any Two. **(4)**

1. $A(x_1, x_1 \tan\theta_1)$, $B(x_2, x_2 \tan\theta_2)$ and $C(x_3, x_3 \tan\theta_3)$ are the vertices of a triangle whose circumcentre is at the origin. If (x, y) is the centroid of the above triangle, then show that

   $$\frac{x}{y} = \frac{\cos\theta_1 + \cos\theta_2 + \cos\theta_3}{\sin\theta_1 + \sin\theta_2 + \sin\theta_3} \cdot \left[x_i \geq 0;\ 0 < \theta_i < \frac{\pi}{2};\ i = 1, 2, 3 \right].$$

2. A(5, 3) and B(–7, 2) are given points. If $m\angle APB = 90^\circ$ then find the equation of the set of points P.
3. Prove that the (–2, –1), (1, 0), (4, 3) and (1, 2) are the vertices of a parallelogram.

(C) Answer any Two. **(4)**

1. A line intersects X and Y axes at A and B respectively. If AB = 10 and 30A = 40B then find the equation of the line.
2. Find the equations of the lines passing through (–2, 3) and forming an equilateral triangle with the line $\sqrt{3}x - 3y + 16 = 0$.
3. Find the equation of a line passing through (2, 3) and which contains a segment of length 2 between the lines 2x + y – 5 = 0 and 2x + y – 3 = 0.

(D) Obtain the angle between the lines ℓ_1 and ℓ_2 having slopes m_1 and m_2. **(3)**

question bank

MATHS-I (050 E) question - 2 paper-1

Q.2 (A) (1) Obtain angle between pair of state line $ax^2 + 2hxy + by^2 = 0$ $(a^2 + h^2 + b^2 \neq 0)$ (3)

(2) Write the equation of state line through (1, -2) parallel to x-axsi & y-axis. (1)

(B) (1) Obtain the equation of circle whose extremites of diameter are A (x_1, y_1) and B (x_2, y_2). (2)

(2) Find the co.ordiantes of the foot of the perpendicular from the origin on the line $\frac{x}{a}+\frac{y}{b}=1$. (1)

(3) Prove that $(2 + \lambda)x + (3 - \lambda)y + 5 = 0$, represents a system of lines pasing through a certain fixed point. (1)

(C) (1) Find the mid-point of the chord of the circle $x^2 + y^2 - 2x - 10y + 1 = 0$ formed by the line $x - 2y + 7 = 0$. (3)

or (1) Obtain the equation of tangent to the circle $x^2 + y^2 = a^2$ making triangle of area a^2 with axes in the first quadrant.

(2) Find the equation of the circle with centre at (4 , 3) and touching the line $3x - 4y + 5 = 0$. (1)

(D) In ΔABC, A is (3 , 4) and the lines containing two of the altitudes are $3x - 4y + 23 = 0$ and $4x + y = 0$. Find the co.ordinates of B and C. (3)

or (D) Find the measure of the angle between the two line represented $3x^2 - 7xy + 2y^2 - 14x + 13y + 15 = 0$ and find their point of intersection. (3)

Question bank

MATHS - I (050 E) Question - 2 Paper - 2

Q.2 (A) (1) Obtain formula to find perpendicular distance from A (x_1, y_1) to the line $ax + by + c = 0$, $a^2 + b^2 \neq 0$, and hence obtain perpendicular distance between two parallel lines. (3)

(2) If the length of the perpendicular segment from the origin is 10 and $\alpha = \frac{-5\pi}{12}$, find the equation of the lines. (1)

(B) (1) Obtain necessary and sufficient condition for two circles to be orthogonal. (2)
If $2x^2 + 2y^2 + 2x - 2y - 7 = 0$ and $x^2 + y^2 - 4x + 6y + k = 0$ are orthogonal circle find k.

(2) Find the measure of the angle between the lines $6x^2 + xy - y^2 = 0$. (1)

(3) Find the perpendicular distance of the point $(2\sqrt{3}, 1)$ from the line $x + \sqrt{3}y - 23\sqrt{3} = 0$. (1)

(C) (1) Show that point $(-5, -2)$ is a point out side the circle $x^2 + y^2 - 4x + 6y - 5 = 0$. (3)
Find the point on the circle which is at the shortest distance from this point.

or (1) Find the equation of the circle which is orthogonal to the circles $x^2 + y^2 + 4y - 13 = 0$ and $x^2 + y^2 + 6x + 2y + 9 = 0$ and whose centre lies on the line $x + y - 7 = 0$.

(2) Find the equation of the line which contains the common chord the circle $x^2 + y^2 + 3x + 4y + 1 = 0$ and $x^2 + y^2 + x - 8y - 1 = 0$. (1)

(D) Prove that the pair of lines $x^2 + 4xy + y^2 = 0$ and line $x - y = 4$ from an equailateral triangle also show that its area is $\frac{8}{\sqrt{3}}$. (3)

or (D) (1) Without using distance formula obtain circumcentre of triangle whose vertices are $(2, 3)$, $(4, 7)$ and $(-2, 5)$. (2)

(2) If the lines $a_1x + b_1y = 7$, $a_2x + b_2y = 7$ and $a_3x + b_3y = 7$ are concurrent, prove that the points (a_1, b_1), (a_2, b_2) and (a_3, b_3) are collinear. (1)

Question bank

MATHS-I (050 E) Question-2 Paper-3

Q.2 (A) (1) Obtain necessary and sufficient condition for three lines of R^2 to be concurrent. (3)

(2) Show that $\{(2t+3, 3t+4)/t \in R\}$ & $\{(6t+5, 9t+7)/t \in R\}$ represents identical lines. (1)

(B) (1) Obtain equation of tangent and normal to the circle $x^2 + y^2 = r^2$ at (x_1, y_1). (2)

(2) Find the angle between the lines $x^2 - 2xy\sec\alpha + y^2 = 0$. $\left(0 < \alpha < \frac{\pi}{2}\right)$ (1)

(3) Obtain the equation of line at a distance of two units from origin and parall to $3x + 4y = 0$. (1)

(C) (1) Obtain the equation of the circle which passes through the point of intersection of two circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 2x - 4y + 4 = 0$ and touching the line $x + 2y = 0$. (3)

or (1) Show that $(1, 1), (2, 2), (6, -4)$ & $(7, -3)$ are the vertices of cyclic quadrilateral.

(2) Obtain the length of the tangent from point $(7, 4)$ to the circle $x^2 + y^2 = 25$. (1)

(D) Without finding the point of intersection of the lines $x - 2y - 2 = 0$ and $2x - 5y + 1 = 0$ find the equation of lines (i) whose both intercepts are equal (ii) passing through arigin. (3)

or (D) If the lines $ax + y + 1 = 0$, $x + by + 1 = 0$ and $x + y + c = 0$ are concurrent $(a \neq b \neq c$ & $a, b \in R - \{1\})$ prove that $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1$ (2)

Question bank
MATHS-I (050-E) Question - 2 Paper-4

Q.2 (A) (1) Prove that $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are two (distinct) intersecting lines and l and m in are any two real numbers, not both zero, then $l(a_1x + b_1y + c_1) + m(a_2x + b_2y + c_2) = 0$ represents a line through their point of intersection. $(l^2 + m^2 \neq 0)$ (3)

(2) If $\frac{1}{2a} + \frac{1}{3b} = K$, where k is constant prove that all lines $\frac{x}{a} + \frac{y}{b} = 1$ passes through a fixed point. (1)

(B) (1) Obtain the equation of circle in the form $x^2 + y^2 + 2gx + 2fy + c = 0$; $(g^2 + f^2 - c > 0)$ Obtain condition that this equation represents a circle also find its radius and centre. (2)

(2) Obtain point of intersection of the line $x\cos\alpha + y\sin\alpha = P$ and $x\sin\alpha - y\cos\alpha = 0$ (1)

(3) If the perpendicular distance between $3x + 4y + 10 = 0$ & $6x + 8y + c = 0$ is $\frac{7}{2}$ then find c, (1)

(C) (1) If the point A (a , 0), A^1 ($-a^1$, 0), B (0 , b) and B^1 (0 , $-b^1$) are on a circle, then prove that $aa^1 = bb^1$. Also find the equation of the circle. (3)

or (1) If the centre of the circle passing thought the origin and orthogonal to the circle $x^2 + y^2 - 4x + 2y + 4 = 0$ lies on the line $x + y - 4 = 0$, then find the equation of this circle.

(2) Show that the $2x - 3y + 39 = 0$ contains one normal of the circle $x^2 + y^2 + 12x - 18y - 5 = 0$. (1)

(D) Coordinates of A in ΔABC are (2 , -5) and the equations of the perpendicular bisectors of $\overline{AB}$ and $\overline{AC}$ are $x - 2y - 2 = 0$ and $x + 3y + 8 = 0$. Find the coordinates of B and C. (3)

or (D) (i) Find the orthocenter of the triangle whose vertices are (2 , -2), (8 , -2) and (6 , 6) (2)

(ii) Find the combine equation of the lines through the origin which are perpendicular to the lines $ax^2 + 2hxy + by^2 = 0$. (1)

Question bank

MATHS-I 050-E Question. 2 Paper-5

Q.2 (A) (1) Prove that if $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of lines, then this pair is parallal to the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$ $(c \neq 0)$ (3)

(2) With the help of slope prove that A (-4 , -5), B (1 , -1) and C (6 , 3) are collinear. (1)

(B) (1) Obtain condition for the line $y = mx + c$, to be tangent to the circle $x^2 + y^2 = r^2$ and the pint of contact. (2)

(2) Equation of line containing two sides of triangle are $x + y = 5$ and $x - y = 3$ and if (2 , 1) is circumcentre of the triangle then obtain centroid. (1)

(3) If the angle between pair of straight lines $x^2 - 4 \operatorname{cosec}\theta\, xy + 4y^2 = 0$ is $\tan^{-1}\left(\frac{4}{5}\right)$ then obtain θ. (1)

(C) (1) Write the equation of curve passing through three intersecting lines, when this curve represent a circle ? And hence find the equation of the circumscribed circle of the triangle formed by three lines $x + y = 6$, $2x + y = 4$ and $x + 2y = 5$. (3)

or (1) Show that the points of intersection of the lines represented by the $2x^2 - 5xy + 2y^2 + 7x - 5y + 3 = 0$ with the axes lie on a circle. Find the equation of this circle.

(2) Find the measure of the angle between two tangents to the circle $x^2 + y^2 = a^2$ drawn from the point (h , k). (1)

(D) Prove that the area of the triangle formed by pair of straight lines $ax^2 + 2hxy + by^2 = 0$ and line $lx + my + n = 0$ is $\left|\frac{n\sqrt{h^2 - ab}}{am^2 - 2hlm + bl^2}\right|$. (3)

or (D) (i) Prove that lines $lx + my + n = 0$, $l_1x + m_1y + n_1 = 0$, $lx + my + n_1 = 0$ and $l_1x + m_1y + n = 0$ form rhombus. Where $lm_1 \neq l_1m$, $m \neq m_1$ and $l^2 + m^2 = l_1 + m_1^2$ (2)

(ii) Does the equation $x^2 + y^2 + 2y + 1 = 0$ represent a pair of straight lines ? why ? (1)

Question bank

MATHS-I (050 E) Question-2 Paper-6

Q-2 (A) (1) Obtain point of intersection of the lines represented by the general quadratic equation $ax^2+2hxy+by^2+2gx+2fy+c=0$; $a^2+b^2+h^2\neq 0$. (3)

(2) Show that P(-4,-5), Q(1,-1) and R(6,3) are collinear points using concept of slope. (1)

(B) (1) Obtain the equation of the circle with centre at (h,k) and radius r, and hence obtain the equation of the unit circle. (2)

(2) Prove that $x^2-y^2-2xy\tan\theta+2ay\sec\theta-a^2=0$ represents a pair of lines. (1)

(3) Obtain the point of intersection of above pair of state lines. (1)

(C) (1) Show that the circles $x^2+y^2-4x+6y+8=0$ and $x^2+y^2-10x-6y+14=0$ touches each other externally, also find point of contact. (3)

(OR) (1) Show that the point (4,-5) is inside the circle $x^2+y^2-4x+6y-5=0$. Find the point on the circle which is at the maximum distance from the point.

(2) If the circles $x^2+y^2+2gx+2fy=0$ and $x^2+y^2+2g'x+2f'y=0$ are tangent to each-other show that $f'g=fg'$. (1)

(D) Find the area of the parallelogram whose sides are along the lines $y=mx+a$, $y=mx+b$, $y=nx+c$ and $y=nx+d$. (3)

(OR) (D) Find the circumcentre of the triangle as a point of concurence of the perpendicular bisectors of the sides if the vertices of the triangle are (2,3), (4,7) and (-2,5).

Question bank

MATHS-I (050 E) Question-2 Paper-7

Q-2 (A) (1) State the necessary and sufficient conditions that a general quadratic eqn. in $\mathbb{R}^2$ represents a pair of lines and state the formula for measure of an angle between them and the co-ordinates of the point of intersection. (3)

(2) Without using distance formula prove that A(2,-3), B(0,1), C(-8,-3) and D(-6,-7) are the vertices of a rectangle. (1)

(B) (1) Discuss the position of the point $P(x_1, y_1)$ relative to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$. (2)

(2) If $\frac{n}{l+m}$ is constant then prove that line $lx + my + n = 0$; $l^2 + m^2 \neq 0$ passes through some fixed point. (1)

(3) Find difference between the slopes of the lines $\sqrt{2}x^2 + xy - \sqrt{2}y^2 = 0$ (1)

(C) (1) Find the set of all points P out side a circle $x^2 + y^2 = 25$ such that the tangent drawn to the circle are perpendicular to each-other. (3)

OR (1) obtain the equation of the circle passing through (1,-2) and (3,-4) and touching x-axis

(2) If the end points a diameter of the circle $x^2 + y^2 - 2x + 6y - 15 = 0$ are $(-2, b)$ and $(a, 1)$ find the value of a and b. (1)

(D) Prove that the lines $(a^2 - 3b^2)x^2 + 8ab\,xy + (b^2 - 3a^2)y^2 = 0$ and $ax + by + c = 0$; $c \neq 0$ contain the sides of an equilateral triangle whose area is $\frac{c^2}{\sqrt{3}(a^2+b^2)}$ (3)

OR (D) Prove that the equation of the lines through the origin which make an angle of measure α with $x + y = 0$ is $x^2 + 2xy \sec 2\alpha + y^2 = 0$; $0 < \alpha < \pi/4$

Question bank

MATHS-I 050-E Question-2 Paper-8

Q-2 (A) (1) Obtain condition that the general homogeneous second degree equation in $\mathbb{R}^2$ represents a pair of lines. (3)

(2) If $a+b+c=0$ then prove that the line $ax+by+c=0$ passes through a fixed point. (1)

(B) (1) Discuss briefly the relation between two circle in a plane. (2)

(2) Find the angle between the lines $x^2 - 2xy \sec\alpha - y^2 = 0$; $0 < \alpha < \pi/2$ (1)

(3) Without finding the point of intersection of the lines $x-2y-2=0$ and $2x-5y+1=0$ find the equation of the line passing through that point and through the point (1,0). (1)

(C) (1) Prove that $x^2+y^2-4x-2y+1=0$ touches Y-axis. Find equation of circle with radius 4 touching this circle at the point where the first circle touches Y-axis. (3)

OR (1) Prove that the circles $x^2+y^2=25$ and $2x^2+2y^2-4x-3y-25=0$ touches each other. Also find the equation of common tangent to these circles.

(2) Obtain the equation of circle touches Y-axis at (0, 3) and radius 5-unit. (1)

(D) Find the points on the line $x+5y-13=0$ which are at a distance of two units from the line $12x-5y+26=0$. (3)

(OR) (D) Find the co-ordinates of the foot of perpendicular from (1,1) on the line $3x+5y-15=0$

Question bank

MATHS-I (050 E) question-2 Paper-9

Q-2 (A) (1) Show that if $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of lines, then this pair is parallel to the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$, $(c \neq 0)$. Also state the condition by which $ax^2 + 2hxy + by^2 = 0$ represents (3)
(i) axes (ii) perpendicular lines and (iii) pair of lines. (1)

(2) obtain the angle between lines $\sqrt{3}x + y - 5 = 0$ and $2x - 5 = 0$.

(B) (1) Obtain parametric equations of a circle $x^2 + y^2 = r^2$ and write the parametric equations of $(x-h)^2 + (y-k)^2 = r^2$. (2)

(2) Prove that $(2+\lambda)x + (3-\lambda)y + (1-2\lambda) = 0$ represents a system of lines passing through a certain fixed point. (1)

(3) Find k, if the following lines are concurrent. (1)

(C) (1) Find the equation of the circle which passes through the point of intersection of the circles $x^2 + y^2 = 13$ and $x^2 + y^2 + x - y - 14 = 0$ and whose centre lies on the line $4x + y - 6 = 0$. (3)

OR (1) Obtain the equation of the circle passing through (0, 3) and which touches the line $3x - 2y - 19 = 0$ at $(5, -2)$

(2) Show that the circle $a^2x^2 + a^2y^2 + 2abx + 2aby + b^2 = 0$ $(a, b \neq 0)$ touches both the axes. (1)

(D) Find the area of the triangle whose sides are along the lines $y = m_1x + c_1$, $y = m_2x + c_2$ and $x = 0$ (3)

(OR) (D) Prove that $x^2 - y^2 - 2xy\tan\theta + 2ay\sec\theta - a^2 = 0$ represents a pair of lines and find their point of intersection.

Question bank

MATHS-I (050 E) Question - 2 paper-10

Q-2 (A) (1) (i) Obtain the perpendicular distance of $ax+by+c=0$ from $A(x_1,y_1)$ in $\mathbb{R}^2$. (3)

(ii) Obtain the distance between parallel lines $ax+by+c=0$ & $ax+by+c'=0$; $a^2+b^2\neq 0$, $c\neq c'$.

(2) If the line $(a+2)x+(a^2-9)y+3a^2-8a+5=0$ is parallel to x-axis, find a and the equation of line. (1)

(B) (1) Discuss the intersection of a circle $x^2+y^2=r^2$ and a line $ax+by+c=0$; $a^2+b^2\neq 0$ (2)

(2) If the equation $x^2-\lambda xy+4y^2+x+2y-2=0$ represents two lines find λ. (1)

(3) If the perpendicular distance of the point $(7,1)$ from the line $7x-24y+k=0$ is 2-unit find the value of k. (1)

(C) (1) If $x^2+y^2+gx+c=0$ and $x^2+y^2+fy+c=0$ touches externally then prove that $4(g^{-2}+f^{-2})=c^{-1}$ (3)

OR (1) Find the equation of the circle whose diametrically opposite points are the point of intersection of the line $y=mx$ with the circle $x^2+y^2-2ax=0$.

(2) Find the cartesian equation of the circle, whose parametric equations are $x=4-2\cos t$, $y=3+2\sin t$; $t\in[0,2\pi)$. (1)

(D) In $\triangle ABC$, A is $(4,-3)$ and two of the medians lie along the lines $2x+y+1=0$ and $x+5y-1=0$. Find the co-ordinates of B and C. (3)

OR (D) If two of the sides of parallelogram are along the lines $x+5y-41=0$ and $7x-13y+1=0$ if one of the diagonals is along the line $5x+y+11=0$, find the vertices of a parallelogram.

III [A] (1) Obtain the equations of tangents to parabola at end of the latus rectum. (2)

(2) If a focal chord of the parabola $y^2 = 4ax$ forms an angle of measure θ with the positive direction of x-axis, show that the length is $4a\operatorname{cosec}^2\theta$. $a > 0$. (2)

OR

(2) (i) Find the equation of the directrix of the parabola $y^2 = -12x$ (1)

(ii) Find the value of the slope m so that $y = mx + 3$ is tangent to the parabola $y^2 = 6x$. (1)

[B] (1) Show that the tangent at the end-points of a focal chord intersect on the directrix. (2)

(2) Find the equations of the tangents passing through $(-15, -7)$ to the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. (2)

OR

(2) Find the equations to the tangents to the ellipse $4x^2 + 3y^2 = 6$ which are parallel to the line $y = 2x + 3$. (2)

[C] (1) For any point P on a rectangular hyperbola, show that $SP \cdot S'P = CP^2$. (2)

(2) Find the equation of the hyperbola passing through the point $(1, 4)$ and having asymptotes $y = \pm 5x$. (2)

[D] (1) State the angle between the asymptotes of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. (1)

(2) Find the equation of a circle with common chord of the circles $x^2 + y^2 - 4x = 0$ and $x^2 + y^2 - 6y = 0$ as a diameter. (2)

III [A] (1) Prove that the equation of the tangent with slope m to the parabola is $y = mx + \frac{a}{m}$. (2)

(2) Find the equation of the tangent to the parabola $y^2 = 4ax$, which has equal intercepts on the axes. Also find the point of contact. (2)

OR

(2) (i) If the y-co-ordinate of a point is three times its x-coordinates on the parabola $y^2 = 18x$, find the co-ordinates of that point. (1)

(ii) Find the focal distance of the point $(2, 8)$ of parabola $y^2 = 32x$. (1)

[B] (1) Define latus-Rectum and find the length of latus Rectum. (2)

(2) Find the standard equations of the ellipse satisfying the conditions:
Length of latus rectum 8 and eccentricity $\frac{1}{3}$. (2)

OR

(2) Find the lengths of the latus rectum, foci, eccentricity and the lengths of the axes for the ellipse $16x^2 + 9y^2 = 144$. (2)

[C] (1) If P is any point on the hyperbola, then $|S'P - SP| = 2a$. (2)

(2) Find the length transverse axis and eccentricity of the hyperbola $x^2 - 4y^2 = 4$. (2)

[D] (1) Find the equations of the asymptotes of hyperbola $\frac{x^2}{100} - \frac{y^2}{25} = 1$. (1)

(2) show that the line $2x - 3y + 39 = 0$, contains a diameter of the circle $x^2 + y^2 + 12x - 18y - 5 = 0$ (2)

III [A] (1) Prove that the tangents at the end-points of a focal-chord intersect orthogonally at the directrix. (2)

(2) Find the equations of the tangent to the parabola $y^2 = 12x$ from the point (2, 5) and the co-ordinates of the point of contact. (2)

OR

2 (i) If one end point of a focal chord of the parabola $y^2 = 16x$ is (9, 12), find its other end point. (1)

(ii) Prove that the line $3x + 4y + 6 = 0$ touches parabola $2y^2 = 9x$. Find the point of contact. (1)

[B] (1) If P is any point on the ellipse, then prove that $SP + S'P = 2a$. (2)

(2) Find the equations of tangents drawn to the ellipse $9x^2 + 16y^2 = 144$ from the point (2, 3). (2)

OR

(2) Find the equations of the tangents of the ellipse $9x^2 + 4y^2 = 36$ parallel to the line $y = 2x$. (2)

[C] (1) Prove that the lines $y = \pm \frac{b}{a}x$ are the asymptotes of the hyperbola. (2)

(2) Show that the eccentricities of the two hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ and $\frac{x^2}{64} - \frac{y^2}{36} = 1$ are equal. (2)

[D] (1) Find the equations of the directries of hyperbola $\frac{y^2}{4} - x^2 = 1$ (1)

(2) If one of the end points of a diameter of the circle $x^2 + y^2 - 2x + 6y - 15 = 0$ is (4, 1) find its other end point. (2)

III [A] (1) Prove that the orthocentre of the triangle formed by any three tangents to a parabola lies on the directrix. (2)

(2) If the focus of the parabola $y^2 = 4ax$ divides a focal chord in the ratio of 1:2, find the equation of the line containing this chord (2)

OR

(2) (i) Find the equations of tangents of parabola $y^2 = 4ax$ at the end points of latus rectum. (1)

(ii) Find the length of latus rectum of the parabola $x = 5y^2$. (1)

[B] (1) The line segment of any tangent, between the tangents at the end-points of the major axis, form a right angle at any focus of the ellipse. (2)

(2) Find the equation of tangent at (3,1) to the ellipse $x^2 + 5y^2 = 14$ (2)

OR

(2) Obtain the condition for line $lx + my + n = 0$ to be the tangents to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (2)

[C] (1) obtain the equation of the director circle of hyperbola. (2)

(2) Find the ratio of eccentricities of the two hyperbolas $3x^2 - 2y^2 = 1$ and $2x^2 - 3y^2 = 1$ (2)

[D] (1) Find the equation of the tangent of hyperbola $x^2 - y^2 = 9$ at $(-5, 4)$ (1)

(2) Find the measure of the angle between two tangents to the circle $x^2 + y^2 = a^2$ drawn from the point (h, k). (2)

III [A] (1) Obtain the standard equation of a Parabola. (2)

(2) Find the coordinates of focus, length of the latus-rectum and the equation of the the directrix for the Parabola $y^2 = 32x$. (2)

OR

(2) (i) If the line $4x + 5y = K$ is a tangent to the Parabola $y^2 = 4x$, find K. (1)

(ii) Find the equation of the tangent at $(1, 2)$ to the parabola $y^2 = 4x$. (1)

[B] (1) Obtain the condition for the line $y = mx + c$, $c \neq 0$ to be a tangent of the Ellipse. (2)

(2) Find the equation of the tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ which cuts equal intercepts on the axes. (2)

OR

(2) Find conditions for the line $x\cos\alpha + y\sin\alpha = p$ to be a tangent of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (2)

[C] (1) If P is any point on the Hyperbola then Prove that $|S'P - SP| = 2a$. (2)

(2) Show that the angle between two asymptotes of the hyperbola $x^2 - 2y^2 = 1$ is $\tan^{-1}(2\sqrt{2})$. (2)

[D] (1) Find the equations of directrices for the hyperbola $x^2 - 4y^2 = 4$. (1)

(2) Find the lengths of the chords of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ cut on the axes. (2)

III [A]

(1) If the tangent to the parabola at point P intersects the X-axis in T, then $SP = ST$. (2)

(2) Show that the point of intersection of the axis of the parabola $y^2 = 4ax$ and the directrix lies on the circle whose diameter is a latus rectum. (2)

OR

(2) (i) Find the co-ordinates of the points of intersection of the parabola $y^2 - 4ax = 0$ and the line $y = 3x - a$. (1)

(ii) Find the condition for $lx + my + n = 0$ to be the tangent of $y^2 = 4ax$. (1)

[B] (1) obtain the equation of tangent at the point P(0) of the ellipse. (2)

(2) Find the eccentricity and co-ordinates of foci for the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$ (2)

OR

(2) Find θ - point for the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$. (2)

[C] (1) Obtain the equation of the tangent at point (x_1, y_1) of a hyperbola. (2)

(2) Find the equations of the tangents drawn to the hyperbola $2x^2 - 3y^2 = 6$ from the point $(-2, -1)$. (2)

[D] (1) Find the equation of the asymptotes of $\frac{x^2}{36} - \frac{y^2}{25} = 1$ in the first and the third quadrant (1)

(2) Show that the circles $x^2 + y^2 - 2ax + c^2 = 0$ and $x^2 + y^2 - 2by - c^2 = 0$ are orthogonal. (2)

III [A] (1) Prove that the standard equation of a parabola is $y^2 = 4ax$. (2)

(2) Find the equations of tangents to $y^2 = 16x$ Parallel and Perpendicular to $3x - 4y + 5 = 0$. Find also their points of contacts. (2)

OR

(2) (i) Find the length of the latus rectum for the parabola $y^2 = -8x$. (1)

(ii) Find the equation of the tangent to parabola $y^2 = 16x$, which make an angle of $\frac{\pi}{4}$ with x-axis. (1)

[B] (1) obtain the equation the tangent at the point $P(x_1, y_1)$ of the Ellipse. (2)

(2) How many tangents can be drawn to the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ at point $(5, 2)$? (2)

OR

(2) P is any point on the ellipse $\frac{x^2}{9} + \frac{y^2}{16} = 1$ and S and S' are foci. Find $SP + S'P$. (2)

[C] (1) If the eccentricities of the hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = \pm 1$ are e_1 and e_2 respectively, then Prove that $e_1^{-2} + e_2^{-2} = 1$ (2)

(2) Find the equation of a common tangent to the hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ (2)

[D] (1) Find the Product of eccentricities of $x^2 - y^2 = 2$ and $x^2 - y^2 = -3$ (1)

(2) Find the equation of the line which contains the common chord the circles $x^2 + y^2 + 3x + 4y + 1 = 0$ and $x^2 + y^2 + x - 6y - 1 = 0$. (2)

III [A] (1) Prove that the foot of perpendicular from focus to any tangent lies on the tangent at the vertex. (2)

(2) Find the equations of common tangent to the circle $x^2+y^2=2a^2$ and the parabola $y^2=8ax$. (2)

OR

(2) (i) Find the measure of the angle between $y^2=8x$ and $x^2=27y$. (1)

(ii) Find the equations of tangents to the parabola $y^2=36x$ from $(2,9)$ (1)

[B] (1) Obtain the parametric equations of an ellips. (2)

(2) Find the equation of the tangent to the ellipse $4x^2+9y^2=45$ at $(3,1)$. (2)

OR

(2) Write the equations of auxiliary circle and director circle of the ellipse $\frac{x^2}{16}+\frac{y^2}{19}=1$. (2)

[C] (1) For a point on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ Prove that $SP \cdot S'P = eP^2 - a^2 + b^2$. (2)

(2) Prove that $3x-4y=5$ is a tangent to the hyperbola $x^2-4y^2=5$. Find the point of contact. (2)

[D] (1) Find the length of latus rectum of $\frac{x^2}{4}-\frac{y^2}{25}=1$. (1)

(2) Find the equation of the circle which passes through the point $(2,-3)$ and the points of intersection of the circles $x^2+y^2=1$ and the circle $x^2+y^2+2x-4y-1=0$. (2)

III [A] (1) Define : Latus-Rectum of a Parabola. Obtain the Parametric equations of a Parabola. (2)

(2) If a chord of the parabola $y^2 = 4ax$ subtents right angle at the vertex, then show that the point of intersection of the tangents drawn at the end points of this chord is on the line $x + 4a = 0$. (2)

OR

(2) (i) Find the equations of tangents to the parabola $y^2 = 4ax$ which make an angle of $\frac{\pi}{4}$ with the X-axis. (1)

(ii) Find the co-ordinates of focus of the Parabola $3y^2 = 16x$. (1)

[B] (1) obtain the standard equation of the ellipse. (2)

(2) Find the equations of tangents of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ making equal intercepts on the co-ordinate axes. (2)

OR

(2) Find the eccentric angle for the ellipse $\frac{x^2}{100} + \frac{y^2}{25} = 1$ at $P(-6, 4)$. (2)

[C] (1) obtain the condition for the line $y = mx + c$, $c \neq 0$ to be a tangent of the hyperbola. (2)

(2) Find the condition for the line $lx + my + n = 0$ to be tangent to $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. (2)

[D] (1) Find the measure of the angle between two asymptotes of the hyperbola $x^2 - y^2 = 4$. (1)

(2) Show that the two lines represented by the equation $x^2 + y^2 + 2xy - 2a^2 = 0$ are tangent to the circle $x^2 + y^2 = a^2$. (2)

III [A] (1) Show that the length of the focal-chord of the parabola $y^2 = 4ax$ at the point P(t) is $a(t + \frac{1}{t})^2$. (2)

(2) Show that the length of the focal chord at P(t) of the parabola $x^2 = 4by$ is $b(t + \frac{1}{t})^2$. (2)

OR

(2) (i) Find the length of the intercept made by the parabola $y^2 = 4x$ on the line $y = x - 8$. (1)

(ii) Find the equation of the tangent at (1, 2) to the parabola $y^2 = 4x$. (1)

[B] (1) If the line containing a focal-chord of the ellipse intersects the auxilliary circle in Q and Q', then prove that $SQ \cdot SQ' = b^2$. (2)

(2) If the line $3x + 4y + k = 0$ is tangent to the ellipse $9x^2 + 16y^2 = 144$, find k. (2)

OR

(2) State the coordinates of the points of intersection of the tangents drawn at the vertices of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (2)

[C] (1) Obtain the equation of the tangent at point θ of a hyperbola. (2)

(2) Find the equations of the tangents to the hyperbola $9x^2 - 4y^2 = 36$ through the point (2, 3) (2)

[D] (1) Find the eccentric angle for the point $(8, 3\sqrt{3})$ of hyperbola $9x^2 - 16y^2 = 144$. (1)

(2) If the circles $x^2 + y^2 + 2gx + 2fy = 0$ and $x^2 + y^2 + 2g_1x + 2f_1y = 0$ are tangent to each other show that $fg_1 = f_1g$. (2)

III [A] (1) Obtain the condition for the line $y = mx + c$ to be a tangent of the parabola $y^2 = 4ax$, and the co-ordinates of the point of contact. (2)

(2) Find the points of intersection of the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. (2)

OR

(2) (i) Prove that the line $y = x + 2a$ touches the parabola $y^2 = 4a(x+a)$. (1)

(ii) Find the equations of the tangents to the parabola $y^2 = 12x$ at the point $(3,6)$. (1)

[B] (1) Obtain the director circle of ellipse. (2)

(2) Find the eccentricity of an ellipse if length of its latus rectum is one-third of its minor axis (2)

OR

(2) Find the distance between foci of the ellipse $3x^2 + 4y^2 = 12$. (2)

[C] (1) Obtain the length of latus-Rectum of hyperbola. (2)

(2) Find the equations of the tangents to the hyperbola $\frac{x^2}{25} - \frac{y^2}{16} = 1$, which cut equal intercept on the axes. (2)

[D] (1) Define: Rectangular Hyperbola. (1)

(2) Find the equation of the circle which is orthogonal to the circles $x^2 + y^2 - 6x + 1 = 0$ and $x^2 + y^2 - 4y + 1 = 0$ and which touches to the line $3x + 4y + 6 = 0$. (2)

III [A] (1) For the parabola $y^2 = 4ax$ if S is the focus and PQ is a focal chord, then prove that $\frac{1}{SP} + \frac{1}{SQ} = \frac{1}{a}$. (2)

(2) Find the condition for the line $x\cos\alpha + y\sin\alpha = p$ to be a tangent to the parabola $y^2 = 4ax$ and obtain the co-ordinates of the point of contact. (2)

OR

2 (i) Prove that the tangent to parabola $y^2 = 44x$ at $(1, -2)$ also passes through $(-2, 1)$. (1)

(ii) Find the equation of tangents passing through $(\frac{3}{2}, 5)$ to parabola $y^2 = 6x$. (1)

[B] (1) If the difference of the eccentric angles of the points P and Q is $\frac{\pi}{2}$ and O is the centre of the ellipse, Prove that
$OP^2 + OQ^2 = a^2 + b^2$. (2)

(2) Find the eccentric angle of the point $P(-6, 4)$ of the ellipse $x^2 + 4y^2 = 100$. (2)

OR

(2) If the chord joining $P(\alpha)$ and $Q(\beta)$ passes through the focus $(ae, 0)$, Prove that
$\tan\frac{\alpha}{2}\tan\frac{\beta}{2} = \frac{e-1}{e+1}$. (2)

[C] (1) If the tangent to the hyperbola at point intersects the x-axis in T then $\frac{ST}{S'T} = \frac{SP}{S'P}$. (2)

(2) Obtain the foci, directries, eccentricity and the length of latus rectum of the Hyperbola $25x^2 - 144y^2 = -3600$ (2)

[D] (1) The foci of a hyperbola is $(\pm 5, 0)$ and $e = \frac{5}{4}$. Then find the distance between their directries. (1)

(2) Show that the circle $a^2x^2 + a^2y^2 + 2abx + 2aby + b^2 = 0$, $a, b \neq 0$ touches both the axes. (2)

III [A] (1) If the tangent at point P of the parabola $y^2 = 4ax$, intersects the line $x = a$ in K and the directrix in U, then Prove that $SK = SU$. (2)

(2) Show that the equation of the common tangent to the parabola $y^2 = 4ax$ and $x^2 = 4by$ is $a^{\frac{1}{3}}x + b^{\frac{1}{3}}y + (ab)^{\frac{2}{3}} = 0$. (2)

OR

(2)(i) The end points of latus-rectum of $y^2 = 8x$ are $(2, 4)$ and $(2, -4)$. Find the point of intersection of tangents at this point. (1)

(ii) Find the equation of directrix for the parabola $y^2 = -8x$. (1)

[B] (1) Obtain the condition for the line $y = mx + c$, $c \neq 0$ to be a tangent of ellipse and the co-ordinates of the point of contact. (2)

(2) Obtain the equation of tangent at the end point of latus rectum of $9x^2 + 16y^2 = 144$ in the first quadrant. (2)

OR

(2) Find the equation of the ellipse, whose foci are $(\pm 2, 0)$ and eccentricity $\frac{1}{3}$. (2)

[C] (1) obtain the standard equation of a hyperbola. (2)

(2) Show that the line $27x - 14y = 106$ is the tangent to the hyperbola $9x^2 - 7y^2 = 212$ (2)

[D] (1) obtain the equation of rectangular hyperbola. (1)

(2) The circle orthogonal to the circles $x^2 + y^2 - 6x + 1 = 0$ and $x^2 + y^2 - 2x - 2y - 7 = 0$ passes through the point $(1, 0)$. Find its equation. (2)

III [A] (1) obtain the equation of the tangent at the point (x_1, y_1) of the parabola $y^2 = 4ax$. (2)

(2) If one endpoint of a focal chord of the parabola $y^2 = 16x$ is $(\frac{16}{9}, -\frac{16}{3})$, find its other end point. (2)

OR

(2) (i) If the line $\sqrt{3}\,y = x + k$ is a tangent to the parabola $y^2 = 4ax$, find K. (1)

(ii) Derive the equations of the tangents drawn from the point (1, 3) to the parabola $y^2 = 8x$. (1)

[B] (1) If the feet of the perpendicular drawn to the tangents at point P from focii S and S' are L and L' respectively, then show that $SL \cdot S'L' = b^2$. (2)

(2) Find the eccentric angles for the points on the ellipse which are at the distance of 2 from the centre of the ellipse $x^2 + 3y^2 = 6$. (2)

OR

(2) calculate the eccentricity of the ellipse $\frac{x^2}{169} + \frac{y^2}{144} = 1$. (2)

[C] (1) obtain the parametric equation of the hyperbola. (2)

(2) Find the equations of the common tangents of $\frac{x^2}{25} - \frac{y^2}{16} = 1$ and $\frac{y^2}{25} - \frac{x^2}{16} = 1$ (2)

[D] (1) Show that the angle between two asymptotes of the hyperbola $x^2 - 2y^2 = 1$ is $\tan^{-1}(2\sqrt{2})$. (1)

(2) Find the lengths of the chords of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ cut on the axes. (2)

Q.4 (A) Which curve is represented by
$9x^2 - 24xy + 16y^2 - 178x - 96y + 169 = 0$?
Find the eccentricity, foci, directrizes, length of major axes (wherever is there) of this curve.

OR (4)

(A) Obtain the equation of the following curves in the standard form.

(1) $x^2 + y^2 - 4x - 6y - 2 = 0$

(2) $3x^2 + 8xy - 3y^2 - 20x + 10y - 15 = 0$.

(B) (1) Discuss the direction of a vector in R^3. (2)

(2) Show that $(2,3,6)$, $(3,-6,2)$, $(6,2,-3)$ are pair-wise perpendicular vectors. (2)

(C) (1) For ΔABC, Obtain sine rule using vectors. (2)

(2) If M, N are mid-points of the sides $\overline{AB}$ and $\overline{CD}$ respectively of a quadrilateral ABCD, then prove that $\overrightarrow{AD} + \overrightarrow{BC} = 2\overrightarrow{MN}$. (2)

(D) (1) A particle at the origin is displaced to the point (6,4) under the influence of a force of magnitude 10 units in the direction making an angle $\pi/3$ with X-axis towards the North. Find the work done. (2)

(2) If $\bar{x}, \bar{y}$ are non-collinear vectors of R^3 then prove $\bar{x}, \bar{y}$ and $\bar{x} \times \bar{y}$ are non-coplanar. (1)

Q.4.(A) Which curve is represented by

$x^2+y^2+2xy-(4\sqrt{2}+2)x-(-4\sqrt{2}+2)y+1=0$?

Find the ecentricity, foci, directrices, length of major axes (wherever is there) of this curve. (4)

OR

(A) Obtain the equation of the following curves in the standard form.

(1) $x^2-y^2+4x+2y+3=0$.

(2) $x^2+xy+y^2+x-4y+1=0$.

(B) (1) Define parallel vectors and orthogonal vectors. (2)

(2) If $\bar{x}=(1,2,-2)$, $\bar{y}=(0,1,-1)$ then find the unit vector such that it makes angle of $\pi/4$ with $\bar{x}$ and $\pi/3$ with $\bar{y}$ (2)

(C)(1) Find the position vector of the point dividing the vector segment. (2)

(2) If G and G' are respectively the centroids of ΔABC and ΔPQR then prove that $\overrightarrow{AP}+\overrightarrow{BQ}+\overrightarrow{CR}=3\overrightarrow{GG'}$, $(A\neq P, B\neq Q, C\neq R, G\neq G')$. (2)

(D)(1) If force of magnitude $12\sqrt{2}$, $5\sqrt{2}$, and 16 units are applied to a particle. in the East, the south and the North-West direction. respectively. Find the magnitude and the direction of resulting force. (2)

(2) Are the vectors $(2,0,1)$, $(-1,1,1)$, $(3,5,2)$ linearly independent ? (1)

Q.4.(A) Which curve is represented by $xy = 16$? Find the eccentricity, foci, equation of directrices, length of axes (whenever possible of this curve. (4)

OR

(A) Obtain the equation of the following curves in the standard form.

(1) $(x-1)(y+2) = 2$

(2) $x^2 + 2xy + y^2 + \sqrt{2}x - \sqrt{2}y = 0$.

(B) (1) With the help of geometrical representation, obtain the angle between two non-null vectors. (2)

(2) If α, β, γ are the direction angles of a vector $\bar{x}$, then prove $\cos 2\alpha + \cos 2\beta + \cos 2\gamma + 1 = 0$. (2)

(C)(1) Obtain the formula for volume of tetrahedron. (2)

(2) If $A - P - B$ and if $\frac{AP}{PB} = \frac{m}{n}$ then prove for any point O in space, $n(\vec{OA}) + m(\vec{OB}) = (m+n)(\vec{OP})$. (2)

(D)(1) Forces of magnitudes 1, 3, 6 units are applied to a particle in direction of vectors $(-3, 4, 0)$, $(0, -3, 4)$, $(4, 0, -3)$ respectively. Consequently, the particle is displaced from $A(1, 2, 3)$ to $B(3, -1, 5)$. Find the work done. (2)

(2) Find 'a' if the vectors $2a\bar{i} + a\bar{j} - 4\bar{k}$ and $a\bar{i} - 2\bar{j} + \bar{k}$ are mutually perpendicular. (1)

Q.4.(A) Which curve is represented by $x^2 + 2xy + y^2 + \sqrt{2}x - \sqrt{2}y = 0$? Find the coordinate of foci, the equation of directrices, length of axes and ecentricity (if possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and Identify.

(1) $xy - 2x - y = 0$

(2) $x^2 + xy + y^2 + x - 4y + 1 = 0$.

(B)(1) Define non-coplanar vector and prove that a necessary condition for three non-null vectors $\bar{x}, \bar{y}, \bar{z}$ to be coplanar is that $\bar{x} \cdot (\bar{y} \times \bar{z}) = 0$. (2)

(2) If $\bar{x} = (\frac{1}{2}, 0, \frac{1}{2})$ and $\bar{y} = (\frac{1}{2}, -1, -\frac{1}{2})$, then find the angle between $\bar{x} + \bar{y}$ and $\bar{x} - \bar{y}$ (2)

(C)(1) Obtain the formula of volume of prism. (2)

(2) Using vectors, prove that the quadrilateral formed with the mid-points of the sides of any quadrilateral, taken in order is a parallelogram. (2)

(D)(1) Forces of magnitudes 5 units in direction (2, 3, 1) and 4 units in direction (−2, −3, −1) are applied to a particle. Find the magnitude and direction of resulting force. (2)

(2) Find the magnitude of the angle between $(1, \sqrt{3})$ and $(0, -1)$. (1)

Q.4.(A) Which curve is represented by $7x^2 - 2xy + 7y^2 + 12\sqrt{2}x - 36\sqrt{2}y + 72 = 0$? Find the foci, directrices, ecentricity, length of the axes and the coordinates of centre. (4)

OR

(A) Obtain the equation of the following curves in the standard form and Identify.

(1) $xy = 16$

(2) $xy - 2x - y = 0$.

(B) (1) Prove that the necessary and sufficient condition that non-null vectors $\bar{x}$ and $\bar{y}$ of R^3 be collinear is that $\bar{x} \times \bar{y} = \bar{0}$ (2)

(2) Find the unit vector in the direction of $2\bar{x} - \bar{y}$, where $\bar{x} = \bar{i} + \bar{j}$ and $\bar{y} = 3\bar{i} + 5\bar{j}$ (2)

(C)(1) Obtain incentre of a triangle by vectors. Also, if triangle is equilateral then prove incentre is equals to centroid. (2)

(2) In a regular hexagon ABCDEF, prove that $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF} = 3\overrightarrow{AD}$ (2)

(D)(1) Find the work done if forces $3\bar{i} - \bar{j} + 2\bar{k}$ and $\bar{i} + 3\bar{j} - \bar{k}$ acting on a particle displace it from A(3, 2, 1) to (5, 4, 2). (2)

(2) Find a unit vector in R^2 perpendicular to (1, 3). (1)

III [A] (1) Obtain the equation of the tangent at the point (x_1, y_1) of the parabola $y^2 = 4ax$. (2)

(2) If one end-point of a focal-chord of the parabola $y^2 = 16x$ is $(9, 12)$ find its other end point. (2)

OR

(2) (i) If the line $3x + 4y + k = 0$ is a tangent to the parabola $y^2 = 12x$, then find k. (1)

(ii) Find the coordinates of focus for the parabola $x^2 = -8y$. (1)

[B] (1) $\overline{PQ}$ is a chord of the ellipse passing through S, and the co-ordinates of P are $(a\cos\theta, b\sin\theta)$, show that $SP \cdot S'P = a^2\sin^2\theta + b^2\cos^2\theta$. (2)

(2) Find the focal distances $S'P$ and SP of the point $P(2\sqrt{2}, 2)$ on the ellipse $x^2 + 2y^2 = 16$. (2)

OR

(2) If P is a point on the ellipse $9x^2 + 25y^2 = 225$, for which $SP = S'P$. Find the co-ordinates of P. (2)

[C] (1) If L and L' are feet of the perpendiculars from S and S' to the tangent at P the hyperbola then $SL \cdot S'L' = b^2$ (2)

(2) Find the equation of the standard hyperbola satisfying the following conditions: Foci $(\pm 2, 0)$ and $e = \frac{3}{2}$. (2)

[D] (1) Find the angle between the asymptotes of the hyperbola $x^2 - 2y^2 = 1$. (1)

(2) Show that the equation $3x^2 + 3y^2 - 6x - 6y - 10 = 0$ represents a circle. Find the centre and radius of this circle. (2)

Q·4 (A) Which curve is represented by the equation $11x^2 + 24xy + 4y^2 - 34x - 8y + 3 = 0$? Find focii, directrices, eccentricity, length of axes (if possible) or find pair of lines if it represent pair of lines. (4)

OR

(A) Obtain the equation of the following curves in the standard form and identify.

(1) $x^2 + y^2 - 10xy + 18x + 6y - 14 = 0$.

(2) $xy = 16$.

(B) (1) Prove that the necessary and sufficient condition that non-null vectors $\bar{x} = (x_1, x_2)$, $\bar{y} = (y_1, y_2)$ of R^2 be collinear is that $x_1y_2 - x_2y_1 = 0$. (2)

(2) If $\bar{a}$ and $\bar{b}$ are unit vectors and $|\bar{a} \times \bar{b}| = 1$ then prove (i) $|\bar{a} - \bar{b}| = \sqrt{3}$, (ii) $(\bar{a}\hat{\ }\bar{b}) = 2\pi/3$. (2)

(C) (1) Write the formula to find sides and angles of a triangle. (2)

(2) If D is the mid-point of $\overline{BC}$ in ΔABC then prove $AB^2 + AC^2 = 2(AD^2 + BD^2)$ using vectors. (2)

(D) (1) A particle is displaced from A(2, 1) to B(4, 2). When force of magnitudes $4\sqrt{5}$ in direction $2\bar{i} + \bar{j}$ and $6\sqrt{5}$ in direction $\bar{i} - 2\bar{j}$ are applied. Find the work done. (2)

(2) Find the vector of length $\sqrt{14}$ in the direction opposite to that of the vector (1, 2, −3). (1)

Q.4 (A) Which curve is represented by the equation $x^2 + y^2 + 2xy - (4\sqrt{2}+2)x - (-4\sqrt{2}+2)y + 1 = 0$? Find foci, equation of directrices, length of axes, eccentricity of this curve. (4)

OR

(A) Obtain the equation of the following curves in the standard form and identify.

(1) $(x-1)(y+2) = 2$

(2) $11x^2 + 24xy + 4y^2 - 34x - 8y + 3 = 0$.

(B) (1) Define Basis vectors and Coplanar vectors. (2)

(2) $\bar{x} = (1,2)$, $\bar{y} = (2,1) \in R^2$. If $\bar{z} = (x,y)$ exists such that $\bar{z} = \alpha\bar{x} + \beta\bar{y}$ then prove $\alpha = \frac{2y-x}{3}$ and $\beta = \frac{2x-y}{3}$ (2)

(C) (1) Obtain the area of a triangle in the form $\Delta = \frac{1}{2}|\bar{b} \times \bar{c}|$ in usual notation. (2)

(2) Using vectors, prove that the diagonals of a rhombus are bisectors of its angles. (2)

(D) (1) A steamer moves in the North-East with a speed of 40 kms. A passenger on the steamer feels the wind to be blowing from the North with $25\sqrt{2}$ kms. speed. Find the true velocity of the wind. (2)

(2) Show that for any $a \in R$, the direction of $(2,3,5)$ and $(a, a+1, a+2)$ can not be same or opposite. (1)

Q.4.(A) Which curve is represented by $3x^2+8xy-3y^2-20x+10y-15=0$? Find focii, equation of directrices, eccentricity, length of axes (if possible). (4)

OR

(A) Obtain the equation of the following curves in standard form and Identify.

(1) $xy-2x-y=0$

(2) $x^2-y^2+4x+2y+3=0$.

(B) (1) Prove that, any vectors of R^3 can be expressed, in a unique way, in the form of the linear combination of $(1,0,0)$, $(0,1,0)$ and $(0,0,1)$. (2)

(2) Find the magnitude of the angle between pair of the vectors

(i) $(1,2,3)$, $(3,2,1)$.

(ii) $2\bar{i}+3\bar{j}-\bar{k}$, $\bar{i}-\bar{j}-\bar{k}$. (2)

(C) (1) Obtain the volume of tetrahedron. (2)

(2) Using vectors, the mid-point of the hypotenuse of a right angled triangle is equidistant from all the vertices of the triangle. (2)

(D) (1) A boat speeds in the North at $6\sqrt{2}$ kms. A man on the boat feels that the wind is blowing from the South-East at 5 kms. Find the true velocity of wind and direction. (2)

(2) What can you say about the direction of vectors $(\sqrt{2},0,-\sqrt{2})$ and $(\pi,0,-\pi)$. (1)

Q.4.(A) Which curve is represented by $x^2 + xy + y^2 + x - 4y + 1 = 0$? Find the eccentricity, foci, directrices, length of major axes (if possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and Identify.

(1) $x^2 + 2xy + y^2 + \sqrt{2}x - \sqrt{2}y = 0$.

(2) $5x^2 - 6xy + 5y^2 + 4\sqrt{2}x - 12\sqrt{2}y + 8 = 0$.

(B) (1) Prove that any vector of R^2 can be expressed, in a unique way, in form of the linear combination of $(1,0)$ and $(0,1)$. (2)

(2) Obtain a unit vector perpendicular to both $\bar{x} = 3\bar{i} - \bar{j} - 4\bar{k}$ and $\bar{y} = -2\bar{i} + 4\bar{j} - 3\bar{k}$ (2)

(C) (1) Obtain the volume of prism. (2)

(2) Find the point P in the plane of a parallelogram ABCD such that $\overrightarrow{PA} + \overrightarrow{PB} + \overrightarrow{PC} + \overrightarrow{PD} = \bar{0}$ (2)

(D) (1) If force on a particle is 5 units in the East and $\sqrt{8}$ units in the South - West. Find in which direction and with what force the particle will move ? (2)

(2) A vector $\bar{r}$ makes with X-axis, Y-axis angles of measures $\pi/3$ and $2\pi/3$ respectively, what is the measure of the angle made by $\bar{r}$ with Z-axis ? (1)

Q.4 (A) Which curve is represented by $3x^2 + 8xy - 3y^2 - 20x + 10y - 15 = 0$? Find focii, ecentricity, directrizes, length of axes. (whenever possible) (4)

OR

(A) (1) Obtain the equation $(x-1)(y+2) = 2$ in the standard form and identify.

(2) Find the angle θ through which the axes are rotated such that the line $x + \sqrt{3}y - 2 = 0$ becomes vertical ? Find the new equation of line.

(B) (1) Define direction angle and the direction cosine of the vector. (2)

(2) If $\bar{x} = (2, -6, 3)$, $\bar{y} = (1, 2, -2)$ and $\theta = (\bar{x} \hat{} \bar{y})$, find the value of $\sin\theta$. Find a unit vector perpendicular to $\bar{x}$ and $\bar{y}$. (2)

(C) (1) For ΔABC, prove $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ by vector. (2)

(2) Using vectors, If a pair of medians of a triangle are congruent, then show that the triangle is isosceles. (2)

(D) (1) If force 2, $\sqrt{5}$, 4 unit act on a particle in direction of vectors $(2,0)$, $(-1,2)$, $(0,-3)$ respectively. Find the magnitude and direction of the resulting force. (2)

(2) Find direction cosines of $\overrightarrow{AB}$ where A and B are $A(1,2,3)$ and $B(-1,2,1)$. (1)

Q.4 (A) Which curve is represented by $xy = 16$? Find focii, directrices, ecentricity, length of major axes (if possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and Identify.

(1) $x^2 + xy + y^2 + x - 4y + 1 = 0$

(2) $x^2 + y^2 - 4x - 6y - 2 = 0$.

(B) (1) If for non-null vectors $\bar{x}, \bar{y} \in R^3$, $(\bar{x} \hat{} \bar{y}) = \alpha$, then prove

(i) $|\bar{x} \times \bar{y}| = |\bar{x}| \cdot |\bar{y}| \sin\alpha$

(ii) $\bar{x} \perp (\bar{x} \times \bar{y})$, $\bar{y} \perp (\bar{x} \times \bar{y})$ (2)

(2) If $\bar{x}, \bar{y}, \bar{z}$ are non-coplanar, prove that $\bar{x} + \bar{y}$, $\bar{y} + \bar{z}$, $\bar{z} + \bar{x}$ are also non-coplanar. (2)

(C) (1) Give the geometrical meaning of $\bar{a} \times \bar{b}$ (2)

(2) Using vectors, show that the perpendicular bisectors of sides of any triangle are concurrent. (2)

(D) (1) A river flows with a speed of 5 kms. One desires to cross the river in the direction perpendicular to the flow, find in what direction should he swim if his speed is 8 kms. (2)

(2) If the measure of angle between $\bar{x} = \bar{i} + \bar{j}$ and $\bar{y} = t\bar{i} - \bar{j}$ is $\frac{3\pi}{4}$ then find t. (1)

Q.4 (A) Which curve is represented by $x^2+y^2-4x-6y-2=0$? Find centre, radius or find ecentricity, focii, length of axes, directrices (whichever is possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and identify.

(1) $3x^2+8xy-3y^2-20x+10y-15=0$.

(2) $(x-1)(y+2)=2$.

(B) (1) Write schwarz inequality. Also, state and prove triangular inequality. (2)

(2) Show that the vectors $(1,2,1), (1,1,4), (1,3,-2)$ of R^3 are coplanar. Also, express each of these vectors as a linear combination of the other two. (2)

(C) (1) Obtain the area of a triangle by using vector in R^2. (2)

(2) If $\vec{AD}$ is an bisector of $\angle BAC$ in $\triangle ABC$ and if $D \in \overline{BC}$, then show that $\frac{BD}{DC} = \frac{AB}{AC}$ (2)

(D) (1) A force of magnitude $2\sqrt{10}$ units is acting on a particle in direction $3\bar{i}-\bar{j}$ and a force of magnitude $3\sqrt{13}$ units is acting on the same particle in direction $2\bar{i}+3\bar{j}$. Under the influence of these forces the particle is displaced from $A(1,2)$ to $B(6,4)$. Find the work done. (2)

(2) If $\bar{x} = -6\bar{i}+3\bar{j}$, $\bar{y} = 4\bar{i}+t\bar{j}$ are perpendicular vectors then find t. (1)

Q.4 (A) Which curve is represented by $3x^2 + 8xy - 3y^2 - 20x + 10y - 15 = 0$? Find foci, directrixies, eccentricity, length of major axes (if possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and identify.

(1) $xy - 2x - y = 0$

(2) $7x^2 - 2xy + 7y^2 + 12\sqrt{2}x - 36\sqrt{2}y + 72 = 0$.

(B) (1) Write lagrange's identity and obtain schwarz inequality. (2)

(2) Show that the vectors (1,2) and (2,1) are non-collinear. Also show that any vector of R^2 can be expressed as a linear combination of these vectors. (2)

(C) (1) Define incentre of a triangle. Also, obtain the position vector of incentre of a triangle. (2)

(2) Using vectors, prove that the diagonals of a rhombus bisect each other orthogonally. (2)

(D) (1) A boat is speeding to the east with a speed of $10\sqrt{2}$ kms. A man on boat feels that the wind is blowing from the South - East. with a speed of 5 kms. Find the true velocity of wind and direction. (2)

(2) If $\bar{x} = -6\bar{i} + 3\bar{j}$, $\bar{y} = 4\bar{i} + t\bar{j}$ are collinear vectors then find t. (1)

Q.4. (A) Which curve is represented by
$x^2 + y^2 + 2xy - (4\sqrt{2}+2)x - (-4\sqrt{2}+2)y + 1 = 0$?
Find foci, equation of directrices, eccentricity, length of axes (whichever is possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and identify.

(1) $x^2 - y^2 + 4x + 2y + 3 = 0$.

(2) $xy = 16$.

(B) (1) Find a unique unit vector in the direction of a non-null vector. (2)

(2) Show that $(1,1,0), (1,0,1), (0,1,1)$ are non-coplanar vectors of R^3. Also, show that any vector of R^3 can be expressed in the form of linear combination of these vectors. (2)

(C) (1) Define centroid of a triangle. Also, Obtain the position vector of centroid of a triangle. (2)

(2) By using vectors, prove that the angle inscribed in a semicircle is a right angle. (2)

(D) (1) If force of magnitudes $\sqrt{2}, 2, \sqrt{3}$ units are applied to a particle in the direction of vectors $(-1,0,1), (1,0,1), (1,1,-1)$ respectively, find the magnitude and direction of the resultant. (2)

(2) If a vector $\bar{r}$ makes with X, Y, Z axis angles α, β, γ respectively, then show that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$. (1)

Q·4·(A) Which curve is represented by

$7x^2 - 2xy + 7y^2 + 12\sqrt{2}x - 36\sqrt{2}y + 72 = 0$?

Find foci, directrices, eccentricity, lengths of axes and coordinates of centre. (if possible). (4)

OR

(A) Obtain the equation of the following curves in the standard form and identify.

(1) $x^2 + 2xy + y^2 + \sqrt{2}x - \sqrt{2}y = 0$.

(2) $xy = 16$.

(B) (1) For non null vectors $\bar{x}, \bar{y} \in R^3$, prove $\bar{x} = \bar{y} \Leftrightarrow |\bar{x}| = |\bar{y}|$ and direction of $\bar{x}$ and $\bar{y}$ are same. (2)

(2) If θ is the measure of angle between unit vectors $\bar{a}$ and $\bar{b}$, prove that $\sin\frac{\theta}{2} = \frac{1}{2}|\bar{a} - \bar{b}|$. (2)

(C) (1) Obtain the position vector of the point dividing the vector segment. (2)

(2) By vectors, prove that the three altitudes in a triangle are concurrent. (2)

(D) (1) A boat is moving with a velocity of 20 kms. in the north and the wind is blowing with velocity $12\sqrt{2}$ kms. from North-East. Find the resulting velocity and its direction. (2)

(2) For A(1, 2, 3), B(4, 1, 2), find the direction cosines of $\overrightarrow{AB}$ (1)

Question Bank ①

Maths-I (050)(E)

Q.5.

(A) ① Prove that the necessary condition for two distinct lines $\bar{r} = \bar{a} + k\bar{l}$, $k \in R$ and $\bar{r} = \bar{b} + k\bar{m}$, $k \in R$ in R^3 to intersect each other is $(\bar{a} - \bar{b}) \cdot (\bar{l} \times \bar{m}) = 0$ (2)

② If the length of the perpendicular from the origin to the plane is p and the direction angle of the perpendicular are α, β, γ then Show that the equation of the plane is $x\cos\alpha + y\cos\beta + z\cos\gamma = p$ (2)

OR

② Obtain vector equation and cartesian equation of the plane passing through two parallel lines in R^3.

(B) ① Obtain the necessary and sufficient condition for the equation of $x^2+y^2+z^2+2ux+2vy+2wz+d=0$ represents a sphere in R^3. (1)

② Find the intersection of the lines $\frac{x-3}{1} = \frac{y+2}{-1} = \frac{z-1}{1}$ and $\frac{x}{2} = \frac{y+1}{0} = \frac{z+3}{3}$ (3)

OR

② Find the equation of the line perpendicular to $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and through $(3, -1, 11)$.

(C) ① Find the co-ordinates of a point equidistants from $(a, 0, 0)$, $(0, b, 0)$, $(0, 0, c)$ and $(0, 0, 0)$ in R^3 $(a \neq 0, b \neq 0, c \neq 0)$. (2)

(2) Verify that the equation $3x^2 + 3y^2 + 3z^2 - 3x - 2y - 6z - 66 = 0$ represents the sphere or not. If it represents the sphere then find the centre and the radius of the sphere. (2)

(D) Obtain the equation of the plane containing $\bar{r} = (1, 1, 1) + k(2, 1, 2)$, $k \in R$ and passing through $(1, -1, 2)$. (3)

OR

(D) Find the length, the foot and the equation of line perpendicular from $(2, -1, 2)$ to the plane $2x - 3y + 4z - 44 = 0$.

(2)

Q.5 (A) (1) Prove that :- Three distinct points A($\bar{a}$), B($\bar{b}$) (2)
C($\bar{c}$) in space are collinear if and only if non-zero real numbers l, m, n can be so obtained that $l\bar{a} + m\bar{b} + n\bar{c} = 0$ and $l + m + n = 0$.

(2) obtain the equation of the plane through A($\bar{a}$) (2)
having Normal $\bar{n}$.

OR

(2) Obtain the equation plane through two parallel (2)
lines in R^3.

(B) (1) Obtain the vector and cartesian equation (1)
of sphere whose extremities of a diameter are A($\bar{a}$) $= (x_1, y_1, z_1)$ and B($\bar{b}$) $= (x_2, y_2, z_2)$.

(2) Obtain the vector and the cartesian forms (3)
of the equations of the line through A(1, 2, 3)
in the direction (-1, 1, 2) and find the co-ordinates
of points on the line distance $\sqrt{6}$ from A.

OR

(2) Find equation of line perpendicular to
$\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $x = 5$, $\frac{y-3}{2} = \frac{z-2}{3}$ and
passing through (3, -1, 11).

(C) (1) A river flows with a speed of 5 kms. (2)
One desires to cross the river in direction
perpendicular to the flow, find in what direction
should he swim if his speed is 8 kms.

(2) Find the centre and the length of a (2)
radius of the sphere represented by the
equation $|\bar{r}|^2 - \bar{r} \cdot (6, 12, 14) + 30 = 0$.

(D) Find the image of (1, 3, 4) relative to (3)
the plane $2x - y + z + 3 = 0$.

OR

(D) Find the equation of plane through (1, 1, 1)
and the line of intersection of planes
$x + 2y + 3z = 4$ and $4x + 3y + z + 1 = 0$.

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Q.5 (A) ① Obtain the equation of the line through A($\bar{a}$), B($\bar{b}$) in vector and cartesian form. (2)

② Obtain the equation of plane through two intersecting lines in R^3. (2)

OR

② Obtain perpendicular distance of a given plane $\bar{r} \cdot \bar{n} = d$ from a given point A($\bar{a}$) in R^3. (2)

(B) ① Define sphere and state vector and cartesian equations of sphere (1)

② Find the shortest distance between the lines $\bar{r} = (2, 1, -2) + k(3, -5, 2)$, $k \in R$ and $\frac{x}{2} = \frac{y}{-3} = \frac{z}{1}$ after showing that these lines are skew lines in R^3. (3)

OR

② If a line makes with diagonals of a cube angles α_i $(i = 1, 2, 3, 4)$ then show that $3\sum_{i=1}^{4} \cos(2\alpha_i) + 4 = 0$. (3)

(C) ① Find the volume of a prism having a vertex at origin O and having it co-terminus edges $\bar{OA}$, $\bar{OB}$, $\bar{OC}$ where A(4, 3, 1), B(3, 1, 2), C(5, 2, 1). (2)

② Derive the equation of sphere through (0, 0, 0), (−a, b, c), (a, −b, c), (a, b, −c). (2)

(D) Find the common section of $x + 2y - 3z = 6$ and $2x - y + z = 7$. (3)

OR

(D) Obtain the equation of the plane through (1, 3, 5) perpendicular to intersection of $3x + y - z = 0$ and $x + 2y + 3z = 5$. (3)