# MATHS

## BOOKS - KC SINHA MATHS (HINGLISH)

## CORDINATES AND STARIGHT LINES - FOR COMPETITION

### Solved Examples

**1.** Let $S$ be a square of nit area. Consider any quadrilateral, which has none vertex on each side of $S$. If $a, b, candd$ denote the lengths of the sides of het quadrilateral, prove that $2 \leq a^2 + b^2 + c^2 + x^2 \leq 4.$

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**2.** The distance between two parallel lines is unity. A point $P$ lies between the lines at a distance $a$ from one of them. Find the length of a side of an equilateral triangle $PQR$ vertex $Q$ of which lies on one of the parallel lines and vertex $R$ lies on the other line.

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**3.** Find the position of point (4, 1) after it undergoes the transformations successively : Reflection about the line $y = x - 1$

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**4.** Find the position of point (4, 1) after it undergoes the transformations successively : Translation by one unit along x-axis in the positive direction.

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**5.** Find the position of point (4, 1) after it undergoes the transformations successively : Rotation through an angle $\frac{\pi}{4}$ about the origin in the anticlockwise direction.

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6. If $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of a $\Delta ABC$ and $(x, y)$ be a point on the internal bisector of angle $A$, then prove that : $b\begin{vmatrix} x & y & 1 \\ x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \end{vmatrix} + c\begin{vmatrix} x & y & 1 \\ x_1 & y_1 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = 0$ where $AC = b$ and $AB = c$.

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7. The vertices of a triangle are $A(x_1, x_1, \tan\theta_1), B(x_2, x_2, \tan\theta_2)$ and $C(x_3, x_3, \tan\theta_3)$. If the circumcentre coincides with origin then

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8. $P, Q, R$ are the points of intersection of a line t with sides $BC, CA, AB$ of a $\Delta ABC$ respectively, then $\frac{BP}{PC} \cdot \frac{CO}{QA} \cdot \frac{AR}{RB} =$

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**9.** If $D, E, and F$ are three points on the sides $BC, AC, and AB$ of a triangle $ABC$ such that $AD, BE, and CF$ are concurrent, then show that $BDxCExAFxEFxFB$ .

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**10.** $A, B, C, D...$ are n points in a plane whose coordinates are $(x_1, y_1), (x_2, y_2), (x_3, y_3), ...AB$ is bisected in the point $G_1; G_1C$ is divided at $G_2$ in the ratio $1:2$; $G_2D$ is divided at $G_3$ in the ratio $1:3$; $G_3E$ at $G_4$ in the ratio $1:4$, and so on until all the points are exhausted. Shew that the coordinates of the final point so obtained are, $\frac{x_1 + x_2 + x_3 + ...... + x_n}{n}$ and $\frac{y_1 + y_2 + y_3 + ..... + yn}{n}$

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**11.** If $A, B, C, D$ are points whose coordinats are $(-2, 3), (8, 9), (0, 4)$ and $(3, 0)$ respectively, find the ratio in which $AB$

is divided by $CD$.

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**12.** If the vertices of a triangle have rational coordinates, then prove that the triangle cannot be equilateral.

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**13.** Prove that that s triangle which has one of the angle as $30^0$ cannot have all vertices with integral coordinates.

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**14.** The coordinatse of the vertices A, B and C of the triangle ABC taken in anticlockwise order are respectively $(x_4, y_r), r = 1, 2, 3$. Prove that the angle $A$ is acute or obtuse according as : $(x_1 - x_2)(x_1 - x_3) + (y_1 - y_2)(y_1 - y_3) > 0$ or $< 0$.

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**15.** ABC is a triangle whose medians AD and BE are perpendicular to each other. If $AD = p$ and $BE = q$ then area of $\triangle ABC$ is

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**16.** Prove that a point can be found which is at the same distance from each of the four points : $\left(am_1, \frac{a}{m_1}\right) \cdot \left(am_2, \frac{a}{m_2}\right) \cdot \left(am_3, \frac{a}{m_3}\right) \text{and} \left(\frac{a}{m_1 m_2 m_3}, am_1 m_2 m_3\right)$

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**17.** If the algebraic sum of perpendiculars from n given points on a variable straight line is zero then prove that the variable straight line passes through a fixed point

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**18.** Find the coordinates of the vertices of a square inscribed in the triangle with vertices $A(0, 0)$, $B(2, 1)$ and $C(3, 0)$, given that two of its vertices are on the side AC`.

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**19.** If the equal sides $AB$ and $AC$ each of whose length is $2a$ of a righ aisosceles triangle $ABC$ be produced to P and so that $BP. CQ = AB$, the line $PQ$ always passes through the fixed point

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**20.** Through the point $P(\alpha, \beta)$ , where $\alpha\beta > 0$, the straight line $\frac{x}{a} + \frac{y}{b} = 1$ is drawn so as to form a triangle of area $S$ with the axes. If $ab > 0$, then the least value of $S$ is $\alpha\beta$ (b) $2\alpha\beta$ (c) $3\alpha\beta$ (d) none

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**21.** Let $(h, k)$ be a fixed point, where $h > 0, k > 0$. A straight line passing through this point cuts the positive direction of the coordinate axes at the point $PandQ$ . Find the minimum area of triangle $OPQ, O$ being the origin.

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**22.** A straight line through the point $A(-2, -3)$ cuts the line $x + 3y = 9$ and $x + y + 1 = 0$ at $B$ and $C$ respectively. Find the equation of the line if $AB. AC = 20.$

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**23.** Show that if any line through the variable point $A(k + 1, 2k)$ meets the lines $7x + y - 16 = 0, 5x - y - 8 = 0, x - 5y + 8 = 0$ at $B, C, D,$ respectively, the $AC, AB, andAD$ are in harmonic progression. (The three lines lie on the same side of point $A\dot{)}$.

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**24.** A line is such that its segment between the lines $5x - y + 4 = 0$ and $3x + 4y - 4 = 0$ is bisected at the point (1,5). Obtain its equation.

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**25.** A variable line $L$ passing through the point $B(2, 5)$ intersects the lines $2x^2 - 5xy + 2y^2 = 0$ at P and Q. Find the locus of the point R on L such that distances BP, BR and BQ are in harmonic progression.

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**26.** Consider a curve $ax^2 + 2hxy + by^2 - 1 = 0$ and a point P not on the curve.A line is drawn from the point P intersects the curve at the point Q and R.If the product PQ.PR is independent of the slope of the line, then the curve is:

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**27.** let ABC be a triangle with AB=AC. If D is the mid-point of BC, E the foot of the perpendicular drawn from D to AC, F is the mid-point of DE. Prove that AF is perpendicular to BE.

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**28.** $(1)$A triangle formed by the lines $x+y=0, x-y=0$ and $lx+my=1$. If $l$and $m$ vary subject to the condition $l^2+m^2=1$ then the locus of the circumcentre of triangle is: $(2)$The line $x+y=p$ meets the $x$-axis and $y$-axis at $A$ and $B$, respectively. A triangle $APQ$ is inscribed in triangle $OAB$, $O$ being the origin, with right angle at $Q$. $P$ and $Q$ lie, respectively, on $OB$ and $AB$. If the area of triangle $APQ$ is $\frac{3}{8}th$ of the area of triangle $OAB$, then $\frac{AQ}{BQ}$ is: equal to

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**29.** Two consecutive sides of a parallelogram are $4x+5y=0$ and $7x+2y=0$ . If the equation of one diagonal is $11x=7y=9$, find the equation of the other diagonal.

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**30.** One diagonal of a square is the portion of the line $7x + 5y = 35$ intercepted by the axes. Obtain the extremities of the other diagonal.

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**31.** A line $4x + y = 1$ passes through the point A(2,-7) and meets line BC at B whose equation is $3x - 4y + 1 = 0$, the equation of line AC such that $AB = AC$ is (a) 52x +89y +519=0(b) 52x +89y-519=0 c) 82x +52y+519=0 (d) 89x +52y -519=0

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**32.** A ray of light is sent along the line $x - 2y - 3 = 0$ upon reaching the line $3x - 2y - 5 = 0,$ the ray is reflected from it. Find the equation of the line containing the reflected ray.

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**33.** A man starts from the point $P(-3, 4)$ and will reach the point $Q(0, 1)$ touching the line $2x + y = 7$ at R. The coordinates R on the line so that he will travel in the shortest distance is

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**34.** A ray of light is sent along the line $2x - 3y = 5$. After refracting across the line $x + y = 1$ it enters the opposite side after torning by $15^0$ away from the line $x + y = 1$. Find the equation of the line along which the refracted ray travels.

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**35.** The equation of two equal sides AB and AC of an isosceies triangle ABC are $x + y = 5$ and $7x - y = 3$respectively Find the equations of the side BC if the area of the triangle ofABC is 5 units

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**36.** The equation of the side AB and AC of a triangle ABC are $3x + 4y + 9$ and $4x - 3y + 16 = 0$ respectively. The third side passes through the point $D(5, 2)$ such that $BD : DC = 4 : 5$. Find the equation of the third side.

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**37.** The equations of two sides of a triangle are $3x - 2y + 6 = 0\ and\ 4x + 5y - 20\ and$ the orthocentre is (1,1). Find the equation of the third side.

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**38.** the equation of perpendicular bisectors of side $AB$, $BC$ of triangle $ABC$ are $x - y = 5$, $x + 2y = 0$ respectively and $A(1, -2)$ then coordinate of $C$

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**39.** If the image of the point $(x_1, y_1)$ with respect to the mirror $ax + by + c = 0$ be $(x_2, y_2)$.

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**40.** If the line $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ cut the coordinate axes in concyclic points, prove that : $a_1a_2 = b_1b_2$.

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**41.** The equation of the diagonals of a rectangle are $y+8x-17=0$ and $y-8x+7=0$. If the area of the rectangle is $8squnits$ then find the sides of the rectangle

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**42.** lines $L_1: ax+by+c=0$ and $L_2: lx+my+n=0$ intersect at the point $P$ and make a angle $\theta$ between each other. find the equation of a line $L$different from $L_2$ which passes through $P$ and makes the same angle $\theta$ with $L_1$

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**43.** If $lx+my+n=0$, where $l, m, n$ are variables, is the equation of a variable line and $l, m, n$ are connected by the relation $al+bm+cn=0$ where $a, b, c$ are constants. Show that the line passes through a fixed point.

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**44.** A triangle has two of its sides along the lines $y = m_1 x \& y = m_2 x$ where $m_1, m_2$ are the roots of the equation $3x^2 + 10x + 1 = 0$ and $H(6, 2)$ be the orthocentre of the triangle. If the equation of the third side of the triangle is $ax + by + 1 = 0$ , then $a = 3$ (b) $b = 1$ (c) $a = 4$ (d) $b = -2$

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**45.** Let $ABC$ and $PQR$ be any two triangles in the same plane. Assume that the perpendiculars from the points $A, B, C$ to the sides $QR, RP, PQ$ respectively are concurrent. Using vector methods or otherwise,prove that the perpendiculars from $P, Q, R \rightarrow BC, CA, AB$ respectively are also concurrent.

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**46.** Let AB be a line segment of length 4 with A on the line $y = 2x$ and B on the line $y = x$. The locus of the middle point of the line segment is

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**47.** A rectangle PQRS has its side PQ parallel to the line $y = mx$ and vertices $P$, $Q$, and $S$ on the lines $y = a$, $x = b$,and $x = -b$, respectively. Find the locus of the vertex $R$.

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**48.** A straight line L through the origin meets the lines $x + y = 1$ and $x + y = 3$ at P and Q respectively. Through P and Q two straight lines $L_1$, and$L_2$ are drawn, parallel to $2x - y - 5$ and $3x + y5$ respectively. Lines $L_1$ and $L_2$ intersect at R. Locus of R, as L varies, is

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**49.** Let $C_1$ and $C_2$ be parabolas $x^2 = y - 1$ and $y^2 = x - 1$ respectively. Let P be any point on $C_1$ and Q be any point $C_2$. Let $P_1$ and $Q_1$ be the reflection of P and Q, respectively w.r.t the line y = x then prove that $P_1$ lies on $C_2$ and $Q_1$ lies on $C_1$ and $PQ \geq [PP_1, QQ_1]$. Hence or otherwise , determine points $P_0$ and $Q_0$ on the parabolas $C_1$ and $C_2$ respectively such that $P_0Q_0 \leq PQ$ for all pairs of points (P,Q) with P on $C_1$ and Q on $C_2$

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**50.** The area of the triangle formed by the intersection of a line parallel to x-axis and passing through P (h, k) with the lines y = x and x + y = 2 is $4h^2$. Find the locus of the point P.

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**51.** A variable line cuts n given concurrent straight lines at $A_1, A_2 \ldots A_n$ such that $\sum_{i=1}^{n} \frac{1}{OA_i}$ is a constant. Show that A,A , A such it always passes through a fixed point, O being the point of intersection of the lines

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**52.** The vertices $B, C$ of a triangle ABC lie on the lines $4y = 3x$ and $y = 0$ respectively and the side BC passes through thepoint $P(0, 5)$. If ABOC is a rhombus, where $O$ is the origin and the point $P$ is inside the rhombus, then find the coordinates of `A\'.

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**53.** Two sides of a rhombus lying in the first quadrant are given by $3x - 4y = 0 and 12x - 5y = 0$ . If the length of the longer diagonal is 12, then find the equations of the other two sides of the rhombus.

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**54.** Determine all the values of $\alpha$ for which the point $(\alpha, \alpha^2)$ lies inside the triangle formed by the lines. $2x + 3y - 1 = 0$ $x + 2y - 3 = 0$ $5x - 6y - 1 = 0$

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**55.** Find the position of the origin with respect to theriangle whose sides are $x + 1 = 0, 3x - 4y - 5 = 0$ and $5x + 12y - 27 = 0.$

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**56.** The equation of straight line passing through (-2,-7) and having an intercept of length 3 between the straight lines : 4x + 3y = 12 , 4x + 3y = 3 are : (A) 7x + 24y + 182 = 0 (B) 7x + 24y + 18 = 0 (C) x + 2 = 0 (D) x - 2 = 0

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**57.** For points $P = (x_1, y_1)$ and $Q = (x_2, y_2)$ of the coordinate plane, a new distance $d(P, Q)$ is defined by $d(P, Q) = |x_1 - x_2| + |y_1 - y_2|$. Let $O(0, 0)$ and $A = (3, 2)$. Prove that the set of points in the first quadrant which are equidistant (wrt new distance) from $O$ and $A$ consists of the union of a line segment of finite length and an infinite ray. Sketch this set in a labelled diagram.

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**58.** The point (4, 1) undergoes the following three transformations successively: (a) Reflection about the line y = x (b) Translation through a distance 2 units along the positive direction of the x-axis. (c) Rotation through an angle $\frac{\pi}{4}$ about the origin in the anti clockwise direction. The final position of the point is given by the co-ordinates.

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**59.** Let $O(0, 0), P(3, 4),$ and $Q(6, 0)$ be the vertices of triangle $OPQ$. The point $R$ inside the triangle $OPQ$ is such that the triangles $OPR, PQR, OQR$ are of equal area. The coordinates of $R$ are $\left(\frac{4}{3}, 3\right)$ (b) $\left(3, \frac{2}{3}\right)$ $\left(3, \frac{4}{3}\right)$ (d) $\left(\frac{4}{3}, \frac{2}{3}\right)$

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**60.** Consider three points $P = (-\sin(\beta - \alpha), -\cos\beta)$, $Q = (\cos(\beta - \alpha), \sin\beta)$, and $R = ((\cos(\beta - \alpha + \theta), \sin(\beta - \theta))$, where $0 < \alpha, \beta, \theta < \frac{\pi}{4}$ Then

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**61.** If $x_1, x_2, x_3$ as well as $y_1, y_2, y_3$ are in G.P. with the same common ratio, then the points $(x_1, y_1), (x_2, y_2)$ and $(x_3, y_3)$ (A) lie on a straight line (B) lie on a parabola (C) lie on a circle (D) are vertices of a triangle

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**62.** The locus of the orthocentre of the triangle formed by the lines $(1+p)x - py + p(1+p) = 0, (1+q)x - qy + q(1+q) = 0$ and y = 0, where $p \neq \cdot q$, is (A) a hyperbola (B) a parabola (C) an ellipse (D) a straight line

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**63.** Let A(h, k), B(1, 1) and C(2, 1) be the vertices of a right angled triangle with AC as its hypotenuse. If the area of the triangle is 1, then the set of values which k can take is given by (1) $\{1, 3\}$ (2) $\{0, 2\}$ (3) $\{-1, 3\}$ (4) $\{-3, -2\}$

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**64.** The perpendicular bisector of the line segment joining P (1, 4) and Q (k, 3) has yintercept $-4$. Then a possible value of k is (1) 1 (2) 2 (3) $-2$ (4) $-4$

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**65.** The lines $p(p^2+1)xy+q=0$ and $(p^2+1)^2x+(p^2+1)y+2q=0$ are perpendicular to a common line for (1) no value of p (2) exactly one value of p (3) exactly two values of p (4) more than two values of p

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**66.** The number of integral values of $m$ for which the x-coordinate of the point of intersection of the lines $3x+4y=9$ and $y=mx+1$ is also an integer is 2 (b) 0 (c) 4 (d) 1

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Exercise

**1.** Let the opposite angular points of a square be $(3, 4) and (1, -1)$ . Find the coordinates of the remaining angular points.

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**2.** A(-4,0) and B (-1,4) are two given points. Cand D are points which are symmetric to the given points A and B respectively with respect to y-axis. Calculate the perimeter of the trapezium ABDC.

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**3.** If the point $A$ is symmetric to the point $B(4, -1)$ with respect to the bisector of the first quadrant then $AB$ is

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**4.** A line through the point $A(2, 0)$ which makes an angle of $30^\circ$ with the positive direction of $x-$ axis is rotated about $A$ in anticlockwise direction through an angle $15^\circ$. Find the equation of the straight line in the new position.

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**5.** The point $(1, -2)$ is reflected in the $x$-axis and then translated parallel to the positive direction of x-axis through a distance of $3$ units, find the coordinates of the point in the new position.

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**6.** The line segment joining $A(3, 0)$ and $B(5, 2)$ is rotated about $A$ in the anticlockwise direction through an angle of $45^0$ so that $B$ goes to $C$. If $D$ is the reflection of $C$ in y-axis, find the coordinates of $D$.

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**7.** Two vertices of a triangle are $A(2, 1)$ and $B(3, -2)$. The third vertex $C$ lies on the line $y = x + 9$. If the centroid of triangle $ABC$ lies on $y$-axis, find the coordinates of $C$ and the centroid.

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**8.** If $a, b, c$ are the $pth, qth, rth$ terms, respectively, of an $HP$ , show that the points $(bc, p), (ca, q),$ and $(ab, r)$ are collinear.

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**9.** The area of a triangle is $\frac{3}{2}$ square units. Two of its vertices are the points $A(2, -3)$ and $B(3, -2)$, the centroid of the triangle lies on the line $3x - y - 2 = 0$, then third vertex C is

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**10.** Prove that the quadrilateral whose vertices are $A(-2, 5), B(4, -1), C(9, 1)$ and $D(3, 7)$ is a parallelogram and find its area. If E divides AC in the ration $2:1$, prove that D, E and the middle point F of BC are collinear.

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**11.** A line through the point $A(2, 0)$ which makes an angle of $30^\circ$ with the positive direction of $x$ – axis is rotated about $A$ in anticlockwise direction through an angle $15^\circ$. Find the equation of the straight line in the new position.

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**12.** A line through the point $P(1, 2)$ makes an angle of $60^0$ with the positive directin of $x - a\xi s$ and is rotated about $P$ in the clockwise direction through an angle $15^0$. Find the equation of the straight line in the new position.

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**13.** The line $2x - y = 5$ turns about the point on it, whose ordinate and abscissae are through an angle of $45^{\circ}$ in the anti-clockwise direction. Find the equation of the line in the new position.

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**14.** The line $x + 2y = 4$ is-translated parallel to itself by $3$ units in the sense of increasing x and is then rotated by $30^{\circ}$ in the clockwise direction about the point where the shifted line cuts the x-axis.Find the equation of the line in the new position

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**15.** $AB$ is a side of a regular hexagon $ABCDEF$ and is of length $a$ with $A$ as the origin and $AB$ and $AE$ as the x-axis andy-axis respectively. Find the equation of lines $AC$, $AF$ and $BE$

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**16.** A straight road is at a distance of $5\sqrt{2}$ miles from a place. The shortest distance of the road from the place is in the N.E. direction. Do the following villages which (i) is 6 miles East and 4 miles North from the place lie on the road or no, (ii) is 4 miles East and 3 miles North from the place, lie on the road or not?

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**17.** In the given figure, PQR is an equilateral triangle and OSPT is a square. If $OT = 2\sqrt{2}$ units find the equation of lines $OT, OS, SP, QR, PR, \text{ and } PQ$.

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**18.** Two particles start from point (2, -1), one moving two units along the line x+ y = 1 and the other 5 units along the line x - 2y = 4, If the particle move towards increasing y, then their new positions are:

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**19.** One end of a thin straight elastic string is fixed at $A(4, -1)$ and the other end $B$ is at $(1, 2)$ in the unstretched condition. If the string is stretched to triple its length to the point $C$, then find the coordinates of this point.

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**20.** The line $PQ$ whose equation is $x - y = 2$ cuts the x-axis at $P, andQ$ is (4,2). The line $PQ$ is rotated about $P$ through $45^0$ in the anticlockwise direction. The equation of the line $PQ$ in the new position is $y = -\sqrt{2}$ (b) $y = 2\,x = 2$ (d) $x = -2$

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**21.** The co-ordinates of the extremities of one diagonal of a square are $(1, 1)$ and $(1, -1)$ Find the co-ordinates of its other vertices and the equation of the other diagonal

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**22.** The straight line passing through $P(x_1, y_1)$ and making an angle $\alpha$ with x-axis intersects $Ax + By + C = 0$ in Q then PQ=

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**23.** A line which the positive direction of x-axis is drawn through the point $P(3, 4),$ to cut the curve $y^2 = 4x$ at $Q$ and $R$. Show that the lengths of the segments $PQ$ and $PR$ are numerical values of the roots of the equation $r^2 \sin^2 \theta + 4r(2 \sin \theta - \cos \theta) + 4 = 0$

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**24.** The lines $2x + 3y + 19 = 0$ and $9x + 6y - 17 = 0$, cut the coordinate axes at concyclic points.

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**25.** A straight line $L$ is perpendicular to the line $5x - y = 1$. The area of the triangle formed by line $L$, and the coordinate axes is 5. Find the equation of line $L$.

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**26.** The line $2x + 3y = 12$ meets the x-axis at $A$ and the y-axis at $B$. The line through (5, 5) perpendicular to $AB$ meets the x-axis, y-axis & the line $AB$ at $C, D, E$ respectively. If $O$ is the origin, then the area of the OCEB is $\frac{20}{3} s\dot{q}\dot{u}nit$ (b) $\frac{23}{3} s\dot{q}\dot{u}nit$ $\frac{26}{3} s\dot{q}\dot{u}nit$ (d) $\frac{5\sqrt{52}}{9} s\dot{q}\dot{u}nit$

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**27.** Two equal sides of an isosceles triangle are given by $7x - y + 3 = 0$ and $x + y = 3$, and its third side passes through the point $(1, -10)$. Find the equation of the third side.

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**28.** A light beam, emanating from the point (3, 10) reflects from the straight line $2x + y - 6 = 0$ and then passes through the point $B(7, 2)$. Find the equations of the incident and reflected beams.

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**29.** Let A $(3, 2)$ and B $(5, 1)$. ABP is an equilateral triangle is constructed one the side of AB remote from the origin then the orthocentre of triangle ABP is:

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**30.** The vertices of a triangle are $A(x_1, x_1, \tan\theta_1)$, $B(x_2, x_2, \tan\theta_2)$ and $C(x_3, x_3, \tan\theta_3)$. If the circumcentre coincides with origin then

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**31.** The circumcentre of a triangle having vertices $A(a, a\tan\alpha), B(b, b\tan\beta), C(c, c\tan\gamma)$ is at origin, where $\alpha + \beta + \gamma = \pi$. Then the orthocentre lies on

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**32.** Determine whether the origin lies inside or outside the triangle whose sides are given by the equations $7x - 5y - 11 = 0, 8x + 3y + 31 = 0, x + 8y - 19 = 0.$

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**33.** The equations of two sides of a square are $3x + 4y - 5 = 0$ and $3x + 4y - 15 = 0$. The third side has a point (6, 5) on it. Find the equation of this third side and the remaining side of the square.

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**34.** Show that the reflection of the line $px + qy + r = 0$ in the line $x + y + 1 = 0$ is the line $qx + py + (p + q - r) = 0$, where $p \neq -q$.

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**35.** A rhombus has two of its sides parallel to the lines $y = 2x + 3$ and $y = 7x + 2$. If the diagonals cut at (1, 2) and one vertex is on the y-axis, find the possible values of the ordinate of that vertex.

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**36.** if $x$ and $y$ coordinates of a point $P$ in $x - y$plane are given by $x = (u\cos\alpha)t, y = (u\sin\alpha)t - \frac{1}{2}gt^2$where $t$ is a aprameter and $u, \alpha, g$ the constants. Then the locus of the point $P$ is a parabola then whose vertex is:

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**37.** A variable line through the point $\left(\frac{6}{5}, \frac{6}{5}\right)$ cuts the coordinates axes in the point $A$ and $B$. If the point $P$ divides $AB$ internally in the ratio $2:1$, show that the equation to the locus of $P$ is : $5xy = 2(2x + y)$.

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**38.** A straight line moves in such a way that the length of the perpendicular upon it from the origin is always $p$. Find the locus of the centroid of the triangle which is formed by the line and the axes.

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**39.** A right angled triangle ABC having a right angle at C, CA=b and CB=a, move such that h angular points A and B slide along x-axis and y-axis respectively. Find the locus of C

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**40.** The vertices of a triangle ABC are the points $(0, b), (\,-a, 0), (a, 0)$. Find the locus of a point $P$ which moves inside the triangle such that the product of perpendiculars from $P$ to $AB$ and $AC$ is equal to the square of the perpendicular to $BC$.

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**41.** Find the locus of the point at which two given portions of the straight line subtend equal angle.

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**42.** A point moves so that the sum of the squares of the perpendiculars let fall from it on the sides of an equilateral triangle is constant. Prove that its locus is a circle.

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**43.** Find the foues of the middle points of the segment of a line passing through the point ofintersection of lines $ax + by + c = 0$ and $lx + my + n = 0$ and intercepted between the axes.

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**44.** A point $P$ move along the y-axis. Another point $Q$ moves so that the fixed straight line $x \cos \alpha + y \sin \alpha = p$ is the perpendicular bisector of the line segment $PQ$.Find the locus of $Q$.

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**45.** The vertices $BandC$ of a triangle $ABC$ lie on the lines $3y = 4xandy = 0$ , respectively, and the side $BC$ passes through the point $\left(\frac{2}{3}, \frac{2}{3}\right)$ . If $ABOC$ is a rhombus lying in the first quadrant, $O$ being the origin, find the equation of the line $BC$.

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**46.** $ABC$ is a right angled triangle, right-angled at $A$. The coordinates of $B$ and $C$ are (6, 4) and ((14, 10) respectively. The angle between the side AB and x-axis is $45^0$. Find the coordinates of $A$.

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**47.** A variable line passing through the origin intersects two given straight lines $2x + y = 4$ and $x + 3y = 6$ at R and S respectively. A point P is taken on this variable line. Find the equation to the locus of the point P if (a) OP is the arithmetic mean of OR and OS. (b) OP is the geometric mean of OR and OS. (c) OP is an harmonic mean of OR and OS

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48. Equations of two straight lines are $x\cos\alpha + y\sin\alpha = p$ and $x\cos\beta + y\sin\beta = p'$. Show that the area of the quadrilateral formed by the two lines and the perpendiculars drawn from the origin to the lines is $\frac{1}{2\sin(B-\alpha)}[2pp' - (p2 + p'2)\cos(\alpha - \beta)\}$.

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49. The line joining $A(b\cos\alpha b\sin\alpha)$ and $B(a\cos\beta, a\sin\beta)$ is produced to the point $M(x, y)$ so that $AM$ and $BM$ are in the ratio $b : a\cdot$ Then prove that $x + y\tan\left(\alpha + \frac{\beta}{2}\right) = 0.$

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**50.** The equation of the side AB and AC of a triangle ABC are $3x + 4y + 9$ and $4x - 3y + 16 = 0$ respectively. The third side passes through the point $D(5, 2)$ such that $BD : DC = 4 : 5$. Find the equation of the third side.

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**51.** Le n be the number of points having rational coordinates equidistant from the point $(0, \sqrt{3})$, the

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**52.** If poitns $A(3, 5)$ and B are equidistant from $H(\sqrt{2}, \sqrt{5})$ and B has rational coordinates,then $AB =$

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**53.** Find the number of point $(x, y)$ having integral coordinates satisfying the condition $x^2 + y^2 < 25$

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**54.** ABC is an equilateral triangle such that the vertices B and C lie on two parallel at a distance 6. If A lies between the parallel lines at a distance 4 from one of them then the length of a side of the equilateral triangle.

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**55.** If all the vertices of a triangle have integral coordinates, then the triangle may be right-angled (b) equilateral isosceles (d) none of these

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**56.** Quadratic equations + Progression series - misc Let $(A(\alpha a, 0), B(\beta, 0), C(\gamma, 0), D(\delta, 0)$ and $\alpha, \beta$ are the roots of equation $ax^2 + 2hx + b = \; = 0.$ While $\gamma, \delta$ , are those of $a - 1x^2 + 2h_1x + b_1 = 0$ If $C$ and $D$ divides AB in the ratio of mal and $\gamma : 1$ and $\mu : 1$ respectively and also $ab_1, hh_1, a_1b$ are in $A.\,P.,$ then $\lambda + \mu$ is equal to

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**57.** Let $A \equiv (\,-4, 0), B \equiv (\,-1, 4).\,C$ and $D$ are points which are symmetric to points $A$ and $B$ respectively with respect to y-axis, then area of the quadrilateral $ABCD$ is (A) 8 sq units (B) 12 sq. units (C) 20 sq. units (D) none of these

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**58.** If $x_1, x_2, x_3$ as well as $y_1, y_2, y_3$ are in A.P., then the points $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ are (A) concyclic (B) collinear (C) three vertices of a parallelogram (D) none of these

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**59.** If $x_1, x_2, x_3$ as well as $y_1, y_2, y_3$ are in G.P. with the same common ratio, then the points $(x_1, y_1), (x_2, y_2)$ and $(x_3, y_3)$ (A) lie on a straight line (B) lie on a parabola (C) lie on a circle (D) are vertices of a triangle

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**60.** Given that $P(3, 1), Q(6. 5),$ and $R(x, y)$ are three points such that the angle $PRQ$ is a right angle and the area of $RQP$ is 7, find the number of such points $R\cdot$

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**61.** Let $\alpha = Lt_{m \to \infty} Lt_{n \to \infty} \cos^{2m} \lfloor n\pi x,$ where $x$ is rational, $\beta = Lt_{m \to \infty} Lt_{n \to \infty} \cos^{2m} \lfloor n\pi x,$ where \'x\' is irrational, then the area of the triangle having vertices $(\alpha, \beta), (-2, 1)$ and $(2, 1)$ is (A) 2 (B) 4 (C) 1 (D) none of these

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**62.** The incenter of the triangle with vertices $(1, \sqrt{3}), (0, 0),$ and $(2, 0)$ is $\left(1, \frac{\sqrt{3}}{2}\right)$ (b) $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$ $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$ (d) $\left(1, \frac{1}{\sqrt{3}}\right)$

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**63.** If $P(1, 2)Q(4, 6), R(5, 7),$ and $S(a, b)$ are the vertices of a parallelogram $PQRS,$ then $a = 2, b = 4$ (b) $a = 3, b = 4$ $a = 2, b = 3$ (d) $a = 1$ or $b = -1$

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**64.** If a point $P$ moves such that the sum of its distances from two perpendicular lines is less than or equal to 2 and $S$ be the region consisting of all such points $P$, then area of the region $S$ is : (A) 4 sq.untis (B) 8 sq. units (C) 6 sq. units (D) none of these

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**65.** If the vertices of a triangle $PQR$ are rational points, then which of the following points of this triangle may not be rational -

(a) Centroid (b) Incenter

(c) Circumcenter (d) Orthocenter

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**66.** If the algebraic sum of the perpendicular distances from the points $(3, 1), (-1, 2)$ and $(1, 3)$ to a variable line be zero, and $\begin{vmatrix} x^2+1 & x+1 & x+2 \\ 2x+3 & 3x+2 & x+4 \\ x+4 & 4x+3 & 2x+5 \end{vmatrix} = mx^4 + nx^3 + px^2 + qx + r$ be an identity in $x$, then the variable line always passes through the point (A) $(-r, m)$ (B) $(-m, r)$ (C) $(r, m)$ (D) $(2r, m)$

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**67.** A man starts from the point $P(-3, 4)$ and reaches the point $Q(0, 1)$ touching the x-axis at $R(\alpha, 0)$ such that $PR + RQ$ is minimum. Then $5|\alpha| =$ ________

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**68.** Let $P \equiv (a, b), Q \equiv (c, d)$ and $0 < a < b < c < d, L \equiv (a, 0), M \equiv (c, 0), R$ lies on x-axis such that $PR = RQ$ is minimum, then $R$ divides $LM$ (A) internally in the ration $a : b$ (B) internally in the ration $b : c$ (C) internally in the ration $b : d$ (D) internally in the ratio $d : b$

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**69.** If $a = \dfrac{\tan\theta}{\tan 3\theta}$, then the point $P(a, a^2)$ (A) necessarily lies in the acute angle between the lines $y = 3x$ and $3y = x$ (B) may lie on line

$3y = x$ or $y = 3x$ (C) necessarily lies in the obtuse angle between the lines $3y = x$ and $y = 3x$ (D) $a\varepsilon\left(\frac{1}{3}, 3\right)$

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**70.** If $\alpha$ an integer and $P(\alpha, \alpha^2)$ is a point in the interior of the quadrilateral

$x = 0, y = 0, 4x + y - 21 = 0$ and $3x + y - 4 = 0$, and $(1 + ax)^n = 1 -$

then $\alpha =$ (A) $a$ (B) $-a$ (C) $a^2$ (D) none of these

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**71.** If $a, b, c$ are variables such that $21a + 40b + 56c = 0$ then the family of lines $ax + by + c = 0$ passes through (A) $\left(\frac{7}{14}, \frac{9}{4}\right)$ (B) $\left(\frac{4}{7}, \frac{3}{8}\right)$ (C) $\left(\frac{3}{8}, \frac{5}{7}\right)$ (D) $(2, 3)$

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**72.** Consider a triangle $PQR$ with $P \equiv (0, 0), Q \equiv (a, 0), R \equiv (0, b)$. Then the centroid, orthocentre and circumcentre (A) lies on a straight line (B) form a scalene triangle with area $\frac{a}{2}|ab|$ (C) form a right-angled triangle with area $\frac{1}{2}|ab|$ (D) none of these

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**73.** The equaiton of the line which bisects the obtuse angle between the lines $x - 2y + 4 = 0$ and $4x - 3y + 2 = 0$ (A) $(4 - \sqrt{5})x - (3 - 2(\sqrt{5})y + (2 - 4\sqrt{5}) = 0$ (B) $(3 - 2\sqrt{5})x - (4 - \sqrt{5})y + (2 + 4(\sqrt{5}) = 0$ (C) $(4 + \sqrt{5}x - (3 + 2(\sqrt{5})y + (2 + 4(\sqrt{5}) = 0$ (D) none of these

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**74.** If two sides of a triangle are represented by $2x - 3y + 4 = 0$ and $3x + 2y - 3 = 0$, then its orthocentre lies on the line : (A) $x-y+\frac{8}{15}=0$ (B) $3x-2y+1=0$ (C) $9x-y+\frac{9}{13}=0$ (D) $4x+3y+\frac{5}{13}=0$

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**75.** Equation of the line equidistant from $3x+4y-25=0$ and $3x+4y+25=0$ is (A) $6x+4y+5=0$ (B) $3x+4y=0$ (C) $3x-4y+5=0$ (D) $6x+8y+5=0$

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**76.** The equation of a line through $(2,-4)$ which cuts the axes so that the intercepts are equal in magnitude is : (A) $x+y+2=0$ (B) $x-y+2=0$ (C) $x+y+6=0$ (D) $x+y-6=0$

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**77.** If a line is perpendicular to the line $5x - y = 0$ and forms a triangle with coordinate axes of area 5 sq. units, then its equation is :

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**78.** Find the equation of a straight line through the intersection of $2x - 3y + 4 = 0$ and $3x + 4y - 5 = 0$ and parallel to $Y$ -axis

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**79.** A variable line intersects the co-ordinate axes at A and B and passes through a fixed point $(a, b)$.then the locus of the vertex C of the rectangle $OACB$ where O is the origin is

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**80.** The family of lines $(l+3m)x+2(l+m)y=(m-l)$, where $l \neq 0$ passes through a fixed point having coordinates (A) $(2, -1)$ (B) (0, 1) (C) $(1, -1)$ (D) $(2, 3)$

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**81.** The equation of the line passing through (1,2) and having a distance equal to 7 units from the points (8,9) is

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**82.** If $a, c, b$ are in AP the family of line $ax+by+c=0$ passes through the point.

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**83.** The coordinates of the vertices A and B of an isosceles triangle $ABC(AC = BC)$ are $(-2, 3)$ and $(2, 0)$ respectively. A line parallel to AB and having a y-intercept equal to $\frac{43}{12}$ passes through $C$, then the coordinatse of $C$ are : (A) $\left(-\frac{3}{4}, 1\right)$ (B) $\left(1, \frac{17}{6}\right)$ (C) $\left(\frac{2}{3}, \frac{4}{5}\right)$ (D) $(1, 0)$

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**84.** The equaiton of the line perpendicular to $2x + 6y + 5 = 0$ and having the length of x-intercept equal to 3 units can be (A) $y = 3x + 5$ (B) $2y = 6x + 1$ (C) $y = 3x + 9$ (D) none of these

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**85.** The point on the line $3x - 2y = 1$ which is closest to the origin is (A) $\left(\frac{3}{13}, -\frac{2}{13}\right)$ (B) $\left(\frac{5}{11}, \frac{2}{11}\right)$ (C) $\left(\frac{3}{5}, \frac{2}{5}\right)$ (D) none of these

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**86.** The points $A(5, -1, 1), B(7, -4, 7), C(1, -6, 10)$ and $D(-1, -3, 4)$ are the vertics o a (A) rhombus (B) square (C) rectangle (D) none of these

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**87.** Distance of a point (2,5) from the line 2x-y-4=0 measured parallel to the line 3x-4y + 8 = 0 is :

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**88.** If $A(-1, 0), B(1, 0)$ and $C(3, 0)$ are three given points, then the locus of point $D$ satisfying the relation $DA^2 + DB^2 = 2DC^2$ is (A) a straight line parallel to x-axis (B) a striaght line parallel to y-axis (C) a circle (D) none of these

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**89.** A point (1, 1) undergoes reflection in the x-axis and then the coordinates axes are rotated through an angle of $\frac{\pi}{4}$ in anticlockwise direction. The final position of the point in the new coordinate system is

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**90.** If the point $(1, a)$ lies in between the lines $x+y=1$ and $2(x+y)=3$ then $a$ lies in (i)$(-\infty, 0) \cup (1, \infty)$ (ii)$\left(0, \frac{1}{2}\right)$ (iii) $(-\infty, 0) \cup \left(\frac{1}{2}, \infty\right)$ (iv) none of these

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**91.** $A=\left(\sqrt{1-t^2}+t, 0\right)$ and $B=\left(\sqrt{1-t^2}-t, 2t\right)$ are two variable points then the locus of mid-point of $AB$ is

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**92.** The equation of a straight line passing through (3, 2) and cutting an intercept of 2 units between the lines $3x + 4y = 11$ and $3x + 4y = 1$ is

(A) $2x + y - 8 = 0$ (B) $3y - 4x + 6 = 0$ (C) $3x + 4y - 17 = 0$ (D) $2x - y - 4 = 0$

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**93.** The coordinates of the foot of perpendicular drawn from the point (2, 4) on the line $x + y = 1$ are (A) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (B) $\left(-\frac{1}{2}, \frac{3}{2}\right)$ (C) $\left(\frac{1}{4}, \frac{3}{4}\right)$ (D) $\left(\frac{3}{2}, -\frac{1}{2}\right)$

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**94.** The equation of straight line equally inclined to the axes and equidistant from the point $(1, -2)$ and $(3, 4)$ is:

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**95.** The equation $\sqrt{x^2 + 4y^2 - 4xy + 4} + x - 2y = 1$ represent a (A) straight line (B) circle (C) parabola (D) pair of lines

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**96.** If a $\Delta ABC$ remains always similar to a given triangle and the point $A$ is fixed and the point $B$ always moves on a given straight line, then locus of $C$ is (A) a circle (B) a straight line (C) a parabola (D) none of these

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**97.** The graph of the function $y = \cos x \cos(x + 2) - \cos^2(x + 1)$ is:

(A) A straight line passing through $(0, \sin^2 1)$ with slope 2

(B) A stright line passing through $(0, 0)$

(C) A parabola with vertex $(1, -\sin^2 1)$

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**98.** A variable line through the point $(p, q)$ cuts the $x$ and $y$ axes at $A$ and $B$ respectively. The lines through $A$ and $B$ parallel to y-axis and x-axis respectively meet at $P$. If the locus of $P$ is $3x + 2y - xy = 0$, then (A) $p = 2, q = 3$ (B) $p = 3, q = 2$ (C) $p = 2, q = -3$ (D) $p = -3, q = -2$

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**99.** If $f(x + y) = f(x).\ f(y)$ for all $x$ and $y$. $f(1) = 2$, then area enclosed by $3|x| + 2|y| \leq 8$ is (A) $f(5)$ sq. units (B) $f(6)$ sq. units (C) $\frac{1}{3}f(6)$ sq. units (D) $f(4)$ sq. units

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**100.** The straight lines $x + y = 0, 3x + y - 4 = 0$ and $x + 3y - 4 = 0$ form a triangle which is (A) isosceles (B) right angled (C) equilateral (D) scalene

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**101.** The point $(-4, 5)$ is vertex of a square and one of its diagonal is $7x - y + 8 = 0$. The equation of other diagonal is $7x - y + 23 = 0$ $7y + x + \;= 30$ $7y + x = 31$ $x - 7y = 30$ $x + 7y + 31 = 0$

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**102.** If $(\alpha, \beta)$ be the circumcentre of the triangle whose sides are $3x - y = 5, x + 3y = 4$ and $5x + 3y + 1 = 0$, then (A) $11\alpha - 21\beta = 0$ (B) $11\alpha + 21\beta = 0$ (C) $\alpha + 2\beta = 0$ (D) none of these

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**103.** if $\frac{x}{a} + \frac{y}{b} = 1$ is a variable line where $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$ ($c$ is constant ) then the locus of foot of the perpendicular drawn from origin

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**104.** If the lines $ax+by+c=0, bx+cy+a=0$ and $cx+ay+b=0(a, b, c$ being distinct) are concurrent, then (A) $a+b+c=0$ (B) $a+b+c=0$ (C) $ab+bc+ca=1$ (D) $ab+bc+ca=0$

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**105.** If $a, b, c$ are the $pth, qth, rth$ terms respectively of an $H.P.$, then the lines $bcx+py+1=0, cax+qy+1=0$ and $abx+ry+1=0$ (A) are concurrent (B) form a triangle (C) are parallel (D) none of these

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**106.** If $a, b, c$ are in A.P. then the family of lines $ax+by+c=0$ (A) passes through a fixed point (B) cuts equal intercepts on both the axes (C) forms a triangle with the axes with area $=\frac{1}{2}|a+c-2b|$ (D) none of these

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**107.** The value of $a$ for which the image of the point $(a, a-1)$ w.r.t the line mirror $3x + y = 6a$ is the point $(a^2 + 1, a)$ is (A) 0 (B) 1 (C) 2 (D) none of these

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**108.** If the lines $ax + by + c = 0, bx + cy + a = 0$ and $cx + ay + b = 0$ be concurrent, then:

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**109.** Through the point $P(\alpha, \beta)$ , where $\alpha\beta > 0,$ the straight line $\frac{x}{a} + \frac{y}{b} = 1$ is drawn so as to form a triangle of area $S$ with the axes. If $ab > 0,$ then the least value of $S$ is $\alpha\beta$ (b) $2\alpha\beta$ (c) $3\alpha\beta$ (d) none

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**110.** The line $x+y=4$ divides the line joining the points $(-1, 1)$ and $(5, 7)$ in the ratio (A) 0.0854166666666667 (B) 0.0430555555555556 (C) 0.0423611111111111 (D) 0.16875

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**111.** A vertex of an equilateral triangle is at (2, 3), and th equation of the opposite side is $x+y=2$, then the equaiton of the other two sides are (A) $y=(2+\sqrt{3})(x-2), y-3=2\sqrt{3}(x-2)$ (B) $y-3=(2+\sqrt{3}(x-2), y-3=(2-\sqrt{3}(x-2)$ (C) $y+3=(2-\sqrt{3}(x-2), y-3=(2-\sqrt{3}(x+2)$ (D) none of these

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**112.** The equation of the bisectors between the lines $3x-4y+7=0$ and $12+5y-2=0$ is (A) $21x+77y-101=0$ (B) $11x+3y+20=0$ (C) $21x-7y+3=0$ (D) $11x-3y+9=0$

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**113.** If one of the diagonals of a square is along the line $x = 2y$ and one of its vertices is (3, 0), then its sides through this vertex are given by the equations (A) $y - 3x + 9 = 0, 3y + x - 3 = 0$ (B) $y + 3x + 9 = 0, 3y + x - 3 = 0$ (C) $y - 3x + 9 = 0, 3y - x + 3 = 0$ (D) $y - 3x + 9 = 0, 3y + x + 9 = 0$

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**114.** The orthocentre of triangle with vertices $\left(2, \frac{\sqrt{3}-1}{2}\right), \left(\frac{1}{2}, -\frac{1}{2}\right), \left(2, , -\frac{1}{2}\right)$

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**115.** A line through $A(-5, -4)$ meets the lines $x + 3y + 2 = 0, 2x + y + 4 = 0 and x - y - 5 = 0$ at the points

$B, CandD$ rspectively, if $\left(\frac{15}{AB}\right)^2 + \left(\frac{10}{AC}\right)^2 = \left(\frac{6}{AD}\right)^2$ find the equation of the line.

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**116.** The normal form of the eqatuion of the line $x + \sqrt{3y} + 4 = 0$ is (A) $x\cos 60^0 + y\sin 60^0 = 2$ (B) $x\cos 24^0 - y\sin 24^0 - 2$ (C) $x\cos 240^0 + y\sin 240^0 - 2$ (D) none of these

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**117.** The equaiton of the line which bisects the obtuse angle between the lines $x - 2y + 4 = 0$ and $4x - 3y + 2 = 0$ (A) $(4 - \sqrt{5})x - (3 - 2(\sqrt{5})y + (2 - 4\sqrt{5}) = 0$ (B) $(3 - 2\sqrt{5})x - (4 - \sqrt{5})y + (2 + 4(\sqrt{5}) = 0$ (C) $(4 + \sqrt{5}x - (3 + 2(\sqrt{5})y + (2 + 4(\sqrt{5}) = 0$ (D) none of these

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**118.** The equation of the diagonal through origin of the quadrilateral formed by the lines $x = 0, y = 0, x + y - 1 = 0$ and $6x + y - 3 = 0,$ is

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**119.** A line passes through the point $(2, 2)$ and is perpendicular to the line $3x + y = 3,$ then its $y$-intercept is

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**120.** If the sum of the distances of a moving point in a plane from the axes is $1,$ then find the locus of the point.

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**121.** If $P = (1, 0); Q = (-1.0) \& R = (2, 0)$ are three given points, then the locus of the points S satisfying the relation, $SQ^2 + SR^2 = 2SP^2$ is -

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**122.** The equaiton of the lines through the point (2, 3) and making an intercept of length 2 units between the lines $y+2x=3$ and $y+2x=5$ are (A) $x+3=0, 3x+4y=12$ (B) $y-2=(0, 4x-3y=6$ (C) $x-2=0, 3x+4y=18$ (D) none of these

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**123.** Line $L$ has intercepts $a and b$ on the coordinate axes. When the axes are rotated through a given angle keeping the origin fixed, the same line $L$ has intercepts $p and q$. Then $a^2+b^2=p^2+q^2$ $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{p^2}+\frac{1}{q^2}$ $a^2+p^2=b^2+q^2$ (d) $\frac{1}{a^2}+\frac{1}{p^2}=\frac{1}{b^2}+\frac{1}{q^2}$

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**124.** The distance between the parallel lnes $y=2x+4$ and $6x-3y-5$ is (A) 1 (B) $\frac{17}{\sqrt{3}}$ (C) $7\frac{\sqrt{5}}{15}$ (D) $3\frac{\sqrt{5}}{15}$

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**125.** The pair of points which lie on the same side of the straight line $3x - 3y - 7 = 0$ is (A) $(0, \ -1)(0, 0)$ (B) $(0, 1), (3, 0)$ (C) $(\ -1, \ -1), (3, 7)$ (D) $(24, \ -3), (1, 1)$

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**126.** The equation of the base of an equilateral triangle $ABC$ is $x + y = 2$ and the vertex is $(2, \ -1)$. The area of the triangle $ABC$ is: $\frac{\sqrt{2}}{6}$ (b) $\frac{\sqrt{3}}{6}$ (c) $\frac{\sqrt{3}}{8}$ (d) None of these

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**127.** Three lines $3x + 4y + 6 = 0, \sqrt{2}x + \sqrt{3}y + 2\sqrt{2} = 0$ and $4x + 7y + 8 = 0$ are (A) sides of triangle (B) concurrent (C) parallel (D) none of these

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128. Given that $P(3, 1), Q(6. 5),$ and $R(x, y)$ are three points such that the angle $PRQ$ is a right angle and the area of $RQP$ is 7, find the number of such points $R$.

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129. Let $PS$ be the median of the triangle with vertices $P(2, 2), Q(6, -1) and R(7, 3)$ Then equation of the line passing through $(1, -1)$ and parallel to $PS$ is $2x - 9y - 7 = 0$ $2x - 9y - 11 = 0$ $2x + 9y - 11 = 0$ $2x + 9y + 7 = 0$

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130. The orthocentre of the triangle formed by the lines $xy = 0$ and $x + y = 1$ is $\left(\frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{3}, \frac{1}{3}\right)$ $(0, 0)$ (d) $\left(\frac{1}{4}, \frac{1}{4}\right)$

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**131.** If $\alpha_1, \alpha_2, \alpha_3, \beta_1, \beta_2, \beta_3$ , are the values of n for which $\sum_{r=0}^{n-1} x^{2r}$ , is divisible by $\sum_{r=0}^{n-1} x^r$ then prove that the triangle having vertices $(\alpha_1, \beta_1), (\alpha_2, \beta_2)$ and $(\alpha_3, \beta_3)$ cannot be an equilateral triangle.

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**132.** The straight lines $3x + y - 4 = 0, x + 3y - 4 = 0$ and $x + y = 0$ form a triangle which is :

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**133.** All points lying inside the triangle formed by the points (1. 3). (5, 0) and (-1, 2) satisfy (A) $3x + 2y \geq 0$ (B) $2x + y - 13 \geq 0$ (C) $2x - 3y - 12 \leq 0$ (D) $-2x + y \geq 0$

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**134.** The equation to a pair of opposite sides of a parallelogram are $x^2 - 5x + 6 = 0$ and $y^2 + 5 = 0$ . The equations to its diagonals are $x + 4y = 13, y = 4x - 7$ (b) $4x + y = 13, 4y = x - 7$ $4x + y = 13, y = 4x - 7$ (d) $y - 4x = 13, y + 4x - 7$

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**135.** Equation(s) of the straight line(s), inclined at $30^0$ to the x-axis such that the length of its (each of their) line segment(s) between the coordinate axes is 10 units, is (are) $x + \sqrt{3}y + 5\sqrt{3} = 0$ $x - \sqrt{3}y + 5\sqrt{3} = 0$ $x + \sqrt{3}y - 5\sqrt{3} = 0$ $x - \sqrt{3}y - 5\sqrt{3} = 0$

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**136.** A ray of light travelling along the line $x + y = 1$ is incident on the x-axis and after refraction it enters the other side of the x-axis by turning $30^0$ away from the x-axis. The equation of the line along which the refracted ray travels is

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**137.** The incident ray is along the line $3x - 4y - 3 = 0$ and the reflected ray is along the line $24x + 7y + 5 = 0$. Find the equation of mirrors.

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**138.** A(1, 2) and B(7, 10) are two points. If P(x) is a point such that the angle APB is $60^{\circ}$ and the area of the triangle APB is maximum, then which of the following is (aré) true?

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**139.** A straight line passing through the point$(2, 2)$ and the axes enclose an area $\lambda$. The intercepts on the axes made by the line are given by the two roots of:

(A) $x^2 - 2|\lambda|x + |\lambda| = 0$ (B) $x^2 + |\lambda|x + 2|\lambda| = 0$

(C) $x^2 - |\lambda|x + |2\lambda| = 0$ (D) None of these

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**140.** Let $L$ be the line $2x+y-2=0$. The axes are rotated by $45^{\circ}$ in clockwise direction then the intercepts made by the line $L$ on the new axes are respectively

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**141.** The sides of a triangle are the straight lines $x+y=1, 7y=x,$ and $\sqrt{3}y+x=0$ . Then which of the following is an interior point of the triangle? Circumcenter (b) Centroid Incenter (d) Orthocenter

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**142.** $A(1,3)$ and $C(7,5)$are two opposite vertices of a square. The equation of a side thro' A is

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**143.** If bx+cy=a, there $a, b, c$ are of the same sign, be a line such that the area enclosed by the line and the axes of reference is $\frac{1}{8}$ square units, then : (A) $b, a, c$ are in G.P. (B) $b, 2a, c$ arein G.P. (C) $b, \frac{a}{2}, c$ are in A.P. (D) $b, \ -2a, c$ are in G.P.

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**144.** If $6a^2-3b^2-c^2+7ab-ac+4bc=0$ then the family of lines $ax+by+c=0, |a|+|b|\neq 0$ can be concurrent at concurrent (A) (-2,3) (B) (3,-1) (C) (2,3) (D) (-3,1)

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**145.** One diagonal of a square is the portion of the line $\sqrt{3}x+y=2\sqrt{3}$ intercepted by the axes. Obtain the extremities of the other diagonal is : (A) $\left(1+\sqrt{3}, \ -1+\sqrt{3}\right)$ (B) $\left(1+\sqrt{3}, 1+\sqrt{3}\right)$ (C) $\left(1-\sqrt{3}, \ -1+\sqrt{3}\right)$ (D) $\left(1-\sqrt{3}, 1+\sqrt{3}\right)$

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**146.** If the vertices P,Q,R of a triangle PQR are rational points, which of the following points of thetriangle PQR is/are always rational point(s) ?(A) centroid(B) incentre(C) circumcentre(D) orthocentreAgrawn Korouteden36

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**147.** A straight line $L$ is perpendicular to the line $5x - y = 1$. The area of the triangle formed by line $L$, and the coordinate axes is 5. Find the equation of line $L$.

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**148.** The points on $x + y = 4$ that lie at a unit distance from the line $4x + 3y - 10 =$ are

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**149.** One side of a square makes an angle $\alpha$ with x axis and one vertex of the square is at origin. Prote that the equations of its diagonals are $x(\sin\alpha + \cos\alpha) = y(\cos\alpha - \sin\alpha)$ or $x(\cos\alpha - \sin\alpha) + y(\sin\alpha + \cos\alpha) = a$, where a is the length of the side of the square.

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**150.** Let the algebraic sum of the perpendicular distances from the points $(2, 0), (0, 2) and (1, 1)$ to a variable straight line be zero. Then the line pass through a fixed point whose coordinates are $(1, 1)$ b. $(2, 2)$ c. $(3, 3)$ d. $(4, 4)$

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**151.** The area of a triangle is 5. Two of its vertices are $(2, \ 1)$ and $(3, \ -2)$. The third vertex lies on $y = x + 3$. Find the third vertex.

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**152.** If $(\alpha, \beta)$ is the foot of perpendicular from $(x_1, y_1)$ to line $lx + my + n = 0,$ then (A) $\frac{x_1 - \alpha}{l} = \frac{y_1 - \beta}{m}$ (B) $\left.\frac{x - 1 - \alpha}{l}\right) = \frac{lx_1 + my_1 + n}{l^2 + m^2}$ (C) $\frac{y_1 - \beta}{m} = \frac{lx_1 + my_1 + n}{l^2 + m^2}$ (D) $\frac{x - \alpha}{l} = \frac{l\alpha + m\beta + n}{l^2 + m^2}$

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**153.** The range of value of $\alpha$ such that $(0, \alpha)$ lies on or inside the triangle formed by the lines y + 3x + 2 = 0, 3y - 2x - 5 = 0, 4y + x - 14 =0 is

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**154.** The equation of two equal sides AB and AC of an isosceies triangle ABC are $x+y=5$ and $7x-y=3$respectively Find the equations of the side BC if the area of the triangle ofABC is 5 units

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**155.** Two sides of a triangle are $(a+b)x+(a-b)y-2ab=0$ and $(a-b)x+(a+b)y-2ab=0$. If the triangle is isosceles and the third side passes through point $(b-a, a-b)$, then the equation of third side can be

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**156.** (1) If coordinates of centroid and circumcentre of a triangle are known, coordinates of its orthocentre can be obtained. (2) Centroid, circumcentre and orthocentre of a triangle are collinear. (A) Both 1 and 2 are true and 2 is the correct explanation of 1 (B) Both 1 and 2 are true and

2 is not a correct explanation of 1 (C) 1 is true but 2 is false (D) 1 is false but 2 is true

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**157.** Let $P, Q, R$ be three non-collinear points having rational coordinatse. (1) Coordinates of incentre of $\Delta PQR$ are rational (2) Incentre of a triangle is the point of intersection of internal bisectors of angle of the triangle. (A) Both 1 and 2 are true and 2 is the correct explanation of 1 (B) Both 1 and 2 are true and 2 is not a correct explanation of 1 (C) 1 is true but 2 is false (D) 1 is false but 2 is true

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**158.** Let $O$ be the origin and $P \equiv (a, a^2)$. (1) If $P(a, a^2)$ lies in the first quadrant between the lines $y = x$ and $y = 2x$, then $1 < a < 2$. (2) Slope of $OP$ is $a$. (A) Both 1 and 2 are true and 2 is the correct explanation of 1 (B) Both 1 and 2 are true and 2 is not a correct explanation of 1 (C) 1 is true but 2 is false (D) 1 is false but 2 is true

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159. Lines $15x - 18y + 1 = 0, 12x + 10y - 3 = 0$ and $6x + 66y - 11 = 0$ donot form a triangle. (2)|(15, -18, 1), (12, 10, -3), (6, 66, -11)|=0` (A) Both 1 and 2 are true and 2 is the correct explanation of 1 (B) Both 1 and 2 are true and 2 is not a correct explanation of 1 (C) 1 is true but 2 is false (D) 1 is false but 2 is true

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160. If the line $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ cut the coordinate axes in concyclic points, prove that : $a_1a_2 = b_1b_2$.

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**161.** (1) The straight lines $(2k+3)x+(2-k)y+3=0$, where $k$ is a variable, pass through the fixed point $\left(-\frac{3}{7}, -\frac{6}{7}\right)$. (2) The family of lines $a_1x+b_1y+c_1+k(a_2x+b_2y+c_2)=0$, where $k$ is a variable, passes through the point of intersection of lines $a_1x+b_1y+c_1=0$ and a_2 x+ b_2 y + c_2 = 0` (A) Both 1 and 2 are true and 2 is the correct explanation of 1 (B) Both 1 and 2 are true and 2 is not a correct explanation of 1 (C) 1 is true but 2 is false (D) 1 is false but 2 is true

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**162.** (1) The lines $y=3x+1$ and $2y=x+3$ are equally inclined to the line $y=\left(1-5\frac{\sqrt{2}}{7}x+5\right.$. (2) The line $y=\left(1-5\frac{\sqrt{2}}{7}x+5\right.$ is parallel to a bisector of the angle between lines $y=3x+1$ and $2y=x+3$. (A) Both 1 and 2 are true and 2 is the correct explanation of 1 (B) Both 1 and 2 are true and 2 is not a correct explanation of 1 (C) 1 is true but 2 is false (D) 1 is false but 2 is true

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**163.** Area of the rhombus formed by the lines $ax \pm by \pm c = 0$ is (A) $2\frac{c^2}{|ab|}$ (B) $\frac{|ab|}{2}c^2$ (C) $\frac{c^2}{|ab|}$ (D) $\frac{|ab|}{c^2}$

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**164.** Prove that the area of the parallelogram formed by the lines

$x \cos \alpha + y \sin \alpha = p, x \cos \alpha + ys \in \alpha = q, x \cos \beta + y \sin \beta = randx \cos$

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**165.** The image of line $2x + y = 1$ in line $x + y + 2 = 0$ is : (A) $x + 2y - 7 = 0$ (B) $2x + y - 7 = 0$ (C) $x + 2y + 7 = 0$ (D) $2x + y + 7 = 0$

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166. Image of ellipse $4x^2 + 9y^2 = 36$ in the line $y = x$ is : (A) $9x^2 + 4y^2 = 36$ (B) $3x^2 + 2y^2 = 36$ (C) $2x^2 + 3y^2 = 36$ (D) none of these

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167. The mirror image of the parabola $y^2 = 4x$ in the tangent to the parabola at the point (1, 2) is $(x - 1)^2 = 4(y + 1)$ (b) $(x + 1)^2 = 4(y + 1)$ $(x + 1)^2 = 4(y - 1)$ (d) $(x - 1)^2 = 4(y - 1)$

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168. Two equal sides of an isosceles triangle are $7x - y + 3 = 0, x - y - 3 = 0$ and its third side passes through the point $(1, 0)$ the equation of the third side is (A) $3x + y + 7 = 0$ (B) $x - 3y + 29 = 0$ (C) $3x + y + 3 = 0$ (D) $3x + y - 3 = 0$

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**169.** Two consecutive sides of a parallelogram are $4x + 5y = 0$ and $7x + 2y = 0$. If the equation of one diagonal is $11x = 7y = 9,$ find the equation of the other diagonal.

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**170.** Lines $L_1 \equiv ax + by + c = 0$ and $L_2 \equiv lx + my + n = 0$ intersect at the point $P$ and make an angle $\theta$ with each other. Find the equation of a line different from $L_2$ which passes through $P$ and makes the same angle $\theta$ with $L_1$.

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**171.** The equation of sides $BC, CA, AB$ of a triangle $ABC$ are $ax + by + c = 0, lx + my + n = 0$ and $px + qy + r = 0$ respectively, then the line : $\dfrac{px + qy + r}{ap + bq} = \dfrac{lx + my + n}{al + mb}$ is (A) perpendicular to AB (B) perpendicular to AC (C) perpendicular to BC (D) none of these

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**172.** If $a$ and $b$ are parameters, then each line of the family of lines $x(a+2b)+y(a-3b)=a-b$ passes through the point whose distance from origin is : (A) $\frac{3}{5}$ (B) $\frac{\sqrt{13}}{5}$ (C) $\frac{\sqrt{11}}{5}$ (D) $\frac{4}{5}$

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**173.** For each natural number k, let $C_k$ denotes the circle radius k centimeters in the counter-clockwise direction.After completing its motion on $C_k$, the particle moves to $C_{k+1}$ in the radial direction. The motion of the particle continues in this manner. The particle starts at (1,0).If the particle crosses the the positive direction of the x-axis for first time on the circle $C_n$,then n equal to

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**174.** A line cuts the x-axis at $A(7, 0)$ and the y-axis at $B(0, \ -5)$ A variable line PQ is drawn perpendicular to AB cutting the x-axis in P and the y-axis in Q. If AQ and BP intersect at R, find the locus of R

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**175.** A straight line $l$ passes through a fixed point (6, 8). If locus of the foot of perpendicular on line $l$ from origin is a circle, then radius of this circle is ... .

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**176.** A line is such that its segment between the lines $5x - y + 4 = 0$ and $3x + 4y - 4 = 0$ is bisected at the point (1,5). Obtain its equation.

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**177.** A straight line $L$ is perpendicular to the line $5x - y = 1$ . The area of the triangle formed by line $L,$ and the coordinate axes is 5. Find the equation of line $L.$

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**178.** A line $4x + y = 1$ passes through the point A(2,-7) and meets line BC at B whose equation is $3x - 4y + 1 = 0$, the equation of line AC such that $AB = AC$ is (a) 52x +89y +519=0(b) 52x +89y-519=0 c) 82x +52y+519=0 (d) 89x +52y -519=0

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**179.** Let AB be a line segment of length 4 with A on the line $y = 2x$ and B on the line $y = x$. The locus of the middle point of the line segment is

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**180.** Let O(0,0), P(3,4), Q(6,0) be the vertices of the triangle OPQ. The point R inside the triangles OPQ is such that the triangles OPR, PQR, OQR are of equal area. The coordinates of R are (1) $\left(\frac{4}{3}, 3\right)$ (2) $\left(3, \frac{2}{3}\right)$ (3) $\left(3, \frac{4}{3}\right)$ (4) $\left(\frac{4}{3}, \frac{2}{3}\right)$

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**181.** Let $S$ be a square of nit area. Consider any quadrilateral, which has none vertex on each side of $S$. If $a, b, c and d$ denote the lengths of the sides of het quadrilateral, prove that $2 \leq a^2 + b^2 + c^2 + x^2 \leq 4.$

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**182.** The equations of two sides of a triangle are $3x - 2y + 6 = 0 \; and \; 4x + 5y - 20 \; and$ the orthocentre is (1,1). Find the equation of the third side.

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**183.** Let the four consecutive compartments made by the lines $2x - 3y + 1 = 0$ and $3x - 5y + 2 = 0$ be I, II, III and IV respectively. Let (0, 0) belong to compartment I. We associate four numbers 100, 200, 300 and 400 to the compartments I, II, III and IV respectively. Then the number associated to the compartment in which $(-1, 1)$ belong is ...

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**184.** A ray of light is sent along the line $x - 2y - 3 = 0$. On reaching the line $3x - 2y - 5 = 0$, the ray is reflected from it. If the equation of reflected ray be $ax - 2y = c$, where $a$ and $c$ are two prime numbers differing by 2, then $a + c =$

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**185.** Consider the lines given by : $L_1 : x + 3y - 5 = 0, L_2 : 3x - ky - 1 = 0, L_3 : 5x + 2y - 12 = 0$ If $a$ be the value of $k$ for which lines $L_1, L_2, L_3$ do not form a triangle and $c$ be the value of $k$ for which one of $L_1, L_2, L_3$ is parallel to at least one of the other lines, then $abc =$

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**186.** A ray of light emanating from $(-4, 3)$ after reflection from x-axis at $(\alpha - 0)$ is normal to circle $x^2 + y^2 - 10x - 2y + 25 = 0$, then $4\alpha =$

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**187.** If the quadrilateral formed by the lines $ax + by + c = 0, 6\sqrt{3}x + 8\sqrt{3}y + k = 0,$ $ax + by + k = 0$ and $6\sqrt{3}x + 8\sqrt{3}y + c = 0$ has diagonals at right angles, then the value of $a^2 + b^2 = \dots$

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**188.** A straight line l with negative slope passes through (8,2) and cuts the coordinate axes at P and Q. Find absolute minimum value of "OP+OQ where O is the origin-

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