MATHS

BOOKS - CENGAGE MATHS (ENGLISH)

COORDINATE SYSYEM

Illustration 1 1

1. Number of points with integral co-ordinates that lie inside a triangle whose co-ordinates are (0, 0), (0, 21) and (21,0).

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Illustration 1 2

1. 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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Illustration 1 3

1. At what point should the origin be shifted if the coordinates of a point $(4, 5)$ become $(-3, 9)$?

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Illustration 1 4

1. If the axes are shifted to the point $(1, -2)$ without rotation, what do the following equations become? $2x^2 + y^2 - 4x + 4y = 0$ $y^2 - 4x + 4y + 8 = 0$

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Illustration 1 5

1. Shift the origin to a suitable point so that the equation $y^2 + 4y + 8x - 2 = 0$ will not contain a term in y and the constant term.

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Illustration 1 6

1. The equation of curve referred to the new axes, axes retaining their directions, and origin $(4, 5)$ is $X^2 + Y^2 = 36$. Find the equation referred to the original axes.

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Illustration 1 7

1. The axes are rotated through an angle $\pi/3$ in the anticlockwise direction with respect to $(0, 0)$. Find the coordinates of point $(4, 2)$ (w.r.t. old coordinate system) in the new coordinates system.

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Illustration 1 8

1. The equation of a curve referred to a given system of axes is $3x^2 + 2xy + 3y^2 = 10$. Find its equation if the axes are rotated through an angle 45^0 , the origin remaining unchanged.

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Illustration 1 9

1. If θ is an angle by which axes are rotated about origin and equation $ax^2 + 2hxy + by^2 = 0$ does not contain xy term in the new system, then prove that $\tan 2\theta = \frac{2h}{a-b}$.

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Illustration 1 10

1. In any triangle ABC, prove that $AB^2 + AC^2 = 2(AD^2 + BD^2)$, where D is the midpoint of BC.

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Illustration 1 11

1. Find the coordinates of the circumcenter of the triangle whose vertices are $(A(5, -1), B(-1, 5),$ and $C(6, 6)$. Find its radius also.

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Illustration 1 12

1. Two points $O(0, 0)$ and $A(3, \sqrt{3})$ with another point P form an equilateral triangle. Find the coordinates of P.

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Illustration 1 13

1. If the coordinates of any two points Q_1 and Q_2 are (x_1, y_1) and (x_2, y_2), respectively, then prove that $OQ_1 \times OQ_2 \cos(\angle Q_1 O Q_2) = x_1 x - 2 + y - 1 y_2,$ whose O is the origin.

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Illustration 1 14

1. 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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Illustration 1 15

1. Find the area of a triangle having vertices $A(3, 2), B(11, 8),$ and $C(8, 12)$.

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Illustration 1 16

1. Prove that the area of the triangle whose vertices are $(t, t-2), (t+2, t+2),$ and $(t+3, t)$ is independent of t.

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Illustration 1 17

1. Find the area of the quadrilateral $ABCD$ having vertices $A(1, 1), B(7, -3), C(12, 2),$ and $D(7, 21)$.

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Illustration 1 18

1. For what value of k are the points $(k, 2 - 2k), (-k + 1, 2k) and (-4 - k, 6 - 2k)$ collinear?

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Illustration 1 19

1. If the coordinates of two points A and B are (3, 4) and $(5, -2)$, respectively, find the coordinates of any point P if $PA = PB$. Area of PAB is 10 sq. units.

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Illustration 1 20

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

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Illustration 1 21

1. Given points $P(2, 3), Q(4, -2), \text{ and } R(\alpha, 0)$. Find the value of a if $PR + RQ$ is minimum.

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Illustration 1 22

1. If $A\left(\frac{3}{\sqrt{2}}, \sqrt{2}\right)$, $B\left(-\frac{3}{\sqrt{2}}, \sqrt{2}\right), C\left(-\frac{3}{\sqrt{2}}, -\sqrt{2}\right)$ and $D(3\cos\theta, 2\sin\theta)$ are four points . If the area of the quadrilateral ABCD is maximum where $\theta \in \left(3\frac{\pi}{2}, 2\pi\right)$ then (a) maximum area is 10 sq units (b) $\theta = 7\frac{\pi}{4}$ (c) $\theta = 2\pi - \frac{\sin^{-1} 3}{\sqrt{85}}$ (d) maximum area is 12 sq units

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Illustration 1 23

1. Find the coordinates of the point which divides the line segments joining the points $(6, 3)$ and $(-4, 5)$ in the ratio $3:2$ (i) internally and (ii) externally.

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Illustration 1 24

1. A(1, 1) and B(2,-3) are two points and D is a point on AB produced such that AD = 3AB. Find the co-ordinates of D.

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Illustration 1 25

1. Determine the ratio in which the line $3x + y - 9 = 0$ divides the segment joining the points (1,3) and $(2, 7)$.

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Illustration 1 26

1. Prove that the points $(-2, -1), (1, 0), (4, 3),$ and (1,2) are the vertices of a parallelogram. Is it a rectangle?

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Illustration 1 27

1. Let $A_1, A_2, A_3, \ldots, A_n$ are n Points in a plane whose coordinates are $(x_1, y_1), (x_2, y_2), \ldots., (x_n, y_n)$ respectively. A_1A_2 is bisected at the point P_1, P_1A_3 is divided in the ratio $1:2$ at P_2, P_2A_4 is divided in the ratio $1:3$ at P_3, P_3A_5 is divided in the ratio $1:4$ at P_4 and the so on until all n points are exhausted. find the coordinates of the final point so obtained.

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Illustration 1 28

1. If vertex A of triangle ABC is $(3, 5)$ and centroid is $(-1, 2)$, then find the midpoint of side BC.

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Illustration 1 29

1. 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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Illustration 1 30

1. If $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$ are the vertices of traingle ABC and $x_1^2 + y_1^2 = x_2^2 + y_2^2 = x_3^2 + y_3^2,$ then show that $x_1 \sin 2A + x_2 \sin 2B + x_3 \sin 2C = y_1 \sin 2A + y_2 \sin 2B + y_3 \sin 2C = 0$

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Illustration 1 31

1. If ΔABC having vertices $A(a\cos\theta_1, a\sin\theta_1), B(a\cos\theta_2, a\sin\theta_2),$ and $C(a\cos\theta_3, a\sin\theta_3)$ are equilateral triangle, then prove that $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$ and $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 0$

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Illustration 1 32

1. Find the orthocentre of the triangle whose vertices are $(0, 0), (3, 0),$ and $(0, 4)$.

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Illustration 1 33

1. If a vertex, the circumcenter, and the centroid of a triangle are (0, 0), (3,4), and (6, 8), respectively, then the triangle must be (a) a right-angled triangle (b) an equilateral triangle (c) an isosceles triangle (d) a right-angled isosceles triangle

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Illustration 1 34

1. If the circumcenter of an acute-angled triangle lies at the origin and the centroid is the middle point of the line joining the points (a^2+1, a^2+1) and $(2a, -2a)$, then find the orthocentre.

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Illustration 1 35

1. Orthocenter and circumcenter of a $\text{triangle} ABC$ are $(a, b) and (c, d)$, respectively. If the coordinates of the vertex A are (x_1, y_1), then find the coordinates of the middle point of BC.

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Illustration 1 36

1. If a vertex of a triangle is $(1, 1)$, and the middle points of two sides passing through it are $-2, 3)$ and $(5, 2)$, then find the centroid and the incenter of the triangle.

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Illustration 1 37

1. The vertices of a triangle are $A(-1, -7), B(5, 1) and C(1, 4)$. If the internal angle bisector of $\angle B$ meets the side AC in D, then find the length AD.

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Illustration 1 38

1. Determine x so that the line passing through $(3, 4) and (x, 5)$ makes an angle of 135^0 angle with positive direction of x-axis

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Illustration 1 39

1. Which line is having the greatest inclination with the positive direction of the x-axis ?

(i) Line joining the points (1,3) and (4,7)

(ii) Line $3x - 4y + 3 = 0$

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Illustration 1 40

1. If the point $(2, 3), (1, 1), and(x, 3x)$ are collinear, then find the value of $x,$ using slope method.

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Illustration 1 41

1. If the points $(a, 0), (b, 0), (0, c)and(0, d)$ are concyclic $(a, b, c, d > 0)$, then prove that $ab = c.$.

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Illustration 1 42

1. If $A(-2, 1), B(2, 3) and C(-2, -4)$ are three points, find the angle between $BA and BC$.

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Illustration 1 43

1. Angle of a line with the positive direction of the x-axis is θ . The line is rotated about some point on it in anticlockwise direction by angle 45^{0} and its slope becomes 3. Find the angle θ.

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Illustration 1 44

1. Let $A(6,4) and B(2,12)$ be two given point. Find the slope of a line perpendicular to AB.

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Illustration 1 45

1. If line $3x-ay-1=0$ is parallel to the line $(a+2)x-y+3=0$ then find the values of a.

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Illustration 1 46

1. If $A(2,\ -1) and B(6,5)$ are two points, then find the ratio in which the food of the perpendicular from $(4,1)$ to AB divides it.

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Illustration 1 47

1. If $(b_2 - b_1)(b_3 - b_1) + (a_2 - a_1)(a_3 - a_1) = 0$, then prove that the circumcenter of the triangle having vertices $(a_1, b_1), (a_2, b_2)$ and (a_3, b_3) is $\left(\frac{a_2 + a_3}{2}, \frac{b_2 + b_3}{2}\right)$.

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Illustration 1 48

1. Find the orthocentre of ABC with vertices $A(1, 0), B(-2, 1)$, and $C(5, 2)$

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Illustration 1 49

1. Two medians drawn from the acute angles of a right angled triangle intersect at an angle $\frac{\pi}{6}$. If the length of the hypotenuse of the triangle is $3 units,$ then the area of the triangle (in sq. units) is $\sqrt{3}$ (b) 3 (c) $\sqrt{2}$ (d) 9

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Illustration 1 50

1. Plot the poitns whose coordinate are given below.

(i) $(2, 3\pi)$

(ii) $(2, -2\pi/3)$

(iii) $(-3, 3\pi/4)$.

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Illustration 1 51

1. Convert the following points from polar coordinates to the corresponding Cartesian coordinates.

(i) $(2, \pi / 3)$

(ii) $(0. \pi / 2)$

(iii) $\left(- \sqrt{2}, \pi / 4\right)$

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Illustration 1 52

1. Convert the following Cartesian coordinates to the corresponding polar coordinates using positive r and negative r. (i) $(ii)(iii)((iv)(v) - 1, 1(vi))(vii)$ (viii) (ii) $(ix)(x)((xi)(\xi i)2, - 3(xiii))(xiv)$ (xv)

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Illustration 1 53

1. Convert Cartesian equation $y = 10$ into a polar equation.

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Illustration 1 54

1. Express the polar equation $r = 2\cos\theta$ in rectangular coordinates.

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Illustration 1 55

1. Convert $x^2 - y^2 = 4$ into a polar equation.

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Illustration 1 56

1. Convert $r \sin \theta = r \cos \theta + 4$ into its equivalent Cartesian equation.

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Illustration 1 57

1. Convert $r = \cos ec\theta e^{r \cos \theta}$ into its equivalent Cartesian equation.

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Illustration 1 58

1. Find the maximum distance of any point on the curve $x^2 + 2y^2 + 2xy = 1$ from the origin.

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Illustration 1 59

1. The sum of the squares of the distances of a moving point from two fixed points (a,0) and $(-a, 0)$ is equal to a constant quantity $2c$. Find the equation to its locus.

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Illustration 1 60

1. Find the locus of a point, so that the join of $(-5, 1)$ and $(3, 2)$ subtends a right angle at the moving point.

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Illustration 1 61

1. Find the locus of a point such that the sum of its distances from the points (0, 2) and (0, -2) is 6.

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Illustration 1 62

1. AB is a variable line sliding between the coordinate axes in such a way that A lies on the x-axis and B lies on the y-axis. If P is a variable point on AB such that $PA = b, Pb = a$, and $AB = a + b,$ find the equation of the locus of P.

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Illustration 1 63

1. Two points $P and Q$ are given. R is a variable point on one side of the line PQ such that $\angle RPQ - \angle RQP$ is a positive constant 2α. Find the locus of the point R.

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Illustration 1 64

1. If the coordinates of a variable point P are $(a\cos\theta, b\sin\theta)$, where θ is a variable quantity, then find the locus of P.

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Illustration 1 65

1. Find the locus of the point $\left(t^2 - t + 1, t^2 + t + 1\right), t \in R$.

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Illustration 1 66

1. Line segment joining $(5, 0)$ and $(10\cos\theta, 10\sin\theta)$ is divided by a point P in ratio $2:3$ If θ varies then locus of P is a ; A) Pair of straight lines C) Straight line B) Circle D) Parabola

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Illustration 1 67

1. if $A(\cos\alpha, \sin\alpha), B(\sin\alpha, -\cos\alpha), C(1, 2)$ are the vertices of Triangle ABC, Find the locsus of its centroid.

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Solved Examples

1. 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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2. Prove that the circumcenter, orthocentre, incenter, and centroid of the triangle formed by the points $A(-1, 11), B(-9, -8),$ and $C(15, -2)$ are collinear, without actually finding any of them.

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3. A rod of length k slides in a vertical plane, its ends touching the coordinate axes. Prove that the locus of the foot of the perpendicular from the origin to the rod is $\left(x^2+y^2\right)^3=k^2x^2y^2.$

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4. OX and OY are two coordinate axes. On OY a fixed point $P(0, c)$ is taken and on OX any point Q is taken. On PQ, an equilateral triangle is described, its vertex R being on the side of PQ away from O. Then prove that the locus of R is $y = \sqrt{3}x - c$

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5. If (x, y) and (x, y) are the coordinates of the same point referred to two sets of rectangular axes with the same origin and it $ux + vy$, where u and v are independent of $xandy$, becomes $VX + UY$, show that $u^2 + v^2 = U^2 + V^2$.

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6. What does the equation $2x^2 + 4xy - 5y^2 + 20x - 22y - 14 = 0$ become when referred to the rectangular axes through the point

$(-2, -3)$, the new axes being inclined at an angle at 45^0 with the old axes?

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7. Prove that the image of point $P(\cos\theta, \sin\theta)$ in the line having slope $\tan(\alpha/2)$ and passing through origin is $Q(\cos(\alpha-\theta), \sin(\alpha-\theta))$.

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8. 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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9. Two straight lines rotate about two fixed points (-a, 0) and (a, 0) in antic clockwise direction. If they start from their position of coincidence such that one rotates at a rate double of the other, then locus of curve is

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Concept Applications 1 1

1. What is the minimum area of a triangle with integral vertices ?

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2. What is length of the projection of line segment joining points $(2, 3)$ and $(7, 5)$ on x-axis.

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3. Point $P(2, 3)$ goes through following transformations in successtion:

(i) reflection in line $y = x$

(ii) translation of 4 units to the right

(iii) translation of 5 units up

(iv) reflection in y-axis

Find the coordinates of final position of the point .

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4. Find the equation to which the equation $x^2 + 7xy - 2y^2 + 17x - 26y - 60 = 0$ is transformed if the origin is shifted to the point $(2, -3)$, the axes remaining parallel to the original axies.

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5. Without rotating the original coordinate axes, to which point should origin be transferred, so that the equation $x^2 + y^2 - 4x + 6y - 7 = 0$ is changed to an equation which contains no term of first degree?

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6. Given the equation $4x^2 + 2\sqrt{3}xy + 2y^2 = 1$. Through what angle should the axes be rotated so that the term xy is removed from the transformed equation.

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Concept Applications 1 2

1. Show that the distance between the points $P(a\cos\alpha, a\sin\alpha)$ and $Q(a\cos\beta, a\sin\beta)$ is $2a\frac{\sin(a-b)}{2}$

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2. Check how the points A,B and C are situated where $A(4, 0), B(-1, -1), C(3, 5)$.

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3. If the points $(1, 1): (0, \sec^2\theta)$; and $(\cos ec^2\theta, 0)$ are collinear, then find the value of θ

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4. Area of the regular hexagon whose diagonal is the join of $(2, 4)$ and $(6, 7)$ is

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5. Let $ABCD$ be a rectangle and P be any point in its plane. Show that $AP^2 + PC^2 = PB^2 + PD^2$.

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6. Find the length of altitude through A of the triangle ABC, where $A \equiv (-3, 0) B \equiv (4, -1), C \equiv (5, 2)$

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7. Find the area of the pentagon whose vertices are $A(1, 1), B(7, 21), C(7, -3), D(12, 2)$, and $E(0, -3)$

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8. Four points $A(6, 3)$, $B(-3, 5)$, $C(4, -2)$ and $D(x, 2x)$ are given in such a way that area of $\frac{DBC}{ABC} = \frac{1}{2}$, find x .

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Concept Applications 1 3

1. If point $P(3, 2)$ divides the line segment AB internally in the ratio of $3:2$ and point $Q(-2, 3)$ divides AB externally in the ratio $4:3$ then find the coordinates of points A and B.

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2. If the point $(x, -1), (3, y), (-2, 3), and(-3, -2)$ taken in order are the vertices of a parallelogram, then find the values of $x and y$.

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3. If the midpoints of the sides of a triangle are $(2, 1), (-1, -3), and(4, 5),$ then find the coordinates of its vertices.

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4. 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 $x + y\tan\left(\frac{\alpha+\beta}{2}\right) = 0.$

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5. If the middle points of the sides of a triangle are $(-2, 3), (4, -3), and (4, 5)$, then find the centroid of the triangle.

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6. Find the incentre of the triangle with vertices $(1, \sqrt{3}), (0, 0)$ and $(2, 0)$

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7. If $(1, 4)$ is the centroid of a triangle and the coordinates of its any two vertices are $(4, -8)$ and $(-9, 7)$, find the area of the triangle.

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8. 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 of $\text{Delta} ABC$ coincides with the origin and $H(x, y)$ is the orthocentre, show that $\frac{y}{x} = \frac{\sin\theta_1 + s \int h\eta_2 + \sin\theta_3}{\cos\theta_1 + \cos\theta_2 + \cos\theta_3}$

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9. If $(x_i, y_i), i = 1, 2, 3$ are the vertices of an equilateral triangle such that

$$(x_1 + 2)^2 + (y_1 - 3)^2 = (x_2 + 2)^2 + (y_2 - 3)^2 = (x_3 + 2)^2 + (y_3 - 3)^2$$

, then find the value of $\frac{x_1 + x_2 + x_3}{y_1 + y_2 + y_3}$

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10. about to only mathematics

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Concept Applications 1 4

1. The line joining the points $(x, 2x) and (3, 5)$ makes an obtuse angle with the positive direction of the x-axis. Then find the values of x.

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2. If the line passing through $(4, 3) and (2, k)$ is parallel to the line $y = 2x + 3,$ then find the value of k.

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3. Triangle ABC lies in the cartesian plane and has an area of 70 sq. units. The coordinates of B and C are $(12, 19)$, and $(23, 20)$ respectively. The line containing the median to the side BC has slope -5. Find the possible coordinates of point A.

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4. For a given point A(0,0), ABCD is a rhombus of side 10 units where slope of AB is $\frac{4}{3}$and slope of AD is $\frac{3}{4}$. The sum of abscissa and ordinate of point C (where C lies in first quadrant) is

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5. The line joining the points $A(2, 1)$, and $B(3, 2)$ is perpendicular to the line $(a^2)x + (a + 2)y + 2 = 0$. Find the values of a.

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6. Find the angle between the line joining the points (1,-2), (3,2) and the line $x + 2y - 7 = 0$

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7. The othocenter of ΔABC with vertices $B(1, -2)$ and $C(-2, 0)$ is $H(3, -1)$.Find the vertex A.

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8. The medians AD and BE of the triangle with vertices $A(0, b), B(0, 0)$ and $C(a, 0)$ are mutually perpendicular. Prove that $a^2 = 2b^2$.

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Concept Applications 1 5

1. Convert the polar coordinates to its equivalent Cartesian coordinates $(2, \pi)$.

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2. Convert the following Cartesian coordinates to the cooresponding polar coordinates using positive r.

(i) $(1, -1)$

(ii) $(-3, -4)$

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3. Convert $2x^2 + 3y^2 = 6$ into the polar equation.

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4. Convert $r = 4\tan\theta\sec\theta$ into its equivalent Cartesian equation.

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5. Find the minimum distance of any point on the line $3x + 4y - 10 = 0$ from the origin using polar coordinates.

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Concept Applications 1 6

1. Find the locus of a point whose distance from (a, 0) is equal to its distance from the y-axis.

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2. The coordinates of the point A and B are $(a, 0)$ and $(-a, 0)$, respectively. If a point P moves so that $PA^2 - PB^2 = 2k^2$, when k is constant, then find the equation to the locus of the point P.

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3. Let A (2,-3) and B(-2,1) be vertices of a triangle ABC. If the centroid of this triangle moves on line 2x + 3y = 1, then the locus of the vertex C is the line :

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4. Q is a variable point whose locus is $2x + 3y + 4 = 0$; corresponding to a particular position of Q, P is the point of section of OQ, O being the origin, such that $OP : PQ = 3 : 1$. Find the locus of P.

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5. Find the locus of the mid-point of the portion of the line $x \cos \alpha + y \sin \alpha = p$ which is intercepted between the axes.

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6. Find the locus of the point of intersection of lines $x\cos\alpha + y\sin\alpha = a$ and $x\sin\alpha - y\cos\alpha = b(\alpha$ is a variable).

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7. A point moves such that the area of the triangle formed by it with the points (1, 5) and $(3, -7) squnits.$ Then, find the locus of the point.

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8. A variable line passing through point $P(2, 1)$ meets the axes at A and B . Find the locus of the circumcenter of triangle OAB (where O is the origin).

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9. A straight line is drawn through $P(3, 4)$ to meet the axis of x and y at $A and B$, respectively. If the rectangle $OACB$ is completed, then find the locus of C.

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Exercises

1. ABC is an isosceles triangle. If the coordinates of the base are $B(1, 3)$ and $C(-2, 7)$, the coordinates of vertex A

A. (1,6)

B. $(-1/2, 5)$

C. $(-5/6, 6)$

D. none of these

Answer: C

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2. If two vertices of a triangle are (1,3) and (4,-1) and the area of triangle is 5 sq. units, then the angle at the third vertex lies in :

A. $\left(0, \frac{\tan^{-1.5}}{4}\right]$

B. $\left(0, \frac{\tan^{-1.5}}{4}\right)$

C. $\left(2\tan^{-1}\frac{5}{4}, 2\right)$

D. none of these

Answer: A

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3. Which of the following sets of points form an equilateral triangle?

$(a)(1, 0), (4, 0), (7, -1)$ $(b)(0, 0), \left(\frac{3}{2}, \frac{4}{3}\right), \left(\frac{4}{3}, \frac{3}{2}\right)$

$(c)\left(\frac{2}{3}, \right), \left(0, \frac{2}{3}\right), (1, 1)$ (d) None of these

A. $(1, 0), (4, 0), (7, -1)$

B. $(0, 0), (3/2, 4/3), 4/3, 3/2)$

C. $(2/3, 0), (0, 2/3), (1, 1)$

D. none of these

Answer: D

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4. A particle p moves from the point $A(0, 4)$ to the point $10, -4)$. The particle P can travel the upper-half plane $\{(x, y) \mid y \geq \}$ at the speed of $1m/s$ and the lower-half plane $\{(x, y) \mid y \leq 0\}$ at the speed of 2 m/s. The coordinates of a point on the x-axis, if the sum of the squares of the travel times of the upper- and lower-half planes is minimum, are (1, 0) (b) (2, 0) (c) (4, 0) (d) (5, 0)

A. (1,0)

B. (2,0)

C. (4,0)

D. (5,0)

Answer: B

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5. If $|x_1y_11x_2y_21x_3y_31| = |a_1b_11a_2b_21a_3b_31|$ then the two triangles with vertices $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ and $(a_1, b_1), (a_2, b_2), (a_3, b_3)$ are equal to area (b) similar congruent (d) none of these

A. equal in area

B. similar

C. congruent

D. none of these

Answer: A

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6. $OPQR$ is a square and M, N are the middle points of the sides $PQandQR$, respectively. Then the ratio of the area of the square to that of triangle OMN is 4:1 (b) 2:1 (c) 8:3 (d) 7:3

A. $4 : 1$

B. $2 : 1$

C. $8 : 3$

D. $7 : 3$

Answer: C

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7. A straight line passing through $P(3, 1)$ meets the coordinate axes at $AandB$. It is given that the distance of this straight line from the origin O is maximum. The area of triangle OAB is equal to

A. $50/3$ sq.units

B. $25/3$ sq.units

C. $20/3$ sq.units

D. $100/3$ sq.units

Answer: A

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8. Let $A \equiv (3, -4), B \equiv (1, 2)\cdot$ Let $P \equiv (2k-1, 2k+1)$ be a variable point such that $PA + PB$ is the minimum. Then k is 7/9 (b) 0 (c) 7/8 (d) none of these

A. $7/9$

B. 0

C. $7/8$

D. none of these

Answer: C

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9. The polar coordinates equivalent to $(-3, \sqrt{3})$ are

A. $\left(2\sqrt{3}, \frac{\pi}{6}\right)$

B. $\left(-2\sqrt{3}, \frac{5\pi}{6}\right)$

C. $\left(2\sqrt{3}, \frac{7\pi}{6}\right)$

D. $\left(2\sqrt{3}, \frac{5\pi}{6}\right)$

Answer: D

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10. If the point $x_1 + t(x_2 - x_1), y_1 + t(y_2 - y_1)$ divides the join of (x_1, y_1) and (x_2, y_2) internally in ratio of $t : 1$ then vlaue of t is

A. $t < 0$

B. $0 < t < 1$

C. $t > 1$

D. $t = 1$

Answer: B

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11. P and Q are points on the line joining $A(-2, 5)$ and $B(3, 1)$ such that $AP = PQ = QB$. Then, the distance of the midpoint of PQ from the origin is 3 (b) $\frac{\sqrt{37}}{2}$ (b) 4 (d) 3.5

A. 3

B. $\sqrt{37/2}$

C. 4

D. 3.5

Answer: B

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12. In triangle ABC, angle B is right angled, $AC = 2$ and $A(2, 2), B(1, 3)$ then the length of the median AD is

A. $\left(\frac{1}{2}\right)$

B. $\sqrt{\frac{5}{2}}$

C. $\frac{5}{\sqrt{2}}$

D. $\frac{1}{\sqrt{2}}$

Answer: B

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13. One vertex of an equilateral triangle is $(2, 2)$ and its centroid is $\left(-\frac{2}{\sqrt{3}}, \frac{2}{\sqrt{3}}\right)$ then length of its side is (a) $4\sqrt{2}$ (b) $4\sqrt{3}$ (c) $3\sqrt{2}$ (d) $5\sqrt{2}$

A. $4\sqrt{2}$

B. $4\sqrt{3}$

C. $3\sqrt{2}$

D. $5\sqrt{2}$

Answer: A

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14. ABCD is a rectangle with $A(-1, 2)$, $B(3, 7)$ and $AB : BC = 4 : 3$. If P is the centre of the rectangle, then the distance of P from each corner is equal to

A. $\frac{\sqrt{14}}{2}$

B. $3\frac{\sqrt{41}}{4}$

C. $2\frac{\sqrt{41}}{3}$

D. $5\frac{\sqrt{41}}{8}$

Answer: D

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15. If $(2, -3), (6, -5)$ and $(-2, 1)$ are three consecutive verticies of a rohmbus, then its area is (a) 24 (b) 36 (c) 18 (d) 48

A. 24

B. 36

C. 18

D. 48

Answer: D

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

A. $\sqrt{7}$

B. $\sqrt{(3-\sqrt{2})^2 + (5-\sqrt{5})^2}$

C. $s\sqrt{34}$

D. none of these

Answer: D

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

A. $n > 2$

B. $n \leq 1$

C. $n \leq 2$

D. $n = 1$

Answer: C

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18. In a $\triangle ABC$ the sides $BC = 5, CA = 4$ and $AB = 3$. If $A(0, 0)$ and the internal bisector of angle A meets BC in D $\left(\frac{12}{7}, \frac{12}{7}\right)$ then incenter of $\triangle ABC$ is

A. $(2, 2)$

B. $(3, 2)$

C. $(2, 3)$

D. $(1, 1)$

Answer: D

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19. If $A(0,0), B(1,0)$ and $C\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ then the centre of the circle for which the lines AB, BC, CA are tangents is

A. $\left(\frac{1}{2}, \frac{1}{4}\right)$

B. $\left(\frac{3}{2}, \frac{\sqrt{3}}{2}\right)$

C. $\left(\frac{1}{2}, \frac{1}{2\sqrt{3}}\right)$

D. $\left(\frac{1}{2}, -\frac{1}{\sqrt{3}}\right)$

Answer: C

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20. Statement 1: If in a triangle, orthocentre, circumcentre and centroid are rational points, then its vertices must also be rational points.

Statement : 2 If the vertices of a triangle are rational points, then the centroid, circumcentre and orthocentre are also rational points.

A. Statement 1 is true, Statement 2 is true and Statement 2 is correct explanation for Statement 1.

B. Statement 1 is true , Statement 2 is true and Statement 2 is not the correct exlpanation for Statement 1.

C. Statement 1 is true, Statement 2 is false.

D. Statement 1 is false, Statement 2 is true.

Answer: D

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21. 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

A. P lies on the line segment RQ

B. Q lies on the segment PR

C. R lies on the line segment PR

D. P,Q,R are non-collinear

Answer: D

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22. If two vertices of a triangle are $(-2, 3)$ and $(5, -1)$ the orthocentre lies at the origin, and the centroid on the line $x + y = 7$, then the third vertex lies at

A. (7,4)

B. (8,14)

C. (12,21)

D. none of these

Answer: D

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23. The vertices of a triangle are $\left(pq, \frac{1}{pq}\right), (pq)\Big), \left(qr, \frac{1}{qr}\right)$, and $\left(rq, \frac{1}{rp}\right)$, where p, q and r are the roots of the equation $y^3 - 3y^2 + 6y + 1 = 0$. The coordinates of its centroid are $(1, 2)$ (b) $(2, -1)$ (c) $(1, -1)$ (d) $(2, 3)$

A. $(1, 2)$

B. $(2, -1)$

C. $(1, -1)$

D. $(2, 3)$

Answer: B

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24. If the vertices of a triangle are $\left(\sqrt{5, 0}\right)$, $(\sqrt{3}, \sqrt{2})$, and $(2, 1)$, then the orthocentre of the triangle is (a) $\left(\sqrt{5}, 0\right)$ (b) $(0, 0)$

$(\sqrt{5}+\sqrt{3}+2, \sqrt{2}+1)$ (d) none of these

A. $(\sqrt{5}, 0)$

B. $(0, 0)$

C. $(\sqrt{5}+\sqrt{3}+2, \sqrt{2}+1)$

D. none of these

Answer: C

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25. Two vertices of a triangle are $(4, -3)\&(-2, 5)$. If the orthocentre of the triangle is at $(1, 2)$, find coordinates of the third vertex .

A. $(-33, -26)$

B. $(33, 26)$

C. $(26, 33)$

D. none of these

Answer: B

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26. In ΔABC if the orthocentre is $(1, 2)$ and the circumcenter is $(0, 0)$ then centroid of ΔABC is.

A. $(1/2, 2/3)$

B. $(1/3, 2/3)$

C. $(2/3, 1)$

D. none of these

Answer: B

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27. A triangle ABC with vertices $A(-1, 0), B\left(-2, \frac{3}{4}\right)$, and $C\left(-3, -\frac{7}{6}\right)$ has its orthocentre at $H\cdot$ Then, the orthocentre of triangle BCH will be $(-3, -2)$ (b) $1, 3)$ $(-1, 2)$ (d) none of these

A. $(-3, -2)$

B. $(1, 3)$

C. $(-1, 2)$

D. none of these

Answer: D

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28. If a triangle ABC, $A \equiv (1, 10)$, circumcenter $\equiv \left(-\frac{1}{3}, \frac{2}{3}\right)$, and orthocentre $\equiv \left(\frac{11}{3}, \frac{4}{3}\right)$, then the coordinates of the midpoint of the side opposite to A are

A. $(1, -11/3)$

B. $(1/5)$

C. $(1, -3)$

D. $(1, 6)$

Answer: A

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29. In the ΔABC, the coordinates of B are $(0, 0)$, $AB = 2$, $\angle ABC = \frac{\pi}{3}$ and the middle point of BC has the coordinates (2,0). The centroid of the triangle is

A. $(1/2, \sqrt{3}/2)$

B. $(5/3, 1/\sqrt{3})$

C. $(4 + \sqrt{3}/3, 1/3)$

D. none of these

Answer: B

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30. If the origin is shifted to the point $\left(\frac{ab}{a-b}, 0\right)$ without rotation, then the equation $(a-b)\left(x^2+y^2\right)-2abx=0$ becomes

A. $(a-b)\left(x^2+y^2\right)-(a+b)xy+abx=a^2$

B. $(a+b)\left(x^2+y^2\right)=2ab$

C. $\left(x^2+y^2\right)=\left(a^2+b^2\right)$

D. $(a-b)^2\left(x^2+y^2\right)=a^2b^2$

Answer: D

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31. A light ray emerging from the point source placed at $P(2, 3)$ is reflected at a point Q on the y-axis. It then passes through the point

$R(5, 10)$. The coordinates of Q are (a) $(0, 3)$ (b) $(0, 2)$ (c) $(0, 5)$ (d) none of these

A. (0,3)

B. (0,2)

C. (0,5)

D. none of these

Answer: C

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32. Point $P(p, 0)$, $Q(q, 0)$, $R(0, p)$, $S(0, q)$ from.

A. parallelogram

B. rhombus

C. cyclic quadrilateral

D. none of these

Answer: C

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33. A rectangular billiard table has vertices at $P(0, 0), Q(0, 7), R(10, 7),$ and $S(10, 0)$. A small billiard ball starts at $M(3, 4)$, moves in a straight line to the top of the table, bounces to the right side of the table, and then comes to rest at $N(7, 1)$. The $y-$ coordinate of the point where it hits the right side is 3.7 (b) 3.8 (c) 3.9 (d) 4

A. 3.7

B. 3.8

C. 3.9

D. 4

Answer: A

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34. ABCD is a square Points $E(4, 3)$ and $F(2, 5)$ lie on AB and CD, respectively,such that EF divides the square in two equal parts. If the coordinates of A are $(7, 3)$,then the coordinates of other vertices can be

A. $(7, 2)$

B. $(7, 5)$

C. $(-1, 3)$

D. $(-1, 5)$

Answer: D

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35. If one side of a rhombus has endpoints (4, 5) and (1, 1), then the maximum area of the rhombus is 50 sq. units (b) 25 sq. units 30 sq. units (d) 20 sq. units

A. 50 sq.units

B. 25 sq.units

C. 30 sq.units

D. 20 sq.units

Answer: B

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36. A rectangle $ABCD$, where $A \equiv (0, 0), B \equiv (4, 0), C \equiv (4, 2) D \equiv (0, 2)$, undergoes the following transformations successively: $f_1(x, y) \overrightarrow{y, x}$ $f_2(x, y) \overrightarrow{x + 3y, y}$ $f_3(x, y) \overrightarrow{(x - y) / 2, (x + y) / 2}\Big)$ The final figure will be square (b) a rhombus a rectangle (d) a parallelogram

A. a square

B. a rhombus

C. a rectangle

D. a parallelogram

Answer: D

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37. If a straight line through the origin bisects the line passing through the given points $(a\cos\alpha, a\sin\alpha)$ and $(a\cos\beta, a\sin\beta)$, then the lines (a) are perpendicular (b) are parallel (c) have an angle between them of $\frac{\pi}{4}$ (d) none of these

A. are perpendicular

B. are parallel

C. have an angle between them of $\pi/4$

D. none of these

Answer: A

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38. Let $A_r, r = 1, 2, 3,$, be the points on the number line such that OA_1, OA_2, OA_3. are in GP, where O is the origin, and the common ratio of the GP be a positive proper fraction. Let M, be the middle point of the line segment $A_r A_{r+1}$. Then the value of $\sum_{r=1}^{\infty} OM_r$ is equal to

(a) $\dfrac{OA_1(OSA_1 - OA_2)}{2(OA_1 + OA_2)}$ (b) $\dfrac{OA_1(OA_2 + OA_1)}{2(OA_1 - OA_2)}$ (c) $\dfrac{OA_1}{2(OA_1 - OA_2)}$ (d) ∞

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39. The vertices of a parallelogram $ABCD$ are $A(3, 1), B(13, 6), C(13, 21)$, and $D(3, 16)$. If a line passing through the origin divides the parallelogram into two congruent parts, then the slope of the line is (a) $\frac{11}{12}$ (b) $\frac{11}{8}$ (c) $\frac{25}{8}$ (d) $\frac{13}{8}$

A. $11/12$

B. $11/8$

C. $25/8$

D. $13/8$

Answer: B

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40. Point A and B are in the first quadrant,point O is the origin. If the slope of OA is 1,slope of OB is 7 and OA=OB,Then slope of AB is: a. -1/5 b. -1/4 c. -1/3 d. -1/2

A. $-1/5$

B. $-1/4$

C. $-1/3$

D. $-1/2$

Answer: D

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41. Let a,b,c be in A.P and x,y,z be in G.P.. Then the points (a, x), (b, y) and (c, z) will be collinear if

A. $x^2 = y$

B. $x = y = z$

C. $y^2 = z$

D. $x = z^2$

Answer: B

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42. If $\sum_{i-1}^{4} \left(x1^2 + y1^2\right) \leq 2x_1x_3 + 2x_2x_4 + 2y_2y_3 + 2y_1y_4$, the points $(x_1, y_1), (x_2, y_2), (x_3, y_3), (x_4, y_4)$ are the vertices of a rectangle collinear the vertices of a trapezium none of these

A. the vertices of a rectangle

B. collinear

C. the vertices of a trapezium

D. none of these

Answer: A

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43. The vertices A and D of square $ABCD$ lie on the positive sides of $x-$ and y-axis , respectively. If the vertex C is the point $(12, 17)$, then the coordinates of vertex B are (a) $(14, 16)$ (b) (15, 3) (c) $17, 5)$ (d) $(17, 12)$

A. (14,16)

B. (15,3)

C. (17,5)

D. (17,12)

Answer: C

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44. 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 (a) $\alpha\beta$ (b) $2\alpha\beta$ (c) $3\alpha\beta$ (d) none

A. $\alpha\beta$

B. $2\alpha\beta$

C. $3\alpha\beta$

D. none

Answer: B

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45. The locus of the moving point whose coordinates are given by $(e^t + e^{-t}, e^t - e^{-t})$ where t is a parameter, is (a) $xy = 1$ (b) $x + y = 2$ (c) $x^2 - y^2 = 4$ (d) $x^2 - y^2 = 2$

A. $xy = 1$

B. $x + y = 2$

C. $x^2 - y^2 = 4$

D. $x^2 - y^2 = 2$

Answer: C

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46. The locus of a point represent by $x = \frac{a}{2}\left(\frac{t+1}{t}\right), y = \frac{a}{2}\left(\frac{t-1}{t}\right)$, where $t = \ \in R - \{0\}$, is

A. $x^2 + y^2 = a^2$

B. $x^2 - y^2 = a^2$

C. $x+y=a$

D. $x-y=a$

Answer: A

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47. Vertices of a variable triangle are $(3,4)$; $(5\cos\theta, 5\sin\theta)$ and $(5\sin\theta, -5\cos\theta)$ where θ is a parameter then the locus of its orthocentre is a. $(x+y-1)^2+(x-y-7)^2=100$ b. $(x+y-7)^2+(x-y-1)^2=100$ c. $(x+y-7)^2+(x+y-1)^2=100$ d. $(x+y-7)^2+(x-y+1)^2=100$

A. 1

B. $1/2$

C. 2

D. $3/2$

Answer: A

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48. Vertices of a variable triangle are $(3, 4); (5\cos\theta, 5\sin\theta)$ and $(5\sin\theta, -5\cos\theta)$ where θ is a parameter then the locus of its orthocentre is a. $(x+y-1)^2+(x-y-7)^2=100$ b. $(x+y-7)^2+(x-y-1)^2=100$ c. $(x+y-7)^2+(x+y-1)^2=100$ d. $(x+y-7)^2+(x-y+1)^2=100$

A. $(x+y-1)^2+(x-y-7)^2=100$

B. $(x+y-7)^2+(x-y-1)^2=100$

C. $(x+y-7)^2+(x+y-1)^2=100$

D. $(x+y-7)^2+(x-y+1)^2=100$

Answer: D

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49. From a point, P perpendicular PM and PN are drawn to x and y axes, respectively. If MN passes through fixed point (a,b), then locus of P is

A. $xy = ax + by$

B. $xy = ab$

C. $xy = bx + ay$

D. $x + y = xy$

Answer: C

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50. The locus of point of intersection of the lines $y + mx = \sqrt{a^2m^2 + b^2}$ and $my - x = \sqrt{a^2 + b^2m^2}$ is

A. $x^2 + y^2 = \frac{1}{a^2} + \frac{1}{b^2}$

B. $x^2 + y^2 = a^2 + b^2$

C. $x^2 + y^2 = a^2 - b^2$

D. $\dfrac{1}{x^2} + \dfrac{1}{y^2} = a^2 - b^2$

Answer: B

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51. If the roots of the equation

$(x_1^2 - a^2)m^2 - 2x_1y_1m + y_1^2 + b^2 = 0(a > b)$ are the slopes of two perpendicular lies intersecting at $P(x_1, y_1)$, then the locus of P is

A. $x^2 + y^2 = a^2 + b^2$

B. $x^2 + y^2 = a^2 - b^2$

C. $x^2 - y^2 = a^2 + b^2$

D. $x^2 - y^2 = a^2 - b^2$

Answer: B

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52. Through point $P(-1, 4)$, two perpendicular lines are drawn which intersect x-axis at Q and R. find the locus of incentre of ΔPQR. a. $x^2 + y^2 + 2x - 8y - 17 = 0$ b. $x^2 - y^2 + 2x - 8y + 17 = 0$ c. $x^2 + y^2 - 2x - 8y - 17 = 0$ d. $x^2 - y^2 + 8x - 2y - 17 = 0$

A. $x^2 + y^2 + 2x - 8y - 17 = 0$

B. $x^2 - y^2 + 2x - 8y + 17 = 0$

C. $x^2 + y^2 - 2x - 8y - 17 = 0$

D. $x^2 - y^2 + 8x - 2y - 17 = 0$

Answer: B

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53. The number of integral points (x,y) (i.e, x and y both are integers) which lie in the first quadrant but not on the coordinate axes and also on the straight line $3x + 5y = 2007$ is equal to

A. 133

B. 135

C. 138

D. 140

Answer: A

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54. The foot of the perpendicular on the line $3x + y = \lambda$ drawn from the origin is C. If the line cuts the x and the y-axis at $A and B$, respectively, then $BC : CA$ is

A. $1 : 3$

B. $3 : 1$

C. $1 : 9$

D. $9 : 1$

Answer: D

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55. The image of $P(a, b)$ on the line $y = \; - x$ is Q and the image of Q on the line $y = x$ is 'R' find the mid-point of 'P' and 'R'

A. $(a + b, b + a)$

B. $((a + b)/2, (b + 2)/2)$

C. $(a - b, b - a)$

D. $(0, 0)$

Answer: D

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56. If the equation of the locus of a point equidistant from the points (a_1, b_1) and (a_2, b_2) is $(a_1 - a_2)x + (b_2 + b_2)y + c = 0$, then the value of C is

A. $a_1^2 - a_2^2 + b_1^2 - b_2^2$

B. $\sqrt{a_1^2 + b_1^2 - a_2^2 - b_2^2}$

C. $\frac{1}{2}\left(a_2^2 + b_2^2 - a_2^2 - b_1^2\right)$

D. $\frac{1}{2}\left(a_1^2 + b_2^2 + a_1^2 + b_2^2\right)$

Answer: D

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57. Consider three lines as follows. $L_1: 5x - y + 4 = 0$ $L_2: 3x - y + 5 = 0$ $L_3: x + y + 8 = 0$ If these lines enclose a triangle ABC and the sum of the squares of the tangent to the interior angles can be expressed in the form $\frac{p}{q}$, where $pandq$ are relatively prime numbers, then the value of $p+q$ is

A. 500

B. 450

C. 230

D. 465

Answer: D

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58. Consider a point A(m,n) , where m and n are positve intergers. B is the reflection of A in the line $y = x$, C is the reflaction of B in the y axis, D is the reflection of C in the x axis and E is the reflection of D is the y axis. The area of the pentagon ABCDE is a. $2m(m+n)$ b. $m(m+3n)$ c. $m(2m+3n)$ d. $2m(m+3n)$

A. $2m(m+n)$

B. $m(m+3n)$

C. $m(2m+3n)$

D. $2m(m+3n)$

Answer: B

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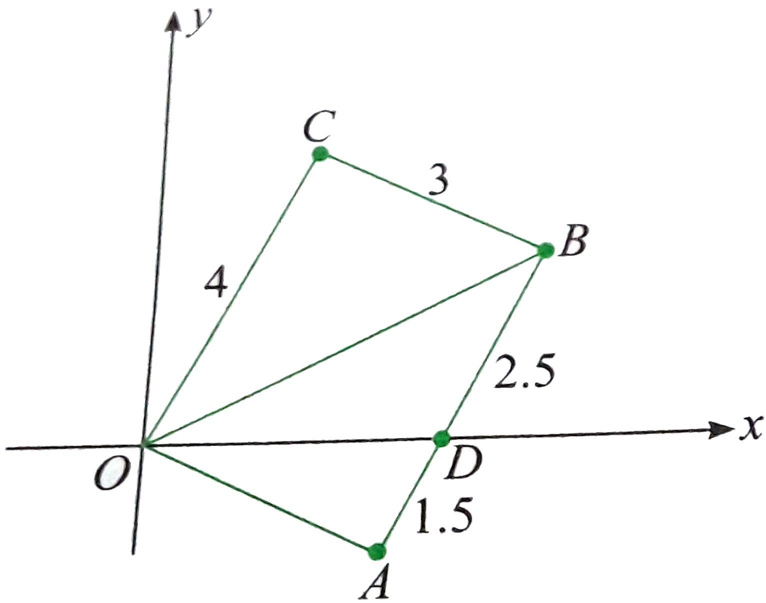
59. In the given figure, OABC is a rectangle. Slope of OB is



a. $1/4$ b. $1/3$

c. $1/2$ d. Cannot be determined

A. $1/4$

B. $1/3$

C. $1/2$

D. Cannot be determined

Answer: C

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Multiple Correct

1. If $(-6, -4), (3, 5), (-2, 1)$ are the vertices of a parallelogram, then the remaining vertex can be $(0, -1)$ (b) $7, 9)$ $(-1, 0)$ (d) $(-11, -8)$

A. $(0, -1)$

B. (7,10)

C. (-1,0)

D. $(-11, -8)$

Answer: B::C::D

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2. Let $0 \equiv (0, 0), A \equiv (0, 4), B \equiv (6, 0)$. Let P be a moving point such that the area of triangle POA is two times the area of triangle POB. The locus of P will be a straight line whose equation can be $x + 3y = 0$ (b) $x + 2y = 0$ $2x - 3y = 0$ (d) $3y - x = 0$

A. $x + 3y = 0$

B. $x + 2y = 0$

C. $2x - 3y = 0$

D. $3y - x = 0$

Answer: A::D

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3. If $) - 4, 0)$ and $(1, -1)$ are two vertices of a triangle of area $4squnits,$ then its third vertex lies on

A. $y = x$

B. $5x + y + 12 = 0$

C. $x + 5y - 4 = 0$

D. $x + 5y + 12 = 0$

Answer: C::D

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4. The area of triangle ABC is $20cm^2$. The coordinates of vertex A are $-5, 0)$ and those of B are $(3, 0)$. The vertex C lies on the line $x - y = 2$. The coordinates of C are

(a)$(5, 3)$ (b) $(-3, -5)$ $(-5, -7)$ (d) $(7, 5)$

A. (5,3)

B. (-3,-5)

C. (-5,-7)

D. (7,5)

Answer: B

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5. If $(a\cos\theta_1, a\sin\theta_1)$, $(a\cos\theta_2, a\sin\theta_2)$, and $(a\cos\theta_3 a\sin\theta_3)$ represent the vertces of an equilateral triangle inscribed in a circle. Then.

A. $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$

B. $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 0$

C. $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 = 0$

D. $\cot\theta_1 + \cot\theta_2 + \cot\theta_3 = 0$

Answer: A::B

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6. If the points $A(0, 0)$, $B(\cos\alpha, \sin\alpha)$, and $C(\cos\beta, \sin\beta)$ are the vertices of a right- angled triangle, then

A. $\sin.\ \dfrac{\alpha-\beta}{2} = \dfrac{1}{\sqrt{2}}$

B. $\cos.\ \dfrac{\alpha-\beta}{2} = \dfrac{1}{\sqrt{2}}$

C. $\cos.\ \dfrac{\alpha-\beta}{2} = -\dfrac{1}{\sqrt{2}}$

D. $\sin.\ \dfrac{\alpha-\beta}{2} = -\dfrac{1}{\sqrt{2}}$

Answer: A::C::D

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7. The ends of a diagonal of a square are $(2, -3)$ and $(-1, 1)$. Another vertex of the square can be (a) $\left(-\frac{3}{2}, -\frac{5}{2}\right)$ (b) $\left(\frac{5}{2}, \frac{1}{2}\right)$ (c) $\left(\frac{1}{2}, \frac{5}{2}\right)$ (d) none of these

A. $(-3, /2, -5/2)$

B. $(5/2, 1/2)$

C. $(1/2, 5/2)$

D. none of these

Answer: A::B

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

A. right-angled

B. equilateral

C. isosceles

D. none of these

Answer: A::C

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9. In a $ABC, A \equiv (\alpha, \beta), B \equiv (1, 2), C \equiv (2, 3),$ point A lies on the line $y = 2x + 3,$ where α, β are integers, and the area of the triangle is S such that $[S] = 2$ where $[\ .]$ denotes the greatest integer function. Then the possible coordinates of A can be $(-7, -11)$ $(-6, -9)$ $(2, 7)$ $(3, 9)$

A. $(-7, -11)$

B. $(-6, -9)$

C. (2,7)

D. (3,9)

Answer: A::B::C::D

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10. In an acute triangle ABC, if the coordinates of orthocentre H are $(4, b)$, of centroid G are $(b, 2b - 8)$ and of circumcenter S are $(-4, 8)$, then b cannot be (a) 4 (b) 8 (c) 12 (d) -12

A. (a) 4

B. (b) 8

C. (c) 12

D. (d) -12

Answer: A::B::C::D

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11. Consider the points $O(0, 0)$, $A(0, 1)$, and $B(1, 1)$ in the x-y plane. Suppose that points $C(x, 1)$ and $D(1, y)$ are chosen such that $0 < x < 1$. And such that $O, C,$ and D are collinear. Let the sum of the area of triangles OAC and BCD be denoted by S. Then which of the following is/are correct?. (a) Minimum value of S is irrational lying in (1 /

3 , 1 / 2) (b) Minimum value of S is irrational in (2 / 3 , 1) . (c) The value of x for the minimum value of S lies in (2 / 3 , 1) . (d) The value of x for the minimum values of S lies in (1 / 3 , 1 / 2) .

A. Minimum value of S is irrational lying in $(1/3, 1/2)$.

B. Minimum value of S is irrational in $(2/3, 1)$.

C. The value of x for the minimum value of S lies in $(2/3, 1)$.

D. The value of x for the minimum values of S lies in $(1/3, 1/2)$.

Answer: A::C

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12. Two sides of a rhombus ABCD are parallel to the lines y = x + 2 and y = 7x + 3 If the diagonals of the rhombus intersect at the point (1, 2) and the vertex A is on the y-axis, then vertex A can be a. (0,3) b. (0,5/2) c. (0,0) d. (0,6)

A. (0,3)

B. (0,5/2)

C. (0,0)

D. (0,6)

Answer: B::C

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

A. (a) $ax + by + 1 = 0$

B. (b) $ax + by = 0$

C. (c) $ax^2 \pm 2bt + y^2 = 0$

D. (d) $ax - by = 0$

Answer: B::D

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Linked

1. For points $P \equiv (x_1, y_1)$ and $Q \equiv (x_2, y_2)$ of the coordinates plane, a new distance d (P,Q) is defined by $d(P, Q) = |x_1 - x_2| + |y_1 - y_2|$. Let $O \equiv (0, 0)$ and $A \equiv (3, 2)$. Consider the set of points P in the first quadrant which are equidistant (with respect to the new distance) from O and A.

The set of poitns P consists of

A. one straight line only

B. union of two line segments

C. union of two infinite rays

D. union of a line segment of finite length and an infinite ray

Answer: D

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2. For points $P \equiv (x_1, y_1)$ and $Q \equiv (x_2, y_2)$ of the coordinates plane, a new distance d (P,Q) is defined by $d(P, Q) = |x_1 - x_2| + |y_1 - y_2|$. Let $O \equiv (0, 0)$ and $A \equiv (3, 2)$. Consider the set of points P in the first quadrant which are equidistant (with respect to the new distance) from O and A.

The area of the ragion bounded by the locus of P and the line $y = 4$ in the first quadrant is

A. 2sq.units

B. 4 sq.units

C. 6 sq.units

D. noen of these

Answer: B

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3. For points $P \equiv (x_1, y_1)$ and $Q \equiv (x_2, y_2)$ of the coordinates plane, a new distance d (P,Q) is defined by $d(P, Q) = |x_1 - x_2| + |y_1 - y_2|$. Let $O \equiv (0, 0)$ and $A \equiv (3, 2)$. Consider the set of points P in the first quadrant which are equidistant (with respect to the new distance) from O and A.

The set of poitns P consists of

A. one -one and onto function

B. many one and onto function

C. one-one and into function

D. relation but not function

Answer: D

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4. Consider the traingle having vertices $O(0, 0)$, $A(2, 0)$, and $B(1, \sqrt{3})$.

Also $b \leq \min\{a_1, a_2, a_3 \ldots . a_n\}$ means $b \leq a_1$ when a_1 is least, $b \leq a_2$

when a_2 is least, and so on. Form this, we can say $b \le a_1, b \le a_2, \dots. b \le a_n$.

Let R be the region consisting of all those points P inside ΔOAB which satisfy $d(P, OA) \le \min[d(P, OB), d(P, AB)]$, where d denotes the distance from the point to the corresponding line. then the area of the region R is

A. $\sqrt{3}$sq,units

B. $(2+\sqrt{3})$ sq.units

C. $\sqrt{3}/2$ sq.units

D. $1/\sqrt{3}$ sq.units

Answer: D

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5. Consider the traingle having vertices $O(0, 0)$, $A(2, 0)$, and $B(1, \sqrt{3})$. Also $b \le \min\{a_1, a_2, a_3 \dots a_n\}$ means $b \le a_1$ when a_1 is least, $b \le a_2$

when a_2 is least, and so on. Form this, we can say $b \leq a_1, b \leq a_2, \ldots . b \leq a_n$.

Let R be the region consisting of all those points P inside ΔOAB which satisfy $d(P, OA) \leq \min[d(P, OB), d(P, AB)]$, where d denotes the distance from the point to the corresponding line. then the area of the region R is

A. $\sqrt{3}$sq,units

B. $1 / \sqrt{3}$ sq.units

C. $\sqrt{3} / 2$sq,units

D. none of these

Answer: B

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6. Let ABCD is a square with sides of unit length. Points E and F are taken om sides AB and AD respectively so that AE= AF. Let P be a point inside the square ABCD.The maximum possible area of quadrilateral CDFE is-

A. $1/8$

B. $1/4$

C. $5/8$

D. $3/8$

Answer: C

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7. Let ABCD be a square with sides of unit lenght. Points E and F are taken on sides AB and AD, respectively,so that $AE = AF$. Let P be a point inside the squre ABCD.

The value of $(PA)^2 - (PB)^2 + (PC)^2 - (PD)^2$ is equal to

A. 3

B. 2

C. 1

D. 0

Answer: D

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8. Let ABCD be a square with sides of unit lenght. Points E and F are taken on sides AB and AD, respectively,so that $AE = AF$. Let P be a point inside the squre ABCD.

Let a line passing through point A divides the sqaure ABD into two parts so that the area of one portion is double the other. then the length of the protion of line inside the square is

A. $\sqrt{10}/3$

B. $\sqrt{13}/3$

C. $\sqrt{11}/3$

D. $2/\sqrt{3}$

Answer: B

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9. Let ABC be an acute- angled triangle and AD, BE, and CF be its medians, where E and F are at (3,4) and (1,2) respectively. The centroid of $\Delta ABC\ G(3, 2)$.

The coordinates of point D is __________

A. (7,-4)

B. (5,0)

C. (7,4)

D. (-3,0)

Answer: B

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10. Let ABC be an acute- angled triangle and AD, BE, and CF be its medians, where E and F are at (3,4) and (1,2) respectively. The centroid of ΔABC $G(3, 2)$.

The coordinates of point D is __________

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Matrix Match Type

1. Match the following lists:

List I	List II
a. Four lines $x + 3y - 10 = 0$, $x + 3y - 20 = 0$, $3x - y + 5 = 0$, and $3x - y - 5 = 0$ form a figure which is	**p.** a quadrilateral which is neither a parallelogram nor a trapezium
b. The points $A(1, 2)$, $B(2, -3)$, $C(-1, -5)$, and $D(-2, 4)$ in order are the vertices of	**q.** a parallelogram
c. The lines $7x + 3y - 33 = 0$, $3x - 7y + 19 = 0$, $3x - 7y - 10$, and $7x + 3y - 4 = 0$ form a figure which is	**r.** a rectangle of area 10 sq. units
d. Four lines $4y - 3x - 7 = 0$, $3y - 4x + 7 = 0$, $4y - 3x - 21 = 0$, $3y - 4x + 14 = 0$ form a figure which is	**s.** a square

6. Match the following lists:

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2. Consider the triangle whose vetices are (0,0) , (5,12) and (16,12).

List I	List II
a. Centroid of the triangle	p. $\left(\frac{21}{2}, \frac{8}{3}\right)$
b. Circumcenter of the triangle	q. (7, 9)
c. Incenter of the triangle	r. (27, −21)
d. Excenter opposite to vertex (5, 12)	s. (7, 8)

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3. Match the following List I to List II

List I	List II
a. The locus of $P(x, y)$ such that $\sqrt{x^2+y^2+8y+16} - \sqrt{x^2+y^2-6x+9} = 5$	**p.** No such point P exists
b. The locus of $P(x, y)$ such that $\sqrt{x^2+y^2+8y+16} - \sqrt{x^2+y^2-6x+9} = \pm 5$	**q.** Line segment
c. The locus of $P(x, y)$ such that $\sqrt{x^2+y^2+8y+16} + \sqrt{x^2+y^2-6x+9} = 5$	**r.** A ray
d. The locus of $P(x, y)$ such that $\sqrt{x^2+y^2+8y+16} - \sqrt{x^2+y^2-6x+9} = 7$	**s.** Two rays

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4.

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Numerical Value

1. Line AB passes through point (2,3) and intersects the positive x and y-axes at A(a,0) and B(0,b) respectively. If the area of ΔAOB is 11. then the value of $4b^2 + 9a^2$ is

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2. A point A divides the join of $P(-5, 1)$ and $Q(3, 5)$ in the ratio $k:1$. Then the integral value of k for which the area of ABC, where B is $(1, 5)$ and C is $(7, -2)$, is equal to 2 units in magnitude is___

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3. The distance between the circumcenter and the orthocentre of the triangle whose vertices are $(0, 0), (6, 8),$ and $(-4, 3)$ is L. Then the value of $\frac{2}{\sqrt{5}}L$ is________

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4. A man strats 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 $|\alpha| = .$

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5. Let $A(0, 1), B(1, 1), C(1, -1), D(-1, 0)$ be four points. If P is any other point, then $PA + PB + PC + PD \geq d$, where $[d]$ represents greatest integer.

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6. A triangle ABC has vertices $A(5, 1), B(-1, -7)$ and $C(1, 4)$ respectively. L be the line mirror passing through C and parallel to AB and a light ray eliminating from point A goes along the direction of internal bisector of the angle A, which meets the mirror and BC at E, D respectively. If sum of the areas of $\triangle ACE$ and $\triangle ABE$ is K sq units then $\frac{2K}{5} - 6$ is

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7. If the area of the triangle formed by the points $(2a, b)(a + b, 2b + a)$, and $(2b, 2a)$ is $2q\dot{u}nits$, then the area of the triangle whose vertices are $(1 + b, a - b), (3b - a, b + 3a)$, and $(3a - b, 3b - a)$ will be____

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8. Lines L_1 and L_2 have slopes m and n, respectively, suppose L_1 makes twice as large angle with the horizontal (mesured counter clockwise from the positive x-axis as does L_2 and L_1 has 4 times the slope of L_2. If L_1 is not horizontal, then the value of the proudct mn equals.

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9. If lines $2x - 3y + 6 = 0$ and $kx + 2y = 12 = 0$ cut the coordinate axes in concyclic points, then the value of $|k|$ is

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10. If from point $P(4, 4)$ perpendiculars to the straight lines $3x + 4y + 5 = 0$ and $y = mx + 7$ meet at Q and R area of triangle PQR is maximum, then m is equal to

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11. 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 $\left(a^2 + 1, a\right)$ is (A) 0 (B) 1 (C) 2 (D) none of these

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12. The maximum area of the convex polyon formed by joining the points $A(0, 0), B(2t^2, 0), C(18, 2), D\left(\frac{8}{r^2}, 4\right)$ and $E(0, 2)$ where $t \in R - \{0\}$ and interior angle at vertex B is greater than or equal to 90° is

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Jee Main

1. The lines $p(p^2 + 1)x - y + q = 0$ and $(p^2 + 1)^2 x + (p^2 + 1)y + 2q = 0$ are perpendicular to a common line for

A. no value of p.

B. exactly one value of p.

C. exactly two values of p.

D. more than two values of p.

Answer: B

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2. If the line 2x + y = k passes through the point which divides the line segment joining the points (1, 1) and (2, 4) in the ratio 3 : 2, then k equals

A. $\frac{29}{5}$

B. 5

C. 6

D. $\frac{11}{5}$

Answer: C

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3. The number of points, having both co-ordinates as integers, that lie in the interior of the triangle with vertices $(0, 0)$, $(0, 41)$ and $(41, 0)$ is

A. 901

B. 861

C. 820

D. 780

Answer: D

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4. Let k be an integer such that the triangle with vertices $(k, -3k), (5, k)$ and $(-k, 2)$ has area $28 sq.$ units. Then the orthocentre of this triangle is at the point : (1) $\left(1, -\frac{3}{4}\right)$ (2) $\left(2, \frac{1}{2}\right)$ (3) $\left(2, -\frac{1}{2}\right)$ (4) $\left(1, \frac{3}{4}\right)$

A. $\left(2, \frac{1}{2}\right)$

B. $\left(2, \ -\frac{1}{2}\right)$

C. $\left(1, \frac{3}{4}\right)$

D. $\left(1, \ -\frac{3}{4}\right)$

Answer: A

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5. Let the orthocentre and centroid of a triangle be $(-3, 5)$ and $B(3, 3)$ respectively. If C is the circumcentre of the triangle then the radrus of the circle having line segment AC as diameter, is

A. $\frac{3\sqrt{5}}{2}$

B. $\sqrt{10}$

C. $2\sqrt{10}$

D. $3\frac{\sqrt{5}}{2}$

Answer: D

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6. The straight line through a fixed point (2,3) intersects the coordinate axes at distinct point P and Q. If O is the origin and the rectangle OPRQ is completed then the locus of R is

A. $3x + 2y = 6xy$

B. $3x + 2y = 6$

C. $2x + 3y = xy$

D. $3x + 2y = xy$

Answer: D

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