MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

CIRCLES - FOR COMPETITION

Solved Examples

1. Find the equation of the circle having the lines $x^2 + 2xy + 3x + 6y = 0$ as its normal and having size just sufficient to contain the circle $x(x-4) + y(y-3) = 0$

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2. Let C denote the circle $x^2 + y^2 - 6y + 5 = 0$. Determine the equaiton of a circle $(sayD)$ which is concentric with C and the angle between the tangents to which (i.e. D) from every point on the circumference of C, is a given constant.

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3. A circle touches x-axis at (2, 0) and has an intercept of 4 units on the y-axis. Find its equation.

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4. $2x - y + 4 = 0$ is a diameter of a circle which circumscribes a rectangle ABCD. If the coordinates of A, B are (4, 6) and (1, 9) respectively, find the area of this rectangle ABCD.

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5. Find the equaiton of the circle passing through the point (2, 8), touching the lines $4x - 3y - 24 = 0$ and $4x + 3y - 42 = 0$ andhaving x-coordinate of the centre of the circle numerically less than or equal to 8.

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6. A circle touches the line $y = x$ at point P such that $OP = 4\sqrt{2}$, Circle contains (-10,2) in its interior & length of its chord on the line $x + y = 0$ is $6\sqrt{2}$. Determine the equation of the circle

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7. Find the equations of the circles touching the lines $y = 0$ and $y = \sqrt{3}(x + 1)$ and having the centres at a distance 1 from the origin.

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8. If the circle C1: $x^2 + y^2 = 16$ intersect another circle C2 of radius 5 in such a way that common chord is of maximum length and has a slope equal to 3/4, then coordinates of the centre of C2 is: a. $\left(\frac{9}{5}, \frac{12}{5}\right)$ b. $\left(\frac{9}{5}, -\frac{12}{5}\right)$ c. $\left(-\frac{9}{5}, -\frac{12}{5}\right)$ d. $\left(-\frac{9}{5}, \frac{12}{5}\right)$

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9. Find the equation to the circle which passes through the origin and cut off equal chords of length $'a'$ from the straight lines $y = xandy = -x$

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10. the values of constant term in the equation of circle passing through $(1, 2)$ and $(3, 4)$ and touching the line $3x + y - 3 = 0$, is

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11. Find the equations of the circles passing through the point $(-4, 3)$ and touching the lines $x + y = 2$ and $x - y = 2$

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12. A circle touches both the x-axis and the line $4x - 3y + 4 = 0$. Its centre is in the third quadrant and lies on the line $x - y - 1 = 0$. Find the equation of the circle.

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13. If $\left(m_i, \frac{1}{m_i}\right), i = 1, 2, 3, 4$ are four distinct points on a circle, show that $m_1 m_2 m_3 m_4 = 1$

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14. Find the equation of the circle passing through the point of intersection of the circles $x^2 + y^2 - 6x + 2y + 4 = 0, x^2 + y^2 + 2x - 4y - 6 = 0$ and with its centre on the line $y = x$.

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15. The equation of the circle described on the common chord of the circles $x^2+y^2-4x-5=0$ and $x^2+y^2+8y+7=0$ as a diameter, is

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16. Show that the circle on the chord $x\cos\alpha+y\sin\alpha-p=0$ of the circle $x^2+y^2=a^2$ as diameter is $x^2+y^2-a^2-2p(x\cos\alpha+y\sin\alpha-p)=0.$

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17. If the circle $x^2+y^2+2gx+2fy+c=0$ bisects the circumference of the circle $x^2+y^2+2g'x+2f'y+c'=0$ then prove that $2g'(g-g')+2f'(f-f')=c-c'$

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18. Show that equation $x^2 + y^2 - 2ay - 8 = 0$ represents, for different values of 'a, asystem of circles"passing through two fixed points A, B on the X-axis, and find the equation ofthat circle of the system the tangents to which at AB meet on the line $x + 2y + 5 = 0$.

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19. A fixed circle is cut by circles passing through two given points $A(x_1, y_1)$ and $B(x_2, y_2)$. Show that the chord of intersection of the fixed circle with any one of the circles, passes through a fixed point.

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20. The line Ax+By+=0 cuts the circle by $x^2 + y^2 + Ax + By + C = 0$at P and Q. The line A'x +B'x+C'=0 cuts the circle

$x^2 + y^2 + a'x + b'y + c' = 0$ at R and S.If P,Q, R and S are concyclic then show that det $\begin{pmatrix} a-a & b-b' & c-c' \\ A & B & C \\ A' & B' & C' \end{pmatrix} = 0$

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21. Two circles $x^2 + y^2 + 2x - 4y = 0$ and $x^2 + y^2 - 8y - 4 = 0$ (A) touch each other externally (B) intersect each other (C) touch each other internally (D) none of these

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22. If the circles $x^2 + y^2 + 2ax + c = 0$ and $x^2 + y^2 + 2by + c = 0$ touch each other, then find the relation between a, b and c.

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23. Prove that the circle $x^2 + y^2 = a^2$ and $(x - 2a)^2 + y^2 = a^2$ are equal and touch each other. Also find the equation of a circle (or circles) of equal radius touching both the circles.

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24. The extremities of a diagonal of a rectangle are $(-4, 4)$ and $(6, -1)$. A circle circumscribes the rectangle and cuts an intercept AB on the y-axis. If Δ be the area of the triangle formed by AB and the tangents to the circle at A and B, then $8\Delta =$.

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25. Extremities of a diagonal of a rectangle are (0, 0) and (4, 3). The equations of the tangents to the circumcircle of the rectangle which are parallel to the diagonal, are

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26. A circle of radius 2 units rools on the outer side of the circle $x^2 + y^2 + 4x = 0$, touching it externally. Find the locus of the centre of this outer circle. Also find the equations of the common tangents of the two circles when the line joining the centres of the two circles makes an angle of 60^0 with x-axis.

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27. Lines $5x + 12y - 10 = 0$ and $5x - 12y - 40 = 0$ touch a circle C1 of diameter 6. If the centre of C1, lies in the first quadrant then the equation of the circle C2, which is concentric with C1, and cuts intercepts of length 8 on these lines is

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28. AB is a diameter of a circle. CD is a chord parallel to AB and $2CD = AB$. The tangent at B meets the line AC produced at E then AE is equal to -

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29. Two parallel tangents to a given circle are cut by a third tangent at the point $RandQ$. Show that the lines from $RandQ$ to the center of the circle are mutually perpendicular.

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30. If $4l^2-5m^2+6l+1=0.$ Prove that $lx+my+1=0$ touches a definite circle. Find the centre & radius of the circle.

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31. Find the equation of the two tangents from the point $(0,1)$ to the circle $x^2+y^2-2x+4y=0$

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32. If from any point P on the circle $x^2 + y^2 + 2gx + 2fy + c = 0$, tangents are drawn to the circle $x^2 + y^2 + 2gx + 2fy + c\sin^2\alpha + (g^2 + f^2)\cos^2\alpha = 0$, then the angle between the tangents is :

(A) α

(B) 2α

(C) $\frac{\alpha}{2}$

(D) $\frac{\alpha}{3}$

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33. Let $2x^2 + y^2 - 3xy = 0$ be the equation of a pair of tangents drawn from the origin O to a circle of radius 3 with centre in the first quadrant. If A is one of the points of contact, then the length of OA is

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34. Tangent drawn from the point $P(4, 0)$ to the circle $x^2 + y^2 = 8$ touches it at the point A in the first quadrant. Find the coordinates of another point B on the circle such that $AB = 4$.

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35. From a point on the line $4x - 3y = 6$, tangents are drawn to the circle $x^2 + y^2 - 6x - 4y + 4 = 0$ which make an angle of $\tan^{-1}\left(\frac{24}{7}\right)$ between them. Find the coordinates of all such points and the equation of tangents.

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36. From a point P, tangents drawn to the circle $x^2 + y^2 + x - 3 = 0, 3x^2 + 3y^2 - 5x + 3y = 0$ and $4x^2 + 4y^2 + 8x + 7y$ are of equal lengths. Find the equation of the circle through P, which touches the line $x + y = 5$ at the point $(6, -1)$.

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37. If the distances from the origin of the centers of three circles $x^2 + y^2 + 2\lambda x - c^2 = 0, (i = 1, 2, 3),$ are in GP, then prove that the lengths of the tangents drawn to them from any point on the circle $x^2 + y^2 = c^2$ are in GP.

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38. If the chord of contact of the tangents drawn from a point on the circle $x^2 + y^2 + y^2 = a^2$ to the circle $x^2 + y^2 = b^2$ touches the circle $x^2 + y^2 = c^2$, then prove that a, b and c are in GP.

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39. Tangent PQ and PR are drawn to the circle $x^2 + y^2 = a^2$ from the pint $P(x_1, y_1)$. Find the equation of the circumcircle of ΔPQR.

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40. Tangents $PT_1,$ and PT_2, are drawn from a point P to the circle $x^2+y^2=a^2$. If the point P line $Px+qy+r=0$, then the locus of the centre of circumcircle of the triangle PT_1T_2 is

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41. Tangents are drawn from the point (h,k) to ^circle $x^2+y^2=a^2$; Prove that the area of the triangle formed by them and the straight line joining their point of contact is $\dfrac{a\left(h^2+k^2-a^2\right)^{\frac{3}{2}}}{h^2+k^2}$

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42. Show that the common tangents to the parabola $y^2=4x$ and the circle $x^2+y^2+2x=0$ form an equilateral triangle.

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43. Find the equation of the circle which passes through the points of intersection of circles $x^2+y^2-2x-6y+6=0$ and $x^2+y^2+2x-6y+6=0$ and intersects the circle $x^2+y^2+4x+6y+4=0$ orthogonally.

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44. Find the length of the chord of the circle $x^2+y^2=4$ through $\left(1, \frac{1}{2}\right)$ which is of minimum length.

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45. Find the equation to the chord of contact of the tangents drawn from an external point $(-3, 2)$ to the circle $x^2+y^2+2x-3=0$.

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46. C1 and C2 are two concentric circles, the radius of C2 being twice that of C1. From a point P on C2, tangents PA and PB are drawn to C1. Then the centroid of the triangle PAB (a) lies on C1 (b) lies outside C1 (c) lies inside C1 (d) may lie inside or outside C1 but never on C1

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47. Let T_1, T_2 and be two tangents drawn from (-2, 0) onto the circle $C: x^2 + y^2 = 1$. Determine the circles touching C and having T_1, T_2 as their pair of tangents. Further, find the equations of all possible common tangents to these circles when taken two at a time

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48. Show that the circles $x^2 + y^2 - 2x - 6y - 12 = 0$ and $x^2 + y^2 + 6x + 4y - 6 = 0$ cut each other orthogonally.

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49. If the equations of two circles, whose radii are r and R respectively, be S = 0 and S' = 0, then prove that the circles $\frac{S}{r} \pm \frac{S'}{R} = 0$will intersect orthogonally

50. Two circles which pass through the points $A(0, a), B(0, -a)$ and touch the line $y = mx + c$ wil cut orthogonally if

51. Obtain the equation of the circle orthogonal to both the circles $x^2 + y^2 + 3x - 5y + 6 = 0$ and $4x^{\circ} + 4y^2 - 28x + 29 = 0$ and whose centre lies on the line $3x + 4y + 1 = 0$

52. The centre of the circle $S = 0$ lie on the line $2x - 2y + 9 = 0 \& S = 0$ cuts orthogonally $x^2 + y^2 = 4$. Show that circle $S = 0$ passes through two fixed points & find their coordinates.

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53. Line 2x+3y+1=0 is a tangent to the circle at (1,-1). This circle is orthogonal to a circle which is drawn having diameter as a line segment with end points (0, -1) and (-2, 3). Then the equation of the circle is

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54. From the point A(0,3) on the circle $x^2 + 4x + (y - 3)^2 = 0$ a chord AB is drawn to a point such that AM = 2AB. The equation of the locus of M is :-

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55. If a circle passes through the point (a, b) and cuts the circle $x^2 + y^2 = k^2$ orthogonally, then the equation of the locus of its center is

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56. Find the locus of the mid-point of the chords of the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ which subtend an angle of 120^0 at the centre of the circle.

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57. Show that the locus of a point such that the ratio of its distances from two given points is constant, is a circle. Hence show that the circle cannot pass through the given points.

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58. Two rods of lengths a and b slide along the x-axis and y-axis respectively in such a manner that their ends are concyclic. The locus of the centre of the circle passing through the end points is:

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59. 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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60. A circle of radius r passes through the origin O and cuts the axes at A and B. Let P be the foot of the perpendicular from the origin to the line AB. Find the equation of the locus of P.

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61. Show that the locus of points from which the tangents drawn to a circle are orthogonal, is a concentric circle. Or Find the equation of the director circle of the circle $x^2 + y^2 = a^2$.

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62. From the origin, chords are drawn to the circle $(x-1)^2 + y^2 = 1$. The equation of the locus of the mid-points of these chords is circle with radius

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63. Let $S \equiv x^2 + y^2 + 2gx + 2fy + c =$ be a given circle. Find the locus of the foot of the perpendicular drawn from the origin upon any chord of S which subtends a right angle at the origin.

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64. Find the locus of the point of intersection of tangents to the circle $x = a\cos\theta, y = a\sin\theta$ at the points whose parametric angles differ by $(i)\frac{\pi}{3}$,

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65. The circles $x^2 + y^2 + 2ax - c^2 = 0$ and $x^2 + y^2 + 2bx - c^2 = 0$ intersect at A and B. A line through A meets one circle at P and a parallel line through B meets the other circle at Q. Show that the locus of the mid-point of PQ is a circle.

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66. A triangle has two of its sides along the axes, its third side touches the circle $x^2 + y^2 - 2ax - 2ay + a^2 = 0$. Find the equation of the locus of the circumcentre of the triangle.

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67. Let a circle be given by $2x(x-1)+y(2y-b)=0, (a \neq 0, b \neq 0)$. Find the condition on $aandb$ if two chords each bisected by the x-axis, can be drawn to the circle from $\left(a, \frac{b}{2}\right)$

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68. Find the intervals of the values of a for which the line $y+x=0$ bisects two chords drawn from the point $\left(\frac{1+\sqrt{2}a}{2}, \frac{1-\sqrt{2}a}{2}\right)$ to the circle $2x^2+2y^2-(1+\sqrt{2}a)x-(1-\sqrt{2}a)=0$

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69. Let C be any circle with centre $(0, \sqrt{2})$. Prove that at most two rational points can be there on C. (A rational point is a point both of whose coordinates are rational numbers)

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70. Find the point P on the circle $x^2 + y^2 - 4x - 6y + 9 = 0$ such that (i) $\angle POX$ is minimum (ii) OP is maximum, where O is the origin and OX is the x-axis.

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71. A circle of diameter $13m$ with the centre O coinciding with the origin of coordinate axes, has the diameter AB on the x-axis (x coordinate of $B > 0$). If the length of the chord AC be $5m$, find the equation of pair of lines BC, C having two possible positions.

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72. The circle $x^2 + y^2 - 6x - 10y + k = 0$ does not touch or intersect the coordinate axes, and the point (1, 4) is inside the circle. Find the range of value of k.

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73. Show that the line 3x-4y-c=0 will meet the circle having center at (2,4) and the radius 5 in real and distinct points if $-35 < c < 15$

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74. (C) 2 45. Three concentric circles of which the biggest is $x^2 + y^2 = 1$, have their radii in A.P If the line $y = x + 1$ cuts all the circles in real and distinct points. The interval in which the common difference of the A.P will lie is:

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75. Consider the family ol circles $x^2 + y^2 = r^2, 2 < r < 5$. If in the first quadrant, the common tangnet to a circle of this family and the ellipse $4x^2 + 25y^2 = 100$ meets the co-ordinate axes at A and B, then find the equation of the locus of the mid-point of AB.

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76. Find the equation of the largest circle with centre (1, 0) that can be inscribed in the ellipse $x^2 + 4y^2 = 16$

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77. The angle between the pair of tangents drawn from a point P to the circle $x^2 + y^2 + 4x - 6y + 9\sin^2\alpha + 13\cos^2\alpha = 0$ is 2α . then the equation of the locus of the point P is $x^2 + y^2 + 4x - 6y + 4 = 0$ $x^2 + y^2 + 4x - 6y - 9 = 0$ $x^2 + y^2 + 4x - 6y - 4 = 0$ $x^2 + y^2 + 4x - 6y + 9 = 0$

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78. If two distinct chords, drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$ (where $pq \neq q$) are bisected by the x-axis, then $p^2 = q^2$ (b) $p^2 = 8q^2$ $p^2 < 8q^2$ (d) $p^2 > 8q^2$

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79. Let C be the circle with centre $(0, 0)$ and radius 3 units. The equation of the locus of the mid points of the chords of the circle C that subtend an angle of $\frac{2\pi}{3}$ at its center is (a) $x^2 + y^2 = \frac{3}{2}$ (b) $x^2 + y^2 = 1$ (c) $x^2 + y^2 = \frac{27}{4}$ (d) $x^2 + y^2 = \frac{9}{4}$

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80. Consider a family of circles which are passing through the point $(-1, 1)$ and are tangent to the x-axis. If (h, k) are the coordinates of the center of the circles, then the set of values of k is given by the interval. $k \geq \frac{1}{2}$ (b) $-\frac{1}{2} \leq k \leq \frac{1}{2}$ $k \leq \frac{1}{2}$ (d) `0

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81. The point diametrically opposite to the point P (1, 0) on the circle $x^2 + y^2 + 2x + 4y - 3 = 0$ is (1) $(3, -4)$ (2) $(-3, 4)$ (3) $(-3, -4)$ (4) $(3, 4)$

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82. If P and Q are the points of intersection of the circles $x^2 + y^2 + 3x + 7y + 2p5 = 0$ and $x^2 + y^2 + 2x + 2yp^2 = 0$, then there is a circle passing through P, Q and $(1, 1)$ for (1) all values of p (2) all except one value of p (3) all except two values of p (4) exactly one value of p

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83. If the circles $x^2 + y^2 + 2x + 2ky + 6 = 0$ and $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally then k equals (A) $2 \text{ or } -\frac{3}{2}$ (B) $-2 \text{ or } -\frac{3}{2}$ (C) $2 \text{ or } \frac{3}{2}$ (D) $-2 \text{ or } \frac{3}{2}$

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84. If the tangent at the point on the circle $x^2 + y^2 + 6x + 6y = 2$ meets the straight ine $5x - 2y + 6 = 0$ at a point Q on the y- axis then the length of PQ is

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85. if $a > 2b > 0$, then positive value of m for which $y = mx - b\sqrt{1+m^2}$ is a common tangent to $x^2 + y^2 = b^2$ and $(x-a)^2 + y^2 = b^2$ is

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86. The radius of the circle, having centre at $(2, 1)$, whose one of the chord is a diameter of the circle $x^2 + y^2 - 2x - 6y + 6 = 0$

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87. Tangents drawn from the point $P(1, 8)$ to the circle $x^2 + y^2 - 6x - 4y - 11 = 0$ touch the circle at the points A and B. The equation of the circumcircle of the triangle PAB is

(A) $x^2 + y^2 + 4x - 6y + 19 = 0$

(B) $x^2 + y^2 - 4x - 10y + 19 = 0$

(C) $x^2 + y^2 - 2x + 6y - 29 = 0$

(D) $x^2 + y^2 - 6x - 4y + 19 = 0$

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88. Let L_1 be a straight line passing through the origin and L_2 be the straight line $x + y = 1$ if the intercepts made by the circle $x^2 + y^2 - x + 3y = 0$ on L_1 and L_2 are equal, then which of the following equations can represent L_1?

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89. Statement 1 : The curve $y = -\frac{x^2}{2} + x + 1$ is symmetric with respect to the line $x = 1$. Statement 2: A parabola is symmetric about its axis (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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90. Tangents are drawn from the point (17, 7) to the circle $x^2 + y^2 = 169$, Statement I The tangents are mutually perpendicular Statement, lls The locus of the points frorn which mutually perpendicular tangents can be drawn to the given circle is $x^2 + y^2 = 338$ (a) Statement I is correct, Statement II is correct; Statement II is a correct explanation for Statementl (b(Statement I is correct, Statement I| is correct Statement II is not a correct explanation for Statementl (c)Statement I is correct, Statement II is incorrect (d) Statement I is incorrect, Statement II is correct

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91. Consider: $L_1 : 2x + 3y + p - 3 = 0$ $L_2 : 2x + 3y + p + 3 = 0$ where p is a real number and $C : x^2 + y^2 + 6x - 10y + 30 = 0$ Statement 1 : If line L_1 is a chord of circle C, then line L_2 is not always a diameter of circle C. Statement 2 : If line L_1 is a a diameter of circle C, then line L_2 is not a chord of circle C. Both the statement are True and Statement 2 is the correct explanation of Statement 1. Both the statement are True but Statement 2 is not the correct explanation of Statement 1. Statement 1 is True and Statement 2 is False. Statement 1 is False and Statement 2 is True.

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92. The circle $x^2 + y^2 - 8x = 0$ and hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ I intersect at the points A and B. Equation of a common tangent with positive slope to the circle as well as to the hyperbola is

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93. The circle $x^2 + y^2 - 8x = 0$ and hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ intersect at the points A and B Equation of the circle with AB as its diameter is

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94. A circle C of radius 1 is inscribed in an equilateral triangle PQR. The points of contact of C with the sides PQ, QR, RP and D, E, F respectively. The line PQ is given by the equation $\sqrt{3}+y-6=0$ and the point D is $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right)$ The equation of circle C is : (A) $(x-2\sqrt{3})^2+(y-1)^2=1$ (B) $(x-2\sqrt{3})^2+\left(y+\frac{1}{2}\right)^2=1$ (C) $(x-\sqrt{3})^2+(y+1)^2=1$ (D) $(x-\sqrt{3})^2+(y-1)^2=1$

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95. A circle C of radius 1 is inscribed in an equilateral triangle PQR. The points of contact of C with the sides PQ, QR, RP and D, E, F respectively. The line PQ is given by the equation $\sqrt{3}+y-6=0$ and the point D is $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right)$. Point E and F are given by : (A) $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right), (\sqrt{3}, 0)$ (B) $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right), \left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ (C) $\left(\frac{3}{2}, \frac{\sqrt{3}}{2}\right), \left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

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96. A circle C of radius 1 is inscribed in an equilateral triangle PQR. The points of contact of C with the sides PQ, QR, RP and D, E, F respectively. The line PQ is given by the equation $\sqrt{3}+y-6=0$ and the point D is $\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right)$. Equation of the sides QR, RP are : (A) $y=\frac{2}{\sqrt{3}}x+1, y=\frac{2}{\sqrt{3}}x-1$ (B) $y=\frac{1}{\sqrt{3}}x, y=0$ (C) $y=\frac{\sqrt{3}}{2}x+1, y=\frac{\sqrt{3}}{2}x-1$ (D) $y=\sqrt{3}x, y=0$

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97. The circle $x^2+y^2-4x-4y+4=0$ is inscribed in a triangle which has two of its sides along the coordinate axes. The locus of the circumcenter of the triangle is $x+y-xy+k\left(x^2+y^2\right)^{\frac{1}{2}}=0$. Find k.

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Exercise

1. Find the equation of the circle passing through the points $A(4, 3)$. $B(2, 5)$ and touching the axis of y. Also find the point P on the y-axis such that the angle APB has largest magnitude.

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2. Find the equation of the circle in which the chord joining the points (a, b) and $(b, -a)$ subtends an angle of 45° at any point on the circumference of the circle.

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3. Prove that the circle $x^2 + y^2 - 6x - 4y + 9 = 0$ bisects the circumference of the circle $x^2 + y^2 - 8x - 6y + 23 = 0$

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4. Prove that the circle $x^2 + y^2 = a^2$ and $(x - 2a)^2 + y^2 = a^2$ are equal and touch each other. Also find the equation of a circle (or circles) of equal radius touching both the circles.

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5. Find the coordinates of the point at which the circles $x^2 - y^2 - 4x - 2y + 4 = 0$ and $x^2 + y^2 - 12x - 8y + 36 = 0$ touch each other. Also, find equations of common tangents touching the circles the distinct points.

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6. The equation of the circle which touches the circle $x^2 + y^2 - 6x + 6y + 17 = 0$ externally and to which the lines $x^2 - 3xy - 3x + 9y = 0$ are normals, is

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7. Two circles have the equations $x^2+y^2+\lambda x+c=0$ and $x^2+y^2+\mu x+c=0$. Prove that one of the circles will be within the other if $\lambda\mu>0$ and $c>0$.

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8. Show that the length of the least chord of the circle $x^2+y^2+2gx+2fy+c=0$ which passes through an internal point (α, β) is equal to $2\sqrt{-\left(\alpha^2+\beta^2+2g\alpha+2f\beta+c\right)}$.

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9. 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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10. The chord along the line $y - x = 3$ of the circle $x^2 + y^2 = k^2$, subtends an angle of 30^0 in the major segment of the circle cut off by the chord. Find k.

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11. Find the equations of the tangents to the circle $x^2 + y^2 = 169$ at $(5, 12)$ and $(12, -5)$ and prove that they cut at right angles. Also find their point of intersection.

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12. The tangent at the point (α, β) to the circle $x^2 + y^2 = r^2$ cuts the axes of coordinates in A and B. Prove that the area of the triangle OAB is $\frac{a}{2}\frac{r^4}{|\alpha\beta|}$, O being the origin.

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13. . Let A be the centre of the circle $x^2 + y^2 - 2x - 4y - 20 = 0$ Suppose that the tangents at the points B(1,7) and D(4,-2) on the circle meet at the point C. Find the area of the quadrilateral ABCD

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14. The tangent to the circle $x^2 + y^2 = 5$ at (1, -2) also touches the circle $x^2 + y^2 - 8x + 6y + 20 = 0$. Find the coordinates of the corresponding point of contact.

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15. Show that the circles $x^2 + y^2 - 10x + 4y - 20 = 0$ and $x^2 + y^2 + 14x - 6y + 22 = 0$ touch each other. Find the coordinates of the point of contact and the equation of the common tangent at the point of contact.

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16. Find the equation of the normal to the circle $x^2 + y^2 - 2x = 0$ parallel to the line $x + 2y = 3$.

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17. If the length of the tangent drawn from (f, g) to the circle $x^2 + y^2 = 6$ be twice the length of the tangent drawn from the same point to the circle $x^2 + y^2 + 3(x + y) = 0$ then show that $g^2 + f^2 + 4g + 4f + 2 = 0$.

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18. Find the area of the triangle formed by the tangents from the point (4, 3) to the circle $x^2 + y^2 = 9$ and the line joining their points of contact.

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19. Show that the length of the tangent from anypoint on the circle : $x^2 + y^2 + 2gx + 2fy + c = 0$ to the circle $x^2 + y^2 + 2gx + 2fy + c_1 = 0$ is $\sqrt{c_1 - c}$.

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20. The equation of three circles are given $x^2 + y^2 = 1, x^2 + y^2 - 8x + 15 = 0, x^2 + y^2 + 10y + 24 = 0$. Determine the coordinates of the point P such that the tangents drawn from it to the circle are equal in length.

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21. If A is the centre of the circle, $x^2 + y^2 + 2g_i x + 5 = 0$ and t_i is the length of the tangent from any point to this circle, $i = 1, 2, 3,$ then show that $(g_2 - g_3)t_1^2 + (g_3 - g_1)t_2^2 + (g_1 - g_2)t_3^2 = 0$

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22. Show that if the length of the tangent from a point P to the circle $x^2 + y^2 = a^2$ be four times the length of the tangent from it to the circle $(x-a)^2 + y^2 = a^2$, then P lies on the circle $15x^2 + 15y^2 - 32ax + a^2 = 0$.

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23. Find the equations of tangents to the circle $x^2 + y^2 = 25$ which pass through $(-1, 7)$ and show that they are at right angles.

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24. Find the equation of the pair of tangents from the origin to the circle $x^2 + y^2 + 2gx + 2fy + k^2 = 0$, and show that their intercept on the line $y = h$ is $2h\frac{k}{k^2 - g^2}$ times the radius of the circle.

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25. Find the equation of the chord of the circle $x^2 + y^2 + 6x + 8y + 9 = 0$, whose middle point is $(-2, -3)$.

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26. Find the coordinates of the middle point of the chord which the circle $x^2 + y^2 + 4x - 2y - 3 = 0$ cuts off on the line $y = x + 2$.

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27. Find the equation to the chord of contact of the tangents drawn from an external point $(-3, 2)$ to the circle $x^2 + y^2 + 2x - 3 = 0$.

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28. Find the co-ordinates of the point of intersection of tangents at the points where the line $2x + y + 12 = 0$ meets the circle $x^2 + y^2 - 4x + 3y - 1 = 0$

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29. The length of tangents from two given points to a given circle are t_1 and t_2. If the two points are conjugate to each other w.r.t. the given circle, prove that the distance between the points will be $\sqrt{t_1^2 + t_2^2}$.

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30. Tangents OP and OQ are drawn from the origin o to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$. Find the equation of the circumcircle of the triangle OPQ.

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31. Tangents PQ and PR are drawn to the circle $x^2 + y^2 = a^2$ from the point $P(x_1, y_1)$.Prove that equation of the circum circle of $\triangle PQR$ is $x^2 + y^2 - xx_1 - yy_1 = 0$.

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32. Show that the equation of the straight line meeting the circle $x^2 + y^2 = a^2$ in two points at equal distance d from (x_1, y_1) on the curve is $xx_1 + yy_1 - a^2 + \frac{1}{2}d^2 = 0$. Deduce the equaiton of the tangent at (x_1, y_1).

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33. find the area of the quadrilateral formed by a pair of tangents from the point (4,5) to the circle $x^2 + y^2 - 4x - 2y - 11 = 0$ and pair of its radii.

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34. Find the radius of the smalles circle which touches the straight line $3x - y = 6$ at $(- , - 3)$ and also touches the line $y = x$. Compute up to one place of decimal only.

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35. Obtain the equations of the straight lines passing through the point A(2, 0) & making 45 with the tangent at A to the circle $(x+2)^2+(y-3)^2=25$. Find the equations of the circles each of radius 3 whose centres are on these straight lines at a distance of $5\sqrt{2}$ from A.

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36. Find 'all equation to the four common tangents to the circles $x^2+y^2=25$ and $(x-12)^2+y^2=9$

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37. A straight line AB is divided at C so that $AC=3CB$. Circles are described on AC and CB as diameters and a common tangent meets

AB produced at D. Show that BD is equal to the radius of the smaller circle.

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38. Two circle of radii a and b touch the axis of y on the opposite side at the origin, the former being on the possitive side. Prove that the other two common tangents are given by $(b-a)x \pm 2\sqrt{ab}y - 2ab = 0$.

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39. For what value of k is the circle $x^2 + y^2 + 5x + 3y + 7 = 0$ and $x^2 + y^2 - 8x + 6y + k = 0$ cut each other orthogonally.

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40. The equation of the circle passing through the origin & cutting the circles $x^2 + y^2 - 4x + 6y + 10 = 0$ and $x^2 + y^2 + 12y + 6 = 0$ at right angles is -

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41. If a circle cuts orthogonally three circles, $S_1 = 0, S_2 = 0, S_3 = 0,$ prove that it cuts orthogonally and circle $kS_1 + lS_2 + mS_3 = 0.$

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42. Prove that the two circles each of which passes through the point $(0, k)$ and $(0, -k)$ and touches the line $y = mx + b$ will cut orthogonally, if $b^2 = k^2(2 + m^2)$.

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43. Find the general equation of a circle cutting $x^2 + y^2 = c^2$ orthogonally and show that if it passes through the point (a, b), it will also pass through the point. $\left(\frac{c^2 a}{a^2 + b^2}, \frac{c^2 b}{a^2 + b^2}\right)$.

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44. If P and Q a be a pair of conjugate points with respect to a circle S. Prove that the circle on PQ as diameter cuts the circle S orthogonally.

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45. Two circles are drawn through the points $(a, 5a)$ and $(4a, a)$ to touch the y-axis. Prove that they intersect at angle $\tan^{-1}\left(\frac{40}{9}\right)$.

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46. Find the condition that the chord of contact of tangents from the point (α, β) to the circle $x^2 + y^2 = a^2$ should subtend a right angle at the centre. Hence find the locus of (α, β).

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47. Locus of the mid points of the chords of the circle $x^2 + y^2 = a^2$ which pass through the fixed point (h, k) is $x^2 + y^2 + 2hx + 2ky = 0$

$x^2 + y^2 - 2hx - 2ky = 0$ $x^2 + y^2 + hx + ky = 0$

$x^2 + y^2 - hx - ky = 0$ $x^2 + y^2 + hx - ky = 0$

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48. The locus of the point of intersection of the two tangents drawn to the circle $x^2 + y^2 = a^2$ which include are angle α is

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49. In Figure, AP and BQ are perpendiculars to the line segment AB and $AP = BQ$. Prove that O is the mid-point of line segment AB and PQ. Figure

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50. A variable circle passes through the point $P(1, 2)$ and touches the x-axis. Show that the locus of the other end of the diameter through P is $(x-1)^2 = 8y$.

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51. A point moves such that the sum of the squares of its distances from the sides of a square of side unity is equal to 9, the locus of such point is

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52. The locus of the centres of the circles which touch $x^2 + y^2 = a^2$ and `x^2+y^2=4ax, externally

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53. The tangent at any point P on the circle $x^2 + y^2 = 2$ cuts the axes in L and M. Find the locus of the middle point of LM.

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54. A triangle has two of its sides along the axes, its third side touches the circle $x^2 + y^2 - 2ax - 2ay + a^2 = 0$. Find the equation of the locus of the circumcentre of the triangle.

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55. A straight line moves such that the algebraic sum of the perpendiculars drawn to it from two fixed points is equal to $2k$. Then, then straight line always touches a fixed circle of radius. $2k$ (b) $\frac{k}{2}$ (c) k (d) none of these

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56. 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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57. The equation of the locus of the mid-points of chords of the circle $4x^2 + 4y^2 - 12x + 4y + 1 = 0$ that subtends an angle of at its centre is $\frac{2\pi}{3}$ at its centre is $x^2 + y^2 - kx + y + \frac{31}{16} = 0$ then k is

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58. Through a fixed point (h, k) secants are drawn to the circle $x^2 + y^2 = r^2$. Then the locus of the mid-points of the secants by the circle is

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59. A variable circle passes through the fixed $A(p, q)$ and touches the x-axis. Show that the locus of the other end of the diameter through A is $(x-p)^2 = 4qy$.

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60. Find the locus of the point of intersection of tangents to the circle $x = a\cos\theta, y = a\sin\theta$ at the points whose parametric angles differ by $(i)\frac{\pi}{3}$,

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61. P is variable point on the line $y = 4$. tangents are drawn to the circle $x^2 + y^2 = 4$ from the points touch it at A and B. The parallelogram PAQB be completed.If locus of Q is $(y+a)(x^2+y^2) = by^2$,the value of $a+b$ Is:

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62. Find the locus of the centre of a circle which passes through the origin and cuts off a length $2l$ from the line $x = c$.

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63. A straight line is drawn from a fixed point O meeting a fixed straight line in P. A point Q is taken on the line OP such that $OP . OQ$ is constant. Show that the locus of Q is a circle.

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64. The locus of the perpendiculars drawn from the point $(a, 0)$ on tangents to the circlo $x^2 + y^2 = a^2$ is

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65. From points on the circle $x^2 + y^2 = a^2$ tangents are drawn to the hyperbola $x^2 - y^2 = a^2$. Then, the locus of mid-points of the chord of contact of tangents is:

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66. If the radical axis of the circles $x^2 + y^2 + 2gx + 2fy + c = 0$ and $2x^2 + 2y^2 + 3x + 8y + 2c = 0$ touches the circle $x^2 + y^2 + 2x - 2y + 1 = 0$, show that either $g = \frac{3}{4}$ or $f = 2$.

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67. A family of circles passing through the points $(3, 7)$ and $(6, 5)$ cut the circle $x^2 + y^2 - 4x - 6y - 3 = 0$. Show that the lines joining the intersection points pass through a fixed point and find the coordinates of the point.

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68. Show that the four points of intersection of the lines : $(2x - y + 1)(x - 2y + 3) = 0$, with the axes lie on a circle and find its centre.

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69. If the tangents are drawn to the circle $x^2 + y^2 = 12$ at the point where it meets the circle $x^2 + y^2 - 5x + 3y - 2 = 0$, then find the point of intersection of these tangents.

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70. Circles are drawn with their centres on the axis of x and touching the straight line $y = x \tan \alpha$. Show that the points of contact of the tangents from a fixed point (h, k) will lie on the curve given by :

$$(x-h)^2 \left(y^2 - x^2 \sin^2 \alpha\right) - 2xy(x-h)(y-k)\sin^2 \alpha + y^2 (y-k)^2 \cos^2 \alpha =$$

.

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71. Find the equation of a circle circumscribing the triangle whose sides are $x = 0, y = 0$ and $lx + my = 1$. If l, m can vary so that $l^2 + m^2 = 4l^2m^2$, find the locus of the centre of the circle.

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72. Find the equation of the system of coaxial circles that are tangent at $(\sqrt{2}, 4)$ to the locus of the point of intersection of two mutually perpendicular tangents to the circle $x^2 + y^2 = 9$.

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73. Let $A = (0, 1)$ and $B = \left(-\frac{p}{2}, \frac{q+1}{2}\right)$ be two fixed points in a plane. Let C denote a circle with centre B and passing through A. Prove that the real roots of the equation $x^2 + px + q = 0$ are given by the abscissae of the points of intersection of C with the x-axis.

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74. Show that the circles $x^2 + y^2 + 2x - 8y + 8 = 0$ and $x^2 + y^2 + 10x - 2y + 22 = 0$ touch each other. Also obtain the equations of the two circles, each of radius 1, cutting both these circles orthogonally.

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75. If the line $lx + my - 1 = 0$ touches the circle $x^2 + y^2 = a^2$, then prove that (l, m) lies on a circle.

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76. A circle touches the hypotenuse of a right angled triangle at its middle point and passes through the mid-point of the shorter side. If a and $b(a < b)$ be the lengths of the sides, then prove that the radius of the circle is $\frac{b}{4}a\sqrt{a^2 + b^2}$

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77. If two distinct chords, drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$ (where $pq \neq q$) are bisected by the x-axis, then $p^2 = q^2$ (b) $p^2 = 8q^2$ $p^2 < 8q^2$ (d) $p^2 > 8q^2$

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78. An acute triangle PQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates (3, 4) and (-4, 3) respectively, then find $\angle QPR$.

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79. If the circles $x^2 + y^2 + 2x + 2ky + 6 = 0$ and $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally then k equals (A) $2 \text{ or } -\dfrac{3}{2}$ (B) $-2 \text{ or } -\dfrac{3}{2}$ (C) $2 \text{ or } \dfrac{3}{2}$ (D) $-2 \text{ or } \dfrac{3}{2}$

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80. The equations of the tangents drawn from the origin to the circle $x^2 + y^2 - 2px - 2qy + q^2 = 0$ are perpendicular if (A) $p^2 = q^2$ (B) $p^2 = q^2 = 1$ (C) $p = \frac{q}{2}$ (D) $q = \frac{p}{2}$

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81. The equation of the circle passing through (1, 0) and (0, 1) and having smallest possible radius is : (A) $2x^2 + y^2 - 2x - y = 0$ (B) $x^2 + 2y^2 - x - 2y = 0$ (C) $x^2 = y^2 - x - y = 0$ (D) $x^2 + y^2 + x + y = 0$

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82. The square of the length of the tangent from $(3, -4)$ on the circle $x^2 + y^2 - 4x - 6y + 3 = 0$ is: (A) 20 (B) 30 (C) 40 (D) 50

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83. If length of the common chord of the circles $x^2+y^2+2x+3y+1=0$ and $x^2+y^2+4x+3y+2=0$ then the value of $[a]$. (where [-] denotes greatest integer function)

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84. The length of the tangent from the point $(4, 5)$ to the circle $x^2+y^2+2x-6y=6$ is : (A) $\sqrt{13}$ (B) $\sqrt{38}$ (C) $2\sqrt{2}$ (D) $2\sqrt{13}$

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85. The two circles $x^2+y^2-2x+6y+6=0$ and $x^2+y^2-5x+6y+15=0$ touch eachother. The equation of their common tangent is : (A) $x=13$ (B) $y=6$ (C) $7x-12y-21=0$ (D) $7x+12y+21=0$

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86. Show that the equation of the circle passing through (1, 1) and the points of intersection of the circles $x^2 + y^2 + 13x - 13y = 0$ and $2x^2 + 2y^2 + 4x - 7y - 25 = 0$ is $4x^2 + 4y^2 + 30x - 13y - 25 = 0$.

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87. If $y = 3x + c$ is a tangent to the circle $x^2 + y^2 - 2x - 4y - 5 = 0$, then c is equal to :

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88. The locus of the point $\left(\sqrt{3h+2}, \sqrt{3k}\right)$ if (h, k) lies on $x + y = 1$ is : (A) a circle (B) an ellipse (C) a parabola (D) a pair of straight lines

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89. Two fixed circles with radii $r_1 and r_2, (r_1 > r_2)$, respectively, touch each other externally. Then identify the locus of the point of intersection of their direction common tangents.

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90. Two circles with radii $a and b$ touch each other externally such that θ is the angle between the direct common tangents, $(a > b \geq 2)$. Then prove that $\theta = 2\sin^{-1}\left(\frac{a-b}{a+b}\right)$.

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91. Given a circle of radius r. Tangents are drawn from point A and B lying on one of its diameters which meet at a point P lying on another diameter perpendicular to the other diameter. The minimum area of the triangle PAB is : (A) r^2 (B) $2r^2$ (C) πr^2 (D) $\frac{r^2}{2}$

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92. Equation of a circle that cuts the circle $x^2 + y^2 + 2gx + 2fy + c = 0$, lines $x = g$ and $y = f$ orthogonally is : (A) $x^2 + y^2 - 2gx - 2fy - c = 0$ (B) $x^2 + y^2 - 2gx - 2fy - 2g^2 - 2f^2 - c = 0$ (C) $x^2 + y^2 + 2gx + 2fy + g^+ f^2 - c = 0$ (D) none of these

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93. The equation of the circle passing through the point of intersection of the circles $x^2 + y^2 - 6x + 2y + 4 = 0$ and $x^2 + y^2 + 2x - 6y - 6 = 0$ and having its centre on $y = 0$ is : (A) $2x^2 + 2y^2 + 8x + 3 = 0$ (B) $2x^2 + 2y^2 - 8x - 3 = 0$ (C) $2x^2 + 2y^2 - 8x + 3 = 0$ (D) none of these

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94. The chord of contact of the pair of tangents drawn from any point on $3x + 4y = 8$ to the circle $x^2 + y^2 = 4$ passes through a fixed point. (A) $\left(\frac{1}{2}, \frac{15}{8}\right)$ (B) $\left(2, \frac{3}{2}\right)$ (C) $\left(\frac{3}{2}, 2\right)$ (D) none of these

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95. $f(x, y) = 0$ is a circle such that $f(0, \lambda) = 0$ and $f(\lambda, 0) = 0$ have equal roots and $f(1, 1) = -2$ then the radius of the circle is : (A) 4 (B) 8 (C) 2 (D) 1

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96. $2x^2 + 2y^2 + 4\lambda x + \lambda = 0$ represents a circle for

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97. The locus of the mid-point of a chord of the circle $x^2 + y^2 - 2x - 2y - 23 = 0,$ of length 8 units is : (A) $x^2 + y^2 - x - y + 1 = 0$ (B) $x^2 + y^2 - 2x - 2y - 7 = 0$ (C) $x^2 + y^2 - 2x - 2y + 1 = 0$ (D) $x^2 + y^2 + 2x + 2y + 5 = 0$

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98. The equation of the circle having the intercept on the line $y + 2x = 0$ by the circle $x^2 + y^2 + 4x + 6y = 0$ as a diameter is : (A) $5x^2 + 5y^2 - 8x + 16y = 0$ (B) $5x^2 + 5y^2 + 8x - 16y = 0$ (C) $5x^2 + 5y^2 - 8x - 16y = 0$ (D) $5x^2 + 5y^2 + 8x \pm 16y = 0$

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99. If tangent at (1, 2) to the circle $C_1 : x^2 + y^2 = 5$ intersects the circle $C_2 : x^2 + y^2 = 9$ at A and B and tangents at A and B to the second circle meet at point C, then the co- ordinates of C are given by

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100. (A) Number of values of a for which the common chord of the circles $x^2 + y^2 = 8$ and $(x - a)^2 + y^2 = 8$ subtends a right angle at the origin is

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101. The locus of the centre of the circle passing through $(1, 1)$ and cutting $x^2 + y^2 = 4$ orthogonally is : (A) $x + y = 3$ (B) $x + 2y = 3$ (C) $2x + y = 3$ (D) $2x - y = 3$

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102. Tangents are drawn to the circle $x^2 + y^2 = 9$ at the points where it is met by the circle $x^2 + y^2 + 3x + 4y + 2 = 0$. Fin the point of intersection of these tangents.

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103. The shortest distance between the parabola $y^2 = 4x$ and the circle $x^2 + y^2 + 6x - 12y + 20 = 0$ is : (A) 0 (B) 1 (C) $4\sqrt{2} - 5$ (D) $4\sqrt{2} + 5$

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104. The number of tangents which can be drawn from the point $(2, 3)$ to the circle $x^2+y^2=13$ are (A) 2 (B) 3 (C) 1 (D) 4

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105. The equation of the circle which inscribes a suqre whose two diagonally opposite vertices are $(4, 2)$ and $(2, 6)$ respectively is : (A) $x^2+y^2+4x-6y+10=0$ (B) $x^2+y^2-6x-8y+20=0$ (C) $x^2+y^2-6x+8y+25=0$ (D) $x^2+y^2+6x+8y+15=0$

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106. The image of the centre of the circle $x^2+y^2=2a^2$ with respect to the line $x+y=1$ is : (A) $(\sqrt{2}, \sqrt{2}$ (B) $\left(\frac{1}{\sqrt{2}}, \sqrt{2}\right)$ (C) $\left(\sqrt{2}, \frac{1}{\sqrt{2}}\right)$ (D) none of these

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107. The radius of the circle passing through the points $(1, 2), (5, 2)$ and $(5, -2)$ is : (A) $5\sqrt{2}$ (B) $2\sqrt{5}$ (C) $3\sqrt{2}$ (D) $2\sqrt{2}$

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108. Angle of intersection of two circle having distance between their centres d is given by : (A) $\cos\theta = \frac{r_1^2 + r_2^2 - d}{2r_1^2 + r_2^2}$ (B) $\sec\theta = \frac{r_1^2 + r_2^2 + d^2}{2r_1r_2}$ (C) $\sec\theta = \frac{2r_1r_2}{r_1^2 + r_2^2 - d^2}$ (D) none of these

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109. The length of the tangent drawn from any point on the circle $x^2 + y^2 + 2gx + 2fy + \lambda = 0$ to the circle $x^2 + y^2 + 2gx + 2fy + \mu = 0$ is : (A) $\sqrt{\mu - \lambda}$ (B) $\sqrt{\lambda - \mu}$ (C) $\sqrt{\mu + \lambda}$ (D) none of these

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110. Two circles $x^2 + y^2 + 2x - 4y = 0$ and $x^2 + y^2 - 8y - 4 = 0$ (A) touch each other externally (B) intersect each other (C) touch each other internally (D) none of these

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111. The equation $x = \frac{2a\theta}{1 + \theta^2}, y = \frac{a(1 - \theta^2)}{1 + \theta^2}$ where a is constant, is the parametric equation of the curve (A) $x^2 - y^2 = a^2$ (B) $x^2 + 4y^2 = 4a^2$ (C) $x^2 + y^2 = a^2$ (D) $x - 2y = a^2$

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112. If a circle having the point $(-1, 1)$ as its centre touches the straight line $x + 2y + 9 = 0$, then the coordinates of the point(s) of contact are : (A) $\left(\frac{7}{3}, -\frac{17}{3}\right)$ (B) $(-3, -3)$ (C) $(-3, 3)$ (D) $(0, 0)$

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113. The radius of the circle touching the straight lines $x - 2y - 1 = 0$ and $3x - 6y + 7 = 0$ is (A) $\frac{1}{\sqrt{2}}$ (B) $\frac{\sqrt{5}}{3}$ (C) $\sqrt{3}$ (D) $\sqrt{5}$

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114. If one end of a diameter of the circle $x^2 + y^2 - 8x - 14y + c = 0$ is the point $(-3, 2)$, then its other end is the point. (A) $(5, 7)$ (B) $(9, 11)$ (C) $(10, 11)$ (D) $(11, 12)$

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115. The equation of the circle which has normals $x - 1)x(y - 2) = 0$ and a tangent $3x + 4y = 6$ is $x^2 + y^2 - 2x - 4y + 4 = 0$ $x^2 + y^2 - 2x - 4y + 5 = 0$ $x^2 + y^2 = 5$ $(x - 3)^2 + 9y - 4\Big)\hat{2} = 5$

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116. If the straight line $y = mx$ lies outside the circle $x^2 + y^2 - 20y + 90 = 0$ then the value of m will satisfy (A) $m < 3$ (B) $|m| < 3$ (C) $m > 3$ (D) $|m| > 3$

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117. If the equation $x^2 + y^2 + 2hxy + 2gx + 2fy + c = 0$ represents a circle, then the condition for that circle to pass through three quadrants only but not passing through the origin is $f^2 > c$ (b) $g^2 > 2$ $c > 0$ (d) $h = 0$

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118. If the chord of contact of tangents from a point P to a given circle passes through $Q,$ then the circle on PQ as diameter. cuts the given circle orthogonally touches the given circle externally touches the given circle internally none of these

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119. The point from which the tangents to the circle $x^2+y^2-4x-6y-16=0, 3x^2+3y^2-18x+9y+6=0$ and x^2+y^2 are equal in length is : (A) $\left(\frac{2}{3}, \frac{4}{17}\right)$ (B) $\left(\frac{17}{16}, \frac{4}{15}\right)$ (C) $\left(\frac{17}{16}, \frac{4}{15}\right)$ (D) $\left(\frac{5}{4}, \frac{2}{3}\right)$

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120. If the two circles $(x+1)^2+(y-3)=r^2$ and $x^2+y^2-8x+2y+8=0$ intersect in two distinct point,then (A) $r>2$ (B) $2<r<8$ (C) $r<2$ (D) $r=2$

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121. The shortest distance from the point $(0,5)$ to the circumference of the circle $x^2+y^2-10x+14y-151=0$ is: (A) 13 (B) 9 (C) 2 (D) 5

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122. If the radii of the circle $(x-1)^2+(y-2)^2=1$ and $(x-7)^2+(y-10)^2=4$ are increasing uniformly w.r.t. times as 0.3 unit/s is and 0.4 unit/s, then they will touch each other at t equal to $45s$

(b) $90s$ (c) $11s$ (d) $135s$

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123. The equation of the circle passing through the point of intersection of the circles $x^2+y^2-4x-2y=8$ and $x^2+y^2-2x-4y=8$ and the point $(-1, 4)$ is $x^2+y^2+4x+4y-8=0$

$x^2+y^2-3x+4y+8=0$ $x^2+y^2+x+y=0$

$x^2+y^2-3x-3y-8=0$

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124. The distance from the center of the circle $x^2+y^2=2x$ to the common chord of the circles $x^2+y^2+5x-8y+1=0$ and

$x^2 + y^2 - 3x + 7y - 25 = 0$ is 2 (b) 4 (c) $\frac{34}{13}$ (d) $\frac{26}{17}$

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125. The locus of the centre of all circles passing through (2, 4) and cutting $x^2 + y^2 = 1$ orthogonally is : (A) $4x + 8y = 11$ (B) $4x + 8y = 21$ (C) $8x + 4y = 21$ (D) $4x - 8y = 21$

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126. The line $x + y = k$ will cut the circle $x^2 + y^2 - 4x - 6y + 5 = 0$ at two distinct points if (A) $k < 1$ (B) $k < 1$ or $K > 9$ (C) $1 < k < 9$ (D) none of these

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127. The locus of the centre of the circle touching the line $2x - y = 1$ at (1, 1) and also touching the line $x + 2y = 1$ is : (A) $x + 3y = 2$ (B)

$x + 2y = 3$ (C) $x + y = 2$ (D) none of these

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128. The circles $x^2 + y^2 + 2ux + 2vy = 0$ and $x^2 + y^2 + 2u_1x + 2v_1y = 0$ touch each other at $(1, 1)$ if : (A) $u + u_1 = v + v_1$ (B) $u + v = v_1 + u_1$ (C) $\frac{u}{u_1} = \frac{v}{v_1}$ (D) none of these

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129. The radius of the circle $ax^2 + (2a - 3)y^2 - 4x - 7 = 0$ is : (A) 1 (B) $\frac{5}{3}$ (C) $\frac{4}{3}$ (D) 3

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130. The equation of the circle passing through $\left(\frac{1}{2}, -1\right)$ and having pair of straight lines $x^2 - y^2 + 3x + y + 2 = 0$ as its two diameters is :

(A) $4x^2+4y^2+12x-4y-15=0$ (B) $4x^2+4y^2+15x+4y-12=0$

(C) $4x^2+4y^2-4x+8y+5=0$ (D) none of these

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131. If the circumference of the circle $x^2+y^2+8x+8y-b=0$ is bisected by the circle $x^2+y^2=4$ and the line $2x+y=1$ and having minimum possible radius is $5x^2+5y^2+18x+6y-5=0$ $5x^2+5y^2+9x+8y-15=0$ $5x^2+5y^2+4x+9y-5=0$ $5x^2+5y^2-4x-2y-18=0$

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132. If the circumference of the circle $x^2+y^2+8x+8y-b=0$ is bisected by the circle $x^2+y^2-2x+4y+a=0$ then $a+b=$ (A) 50 (B) 56 (C) -56 (D) -34

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133. If two circles $x^2 + y^2 + ax + by = 0$ and $x^2 + y^2 + kx + ly = 0$ touch each other, then (A) $al = bk$ (B) $ak = bl$ (C) $ab = kl$ (D) none of these

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134. The circle $x^2 + y^2 - 6x - 10y + p = 0$ does not touch or intersect the axes and the point (1, 4) is inside the circle, then (A) $0 < p < 29$ (B) $25 < p < 29$ (C) $25 < p < 35$ (D) none of these

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135. The chords of contact of tangents from three points $A, BandC$ to the circle $x^2 + y^2 = a^2$ are concurrent. Then $A, BandC$ will be concyclic (b) be collinear form the vertices of a triangle none of these

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136. The radical centre of three circles : $x^2+y^2+x+2y+3=0, x^2+y^2+2x+4y+5=0$ and x^2+y^2-7x

is : (A) $\left(-\frac{2}{3}, -\frac{2}{3}\right)$ (B) $\left(\frac{1}{3}, \frac{1}{3}\right)$ (C) $\left(\frac{1}{4}, \frac{1}{4}\right)$ (D) $(0, 0)$

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137. The centre of circle which passes through $A(h, 0), B(0, k)$ and $C(0, 0)$ is : (A) $\left(\frac{h}{2}, 0\right)$ (B) $\left(0, \frac{k}{2}\right)$ (C) $\left(\frac{h}{2}, \frac{k}{2}\right)$

(D) (h, k)`

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138. The number of common tangents to the circles $x^2+y^2-4x+6y+8=0$ and $x^2+y^2-10x-6y+14=0$ is : (A) 2

(B) 3 (C) 4 (D) none of these

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139. The equation of the circle and its chord are respectively $x^2+y^2=a^2$ and $x+y=a$. The equation of circle with this chord as diameter is : (A) $x^2+y^2+ax+ay+a^2=0$ (B) $x^2+y^2+2ax+2ay=0$ (C) $x^2+y^2-ax-ay=0$ (D) $ax^2+ay^2+x+y=0$

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140. If $\left(x_i, \frac{1}{x_i}\right), i=1,2,3,4$ are four distinct points on a circle, then

(A) $x_1x_2=x_3x_4$ (B) $x_1x_2x_3x_4=1$ (C) $x_1+x_2+x_3+x_4=1$ (D) $\frac{1}{x_1}+\frac{1}{x_2}+\frac{1}{x_3}+\frac{1}{x_4}=1$

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141. Tangents OA and OB are drawn from the origin to the circle $(x-1)^2+(y-1)^2=1$. Then the equation of the circumcircle of the triangle OAB is : $(A)x^2+y^2+2x+2y=0$ (B) $x^2+y^2+x+y=0$ (C) $x^2+y^2-x-y=0$ $(D)x^2+y^2-2x-2y=0$

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142. Four distinct points $(k, 2k), (2, 0), (0, 2)$ and $(0, 0)$ lie on a circle for : (A) $k = 0$ (B) $k = \frac{6}{5}$ (C) $k = 1$ (D) $k = -1$

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143. The circles $x^2 + y^2 - 4x - 81 = 0$ and $x^2 + y^2 + 24x - 81 = 0$ intersect each other at A and B. The equation of the circle with AB as the diameter is : (A) $x^2 + y^2 = 81$ (B) $x^2 + y^2 = 9$ (C) $x^2 + y^2 = 16$ (D) $x^2 + y^2 = 1$

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144. The coordinates of two points $PandQ$ are $(x_1, y_1)and(x_2, y_2)andO$ is the origin. If the circles are described on $OPandOQ$ as diameters, then the length of their common chord is $\frac{|x_1y_2 + x_2y_1|}{PQ}$ (b) $\frac{|x_1y_2 - x_2y_1|}{PQ}$ $\frac{|x_1x_2 + y_1y_2|}{PQ}$ (d) $\frac{|x_1x_2 - y_1y_2|}{PQ}$

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145. A straight lien is drawn from a fixed point O metting a fixed straight line P. A point Q is taken on the line OP such that $OP.\,OQ$ is constant. Show that the locus of Q is a circle.

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146. A variable straight line is drawn from a fixed point O meeting a fixed circle in P and a point Q is taken on this line such that $OP.\,OQ$ is constant, then locus of Q is : (A) a straight line (B) a circle (C) a parabola (D) none of these

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147. The point on the circle $(x-3)^2+(y-4)^2=4$ which is at least distance from the circle $x^2+y^2=1$ is : (A) $\left(\frac{3}{5}, \frac{4}{5}\right)$ (B) $\left(\frac{9}{5}, \frac{12}{5}\right)$ (C) $(9, 12)$ (D) none of these

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148. If two distinct chords drawn from the point (a, b) on the circle $x^2+y^2-ax-by=0$ (where $ab \neq 0$) are bisected by the x-axis, then the roots of the quadratic equation $bx^2-ax+2b=0$ are necessarily. (A) imaginary (B) real and equal (C) real and unequal (D) rational

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149. If the chord of contact of the tangents from a point on the circle $x^2+y^2=a^2$ to the circle $x^2+y^2=b^2$ touch the circle $x^2+y^2=c^2$, then the roots of the equation $ax^2+2bx+c=0$ are necessarily. (A) imaginary (B) real and equal (C) real and unequal (D) rational

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150. If the angle of intersection of the circle $x^2 + y^2 + x + y = 0$ and $x^2 + y^2 + x - y = 0$ is θ , then the equation of the line passing through (1, 2) and making an angle θ with the y-axis is $x = 1$ (b) $y = 2$ $x + y = 3$ (d) $x - y = 3$

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151. Locus of the middle points of the line segment joining $P\left(0, \sqrt{1 - t^2} + t\right)$ and $Q\left(2t, \sqrt{1 - t^2} - t\right)$ cuts an intercept of length a on the line $x + y = 1$, then $a =$ (A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$ (C) 2 (D) none of these

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152. If $f(x + y) = f(x).\, f(y)$ for all x and y. $f(1) = 2,$ and $\alpha_n = f(n), n\varepsilon N,$ then equation of the circle having

(α_1, α_2) and (α_3, α_4) as the ends of its one diameter is : (A) $(x-2)(x-8)+(y-4)(y-16)=0$ (B) $(x-4)(x-8)+(y-2)(y-16)=0$ (C) $(x-4)(x-16)+(y-4)(y-8)=0$ (D) none of these

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153. If $(1+ax)^n = 1+8x+24x^2+\ldots$ and a line through (a, n) cuts the circle $x^2+y^2=4$ in A and B, then $PA.\,PB=$. (A) 4 (B) 16 (C) 8 (D) none of these

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154. If $\left(m_r, \dfrac{1}{m_r}\right), r=1, 2, 3, 4$ are concyclic points and $f(x)=x$, when x is rational $=1-x$, when x is irrational and a is a point where $f(x)$ is continuous, then $m_1m_2m_3m_4=$ (A) a (B) $2a$ (C) $-2a$ (D) none of these

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155. One of the diameters of the circle circumscribing the rectangle ABCD is $4y = x + 7$. If A and B are the points $(-3, 4)$ and $(5, 4)$ and slope of the curve $y = \frac{ax}{b - x}$ at point $(1, 1)$ be 2, then centre of circle is : (A) (a, b) (B) (b, a) (C) $(-a, -b)$ (D) $(a, -b)$

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156. If $a + b + 3c = 0, c \neq 0$ and p and q be the number of real roots of the equation $ax^2 + bx + c = 0$ belonging to the set $(0, 1)$ and not belonging to set $(0, 1)$ respectively, then locus of the point of intersection of lines $x\cos\theta + y\sin\theta = p$ and $x\sin\theta - y\cos\theta = q$, where θ is a parameter is : (A) a circle of radius $\sqrt{2}$ (B) a straight line (C) a parabola (D) a circle of radius 2

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157. If a circle passes through the point of intersection of the lines $x + y + 1 = 0$ and $x + \lambda y - 3 = 0$ with the coordinate axis, then value of λ is

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158. An equilateral triangle whose two vertices are $(-2, 0)$ and $(2, 0)$ and which lies in the first and second quadrants only is circumscribed by a circle whose equation is : (B) $\sqrt{3}x^2 + \sqrt{3}y^2 - 4x - 4\sqrt{3}y = 0$ (C) $\sqrt{3}x^2 + \sqrt{3}y^2 - 4y + 4\sqrt{3}y = 0$ (D) $\sqrt{3}x^2 + \sqrt{3}y^2 - 4y - 4\sqrt{3} = 0$

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159. Three sides of a triangle are represented by lines whose combined equation is $(2x + y - 4)(xy - 4x - 2y + 8) = 0$, then the equation of its circumcircle will be : (A) $x^2 + y^2 - 2x - 4y = 0$ (B) $x^2 + y^2 + 2x + 4y = 0$ (C) $x^2 + y^2 - 2x + 4y = 0$ (D) $x^2 + y^2 + 2x - 4y = 0$

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160. Two circles, each having radius 4, have a common tangent given by $3x + 2y - 6 = 0$ at $(2, 0)$. Then their centres are : (A) $\left(2 + \frac{5}{\sqrt{13}}, \frac{8}{\sqrt{13}}\right), \left(2 - \frac{5}{\sqrt{13}}, \frac{-8}{\sqrt{13}}\right)$ (B) $\left(2 + \frac{12}{\sqrt{13}}, \frac{8}{\sqrt{13}}\right), \left(2 - \frac{12}{\sqrt{13}}, \frac{-8}{\sqrt{13}}\right)$ (C) $(2, 3), (4, 5)$ (D) none of these

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161. The range of values of $\theta \varepsilon [0, 2\pi]$ for which $(1 + \sin\theta, 1 + \cos\theta)$ lies inside the circle $x^2 + y^2 = 1$, is : (A) $(0, \pi)$ (B) $\left(5\frac{\pi}{4}, 7\frac{\pi}{4}\right)$ (C) $\left(\pi, 3\frac{\pi}{2}\right)$ (D) $\left(3\frac{\pi}{2}, 2\pi\right)$

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162. The value of λ for which the circles $x^2 + y^2 = 1$ and $x^2 + y^2 - 4\lambda x + 8 = 0$ have only two common tangetns, is : (A) $\left(-\frac{9}{4}, \frac{9}{4}\right)$ (B) $\left(-\infty, -\frac{9}{4}\right)\Big] \cup \left[\frac{9}{4}, \infty\right)$ (C) $\left(-\infty, -\frac{9}{4}\right] \cup \left[\frac{9}{4}, \infty\right)$ (D) none of these

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163. The chord of contact of the pair of tangents to the circle $x^2 + y^2 = 4$ drawn from any point on the line $x + 2y = 1$ passes through the fixed point. (A) $(2, 4)$ (B) $(4, 8)$ (C) $(2, 8)$ (D) $(3, 2)$

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164. The equation of the line(s) parallel to $x - 2y = 1$ which touch(es) the circle $x^2 + y^2 - 4x - 2y - 15 = 0$ is (are) $x - 2y + 2 = 0$ (b) $x - 2y - 10 = 0$ $x - 2y - 5 = 0$ (d) $3x - y - 10 = 0$

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165. If $\frac{x}{\alpha} + \frac{y}{\beta} = 1$ touches the circle $x^2 + y^2 = a^2$ then point $\left(\frac{1}{\alpha}, \frac{1}{\beta}\right)$ lies on (a) straight line (b) circle (c) parabola (d) ellipse

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166. Tangents are drawn to the circle $x^2 + y^2 = 32$ from a point A lying on the x-axis. The tangents cut the y-axis at points B and C, then the coordinate(s) of A such that the area of the triangle ABC is minimum may be: (A) $(4\sqrt{2}, 0)$ (B) $(4, 0)$ (C) $(-4, 0)$ (D) $(-4\sqrt{2}, 0)$

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167. The equation of four circles are $(x \pm a)^2 + (y \pm a2 = a^2$. The radius of a circle touching all the four circles is $(\sqrt{2} + 2)a$ (b) $2\sqrt{2}a$ $(\sqrt{2} + 1)a$ (d) $(2 + \sqrt{2})a$

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168. The equation of tangent to the circle $x^2 + y^2 - 4x = 0$ which is perpendicular to the normal drawn through the origin can be : (A) $x = 0$ (B) $x = 4$ (C) $x + y = 2$ (D) none of these

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169. The equation of the tangent to the circle $x^2 + y^2 = 25$ passing through $(-2, 11)$ is $4x + 3y = 25$ (b) $3x + 4y = 38$ $24x - 7y + 125 = 0$ (d) $7x + 24y = 250$

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170. The equation of a circle of radius 1 touching the circles $x^2 + y^2 - 2|x| = 0$ is: (A) $x^2 + y^2 + 2\sqrt{3x} - 2 = 0$ (B) $x^2 + y^2 - 2\sqrt{3}y + 2 = 0$ (C) $x^2 + y^2 + 2\sqrt{3}y + 2 = 0$ (D) $x^2 + y^2 + 2\sqrt{3}x + 2 = 0$

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171. A circle C and the circle $x^2 + y^2 = 1$ are orthogonal and have radical axis parallel to y-axis, then C can be : (A) $x^2 + y^2 + 1 = 0$ (B) $x^2 + y^2 + 1 = y$ (C) $x^2 + y^2 + 1 = -x$ (D) $x^2 + y^2 - 1 = -x$

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172. Circles $x^2+y^2=1$ and $x^2+y^2-8x+11=0$ cut off equal intercepts on a line through the point $\left(-2, \frac{1}{2}\right)$. The slope of the line is : (A) $\frac{-1+\sqrt{29}}{14}$ (B) $\left(1+\frac{\sqrt{7}}{4}\right.$ (C) $\frac{-1-\sqrt{29}}{14}$ (D) none of these

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173. The equations of tangents to the circle $x^2+y^2-6x-6y+9=0$ drawn from the origin in $x=0$ (b) $x=y$ $c=0$ (d) $x+y=0$

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174. Tangents drawn from $(2, 0)$ to the circle $x^2+y^2=1$ touch the circle at A and B. Then (A) $A \equiv \left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$, B -= (-1/2, - sqrt(3)/2)(B)A-= (- 1/2, (-sqrt(3)/2), $B \equiv \left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ (C) $A \equiv \left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$, B-= (1/2, - sqrt(3)/2) (D) $A \equiv \left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$, $B \equiv \left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

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175. If the circles $x^2 + y^2 - 9 = 0$ and $x^2 + y^2 + 2ax + 2y + 1 = 0$ touch each other, then α is $-\frac{4}{3}$ (b) 0 (c) 1 (d) $\frac{4}{3}$

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176. If P and Q are two points on the circle $x^2 + y^2 - 4x + 6y - 3 = 0$ which are farthest and nearest respectively from the point $(7, 2)$ then. (A) $P \equiv \left(2 - 2\sqrt{2}, \ -3 - 2\sqrt{2}\right)$ (B) $Q \equiv \left(2 + 2\sqrt{2}, \ -3 + 2\sqrt{2}\right)$ (C) $P \equiv \left(2 + 2\sqrt{2}, \ -3 + 2\sqrt{2}\right)$ (D) $Q \equiv \left(2 - 2\sqrt{2}, \ -3 + 2\sqrt{2}\right)$

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177. If point $P(x, y)$ is called a lattice point if $x, y \in I$. Then the total number of lattice points in the interior of the circle $x^2 + y^2 = a^2, a \neq 0$ can not be:

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178. The points on the line $x = 2$ from which the tangents drawn to the circle $x^2 + y^2 = 16$ are at right angles is (are) $(2, 2\sqrt{7})$ (b) $(2, 2\sqrt{5})$ $(2, -2\sqrt{7})$ (d) $(2, -2\sqrt{5})$

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179. The point of contact of a tangent from the point $(1, 2)$ to the circle $x^2 + y^2 = 1$ has the coordinates :

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180. The equation of a circle S_1 is $x^2 + y^2 = 1$. The orthogonal tangents to S_1 meet at another circle S_2 and the orthogonal tangents to S_2 meet at the third circle S_3. Then (A) radius of S_2 and S_1 are in ratio $1 : \sqrt{2}$ (B) radius of S_2 and S_1 are in ratio $1 : 2$ (C) the circles S_1, S_2 and S_3 are concentric (D) none of these

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181. A particle from the point $P(\sqrt{3}, 1)$ moves on the circle $x^2 + y^2 = 4$ and after covering a quarter of the circle leaves it tangentially. The equation of a line along with the point moves after leaving the circle is

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182. $A\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ is a point on the circle $x^2 + y^2 = 1$ and B is another point on the circle such that $AB = \frac{\pi}{2}$ units. Then coordinates of B can be : (A) $\left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right)$ (B) $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ (C) $\left(-\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right)$ (D) none of these

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183. Statement 1 : The circle $x^2 + y^2 - 8x - 6y + 16 = 0$ touches x-axis. Statement : 2 : y-coordinate of the centre of the circle $x^2 + y^2 - 8x - 6y + 16 = 0$ is numerically equal to its radius. (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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184. If point $P(x, y)$ is called a lattice point if $x, y \in I$. Then the total number of lattice points in the interior of the circle $x^2 + y^2 = a^2, a \neq 0$ can not be:

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185. Statement 1 : The line $(x-12)\cos\theta + (y-3)\sin\theta = 1$ touches a fixed circle for all values of θ. Statement 2 : $y - \beta = m(x-\alpha) \pm a\sqrt{1+m^2}$ is tangent to the circle $(x-\alpha)^2 + (y-\beta)^2 = a^2$ for all values of m. (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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186. Let $S_1 \equiv x^2 + y^2 - a^2 = 0$ and $S_2 \equiv x^2 + y^2 - 2\sqrt{2}x - 2\sqrt{2}y - a = 0$ be two circles. Statement 1 : The value of a for which the circles $S_1 = 0$ and $S_2 = 0$ have exactly three common tangents are 0 and 5. Statement 2 : Two circles have exactly 3 common tangents if they touch each other externally. (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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187. The equation of the diameter of the circle $x^2 + y^2 + 4x + 4y - 11 = 0$, which bisects the chord cut off by the circle on the line $2x - 3y - 3 = 0$ is $3x + 2y + 10 = 0$. Statement 2 : The diameter of a circle is a chord of the circle of maximum length. (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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188. $x - y + b = 0$ is a chord of the circle $x^2 + y^2 = a^2$ subtending an angle 60^0 in the major segment of the circle. Statement 1 : $\frac{b}{a} = \pm\sqrt{2}$. Statement 2 : The angle subtended by a chord of a circle at the centre is twice the angle subtended by it at any point on the circumference. (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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189. A line is tangent to a circle if the length of perpendicular from the centre of the circle to the line is equal to the radius of the circle. For all values of θ the lines $(x-3)\cos\theta+(y-4)\sin\theta=1$ touch the circle having radius. (A) 2 (B) 1 (C) 5 (D) none of these

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190. A line is tangent to a circle if the length of perpendicular from the centre of the circle to the line is equal to the radius of the circle. If $4l^2-5m^2+6l+1=0$, then the line $lx+my+1=0$ touches a fixed circle whose centre. (A) Lies on x-axis (B) lies on yl-axis (C) is origin (D) none of these

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191. A given line L_1 cut x and y-axes at P and Q respectively and has intercepts a and $\frac{b}{2}$ on x and y-axes respectively. Let another line L_2 perpendicular to L_1 cut x and y-axes at R and S respectively. Let T be the point of intersection of PS and QR. Locus of T is a circle having centre at (A) (a, b) (B) $\left(a, \frac{b}{2}\right)$ (C) $\left(\frac{a}{2}, b\right)$ (D) $\left(\frac{a}{2}, \frac{b}{4}\right)$

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192. A given line L_1 cut x and y-axes at P and Q respectively and has intercepts a and $\frac{b}{2}$ on x and y-axes respectively. Let another line L_2 perpendicular to L_1 cut x and y-axes at R and S respectively. Let T be the point of intersection of PS and QR. If two chords each bisected by x-axis can be drawn from $\left(a, \frac{b}{2}\right)$ to the locus of T, then (A) $a^2 > 2b^2$ (B) $b^2 > 2a^2$ (C) $a^2 < 2b^2$ (D) $b^2 < 2a^2$

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193. A given line L_1 cut x and y-axes at P and Q respectively and has intercepts a and $\frac{b}{2}$ on x and y-axes respectively. Let another line L_2 perpendicular to L_1 cut x and y-axes at R and S respectively. Let T be the point of intersection of PS and QR. A straight line passes through the centre of locus of T. Then locus of the foot of perpendicular to it from origin is : (A) a straight line (B) a circle (C) a parabola (D) none of these

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194. A line intersects x-axis at $A(2, 0)$ and y-axis at $B(0, 4)$. A variable lines PQ which is perpendicular to AB intersects x-axis at P and y-axis at Q. AQ and BP intersect at R. Locus of R is : (A) $x^2 + y^2 - 2x + 4y = 0$ (B) $x^2 + y^2 + 2x + 4y = 0$ (C) $x^2 + y^2 - 2x - 4y = 0$ (D) $x^2 + y^2 + 2x - 4y = 0$

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195. A line intersects x-axis at $A(2, 0)$ and y-axis at $B(0, 4)$. A variable lines PQ which is perpendicular to AB intersects x-axis at P and y-axis at Q. AQ and BP intersect at R. The locus of R and the circle $x^2 + y^2 - 8y - 4 = 0$ (A) touch each other internally (B) touche the given circle externally (C) intersect in two distinct points (D) neither intersect nor touch each other

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196. A line intersects x-axis at $A(2, 0)$ and y-axis at $B(0, 4)$. A variable lines PQ which is perpendicular to AB intersects x-axis at P and y-axis at Q. AQ and BP intersect at R. Image of the locus of R in the line $y = -x$ is : (A) $x^2 + y^2 - 2x + 4y = 0$ (B) $x^2 + y^2 + 2x + 4y = 0$ (C) $x^2 + y^2 - 4y = 0$ (D) $x^2 + y^2 + 2x - 4y = 0$

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197. Two circles centres A and B radii r_1 and r_2 respectively. (i) touch each other internally iff $|r_1 - r_2| = AB$. (ii) Intersect each other at two points iff $|r_1 - r_2| < AB < r_1 r_2$. (iii) touch each other externally iff $r_1 + r_2 = AB$. (iv) are separated if $AB > r_1 + r_2$. Number of common tangents to the two circles in case (i), (ii), (iii) and (iv) are 1, 2, 3 and 4 respectively. circles $x^2 + y^2 + 2ax + c^2 = 0$ and $x^2 + y^2 + 2by + c^2 = 0$ touche each other if (A) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{2}{c^2}$ (B) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{2}{c^2}$ (C) $\frac{1}{a^2} - \frac{1}{b^2} = \frac{2}{c^2}$ (D) $\frac{1}{a^2} - \frac{1}{b^2} = \frac{4}{c^2}$

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198. Two circles centres A and B radii r_1 and r_2 respectively. (i) touch each other internally iff $|r_1 - r_2| = AB$. (ii) Intersect each other at two points iff $|r_1 - r_2| < AB < r_1 r_2$. (iii) touch each other externally iff $r_1 + r_2 = AB$. (iv) are separated if $AB > r_1 + r_2$. Number of common tangents to the two circles in case (i), (ii), (iii) and (iv) are 1, 2, 3 and 4 respectively. If circles $(x-1)^2 + (y-3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect each other at two different points, then : (A) $1 < r < 5$ (B) $5 < r < 8$ (C) $2 < r < 8$ (D) none of these

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199. Two circles centres A and B radii r_1 and r_2 respectively. (i) touch each other internally iff $|r_1 - r_2| = AB$. (ii) Intersect each other at two points iff $|r_1 - r_2| < AB < r_1 r_2$. (iii) touch each other externally iff $r_1 + r_2 = AB$. (iv) are separated if $AB > r_1 + r_2$. Number of common tangents to the two circles in case (i), (ii), (iii) and (iv) are 1, 2, 3 and 4 respectively. Number of common tangents to the circles $x^2 + y^2 - 6x = 0$ and $x^2 + y^2 + 2x = 0$ is (A) 1 (B) 2 (C) 3 (D) 4

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200. Equation of any circle passing through the point(s) of intersection of circle $S = 0$ and line $L = 0$ is $S + kL = 0$. Let $P(x_1, y_1)$ be a point outside the circle $x^2 + y^2 = a^2$ and PA and PB be two tangents drawn to this circle from P touching the circle at A and B. On the basis of the above information : Equation of circumcircle of ΔPAB is : (A) $x^2 + y^2 + \times_1 + yy_1 = 0$ (B) $x^2 + y^2 + \times_1 - yy_1 = 0$ (C) $x^2 + y^2 + \times_1 - yy_1 - a^2 = 0$ (D) $x^2 + y^2 - \times_1 - yy_1 - a^2 = 0$

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201. Equation of any circle passing through the point(s) of intersection of circle $S = 0$ and line $L = 0$ is $S + kL = 0$. Let $P(x_1, y_1)$ be a point outside the circle $x^2 + y^2 = a^2$ and PA and PB be two tangents drawn to this circle from P touching the circle at A and B. On the basis of the above information : If P lies on the $px + qy = r$, then locus of circumcentre of ΔPAB is : (A) $2px + 2qy = r$ (B) $px + qy = r$ (C) $px - qy = r$ (D) $2px - 2py = r$

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202. Equation of any circle passing through the point(s) of intersection of circle $S = 0$ and line $L = 0$ is $S + kL = 0$. Let $P(x_1, y_1)$ be a point outside the circle $x^2 + y^2 = a^2$ and PA and PB be two tangents drawn to this circle from P touching the circle at A and B. On the basis of the above information : The circle which has for its diameter the chord cut off on the line $px + qy - 1 = 0$ by the circle $x^2 + y^2 = a^2$ has centre

(A) $\left(\frac{p}{p^2 + q^2}, \frac{-q}{p^2 + q^2}\right)$ (B) $\left(\frac{p}{p^2 + q^2}, \frac{q}{p^2 + q^2}\right)$ (C) $\left(\frac{p}{p^2 + q^2}, \frac{q}{p^2 + q^2}\right)$

(D) none of these

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203. The circle $x^2 + y^2 - 4x - 4y + 4 = 0$ is inscribed in a triangle which has two of its sides along the coordinate axes. The locus of the circumcenter of the triangle is $x + y - xy + k\left(x^2 + y^2\right)^{\frac{1}{2}} = 0$. Find k.

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204. Three distinct points A, B and C are given in the 2-dimensional coordinate plane such that the ratio of the distance of any one of them from the point $(1, 0)$ to the distance from the point $(-1, 0)$ is equal to $1:3$. Then the circumcentre of the triangle ABC is at the point (1) $(0, 0)$ (2) $\left(\frac{5}{4}, 0\right)$ (c) $\left(\frac{5}{2}, 0\right)$ (d) $\left(\frac{5}{3}, 0\right)$

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205. Let ABCD be a square of side length 2 units. C2 is the circle through vertices A, B, C, D and C1 is the circle touching all the sides of the square ABCD. L is a line through A. 27. If P is a point on C1 and Q in another point on C2, then 2222 2222 PA PB PC PD QA QB QC QD +++ +++ is equal to (A) 0.75 (B) 1.25 (C) 1 (D) 0.5

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206. A circle touches the line L and the circle C_1 externally such that both the circles are on the same side of the line, then the locus of centre of the circle is (a) Ellipse (b) Hyperbola (c) Parabola (d) Parts of straight line

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207. ABCD is a square with side AB = 2. A point P moves such that its distance from A equals its distance from the line BD. The locus of P meets the line AC at T_1 and the line through A parallel to BD at T_2 and T_3. The area of the triangle $T_1T_2T_3$ is :

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208. $3x - 2y + 1 = 0$ and $2x - y = 0$ are the equation of the sides AB and AD of the parallelogram $ABCD$ and the equation of a diagonal of the parallelogram is $5x - 3y - 1 = 0$. The equation of the other diagonal of the parallelogram is : (A) $x - y + 1 = 0$ (B) $x - y - 1 = 0$ (C) $3x + 5y + 13 = 0$ (D) $3x + 5y = 13$

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209. $3x - 2y + 1 = 0$ and $2x - y = 0$ are the equation of the sides AB and AD of the parallelogram $ABCD$ and the equation of a diagonal of the parallelogram is $5x - 3y - 1 = 0$. The centroid of ΔABD is : (A) $\left(1, \frac{4}{3}\right)$ (B) $\left(3, \frac{14}{3}\right)$ (C) $\left(\frac{7}{3}, \frac{10}{3}\right)$ (D) $\left(\frac{5}{3}, \frac{8}{3}\right)$

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210. $3x - 2y + 1 = 0$ and $2x - y = 0$ are the equation of the sides AB and AD of the parallelogram $ABCD$ and the equation of a diagonal of the parallelogram is $5x - 3y - 1 = 0$. The area of the parallelogram $ABCD$ is : (A) 2 sq. units (B) 4 sq. units (C) 6 sq. units (D) 8 sq. units

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211. From a point P outside a circle with centre at C, tangents PA and PB are drawn such that $\frac{1}{(CA)^2} + \frac{1}{(PA)^2} = \frac{1}{16}$, then the length of chord AB is

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212. the no. of possible integral values of m for which the circle $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y + m^2 = 0$ has exactly two common tangents are

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213. The extremities of a diagonal of a rectangle are $(-4, 4)$ and $(6, -1)$. A circle circumscribes the rectangle and cuts an intercept AB on the y-axis. If Δ be the area of the triangle formed by AB and the tangents to the circle at A and B, then $8\Delta =$.

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214. A rectangle $ABCD$ is inscribed in a circle with a diameter lying along the line $3y = x + 10$. If A and B are the points $(-6, 7) and (4, 7)$ respectively, find the area of the rectangle and equation of the circle.

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215. Number of integral values λ for which the varaible line $3x + 4y - \lambda = 0$ lies between the circles $x^2 + y^2 - 2x - 2y + 1 = 0$ and $x^2 + y^2 - 18x - 2y + 78 = 0$, without intersecting any circle at two distinct points.

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216. If the coordinates of points A, B, C satisfy the relation $xy = 1000$ and (α, β) be the coordinates of the orthocentre of ΔABC, then the value of $\alpha\beta$ is

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217. 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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