MATHS

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

CIRCLE

Solved Problems

1. Find the equation of circle with centre

$(1, 4)$ and radius '5'

A.

B.

C.

D.

Answer: i.e., $x^2 + y^2 - 2x - 8y - 8 = 0$

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2. Find the centre and radius of the circle

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

A.

B.

C.

D.

Answer: $= 3$

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3. Find the centre and radius of the circle

$3x^2 + 3y^2 - 6x + 4y - 4 = 0$

A.

B.

C.

D.

Answer: $= \frac{5}{3}$

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4. Find the equation of the ciracle whose centre is $(-1, 2)$ and which passes through $(5, 6)$

A.

B.

C.

D.

Answer: $x^2 + y^2 + 2x - 4y - 47 = 0$

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5. Find the equation of the circle passing through $(2, 3)$ and concentric with the circle $x^2 + y^2 + 8x + 12y + 15 = 0$

A.

B.

C.

D.

Answer: $x^2 + y^2 + 8x + 12y - 65 = 0$

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6. From the point A $(0, 3)$ on the circle $x^2 + 4x + (y - 3)^2 = 0$ a chord AB is drawn and extended to a point M such that

AM = 2 AB. Find the equation of the locus

of M.

A.

B.

C.

D.

Answer: $x^2 + y^2 + 8x - 6y + 9 = 0$

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7. If the circle $x^2 + y^2 + ax + by - 12 = 0$ has the centre at $(2, 3)$ then find a, b, and the radius of the circle.

A.

B.

C.

D.

Answer: $= 5$

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8. If the circle $x^2 + y^2 - 4x + 6y + a = 0$ has radius 4 then find a.

A.

B.

C.

D.

Answer: $= -3$

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9. Find the equation of the circle passing through $(4, 1), (6, 5)$ and having the centre on the line $4x + y - 16 = 0$.

A.

B.

C.

D.

Answer: $x^2 + y^2 - 6x - 8y + 15 = 0$

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10. Suppose a point (x_1, y_1) satisfies $x^2 + y^2 + 2gx + 2fy + c = 0$ then show that it represents a circle whenever g, f and c are real.

A.

B.

C.

D.

Answer: $= (x_1 + g)^2 + (y_1 + f)^2 \geq 0$

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11. Find the equation of the circle whose extremities of a diameter are $(1, 2)$ and $(4, 5)$

A.

B.

C.

D.

Answer: $x^2 + y^2 - 5x - 7y + 14 = 0$

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12. Find the other end of the diameter of the circle $x^2 + y^2 - 8x - 8y + 27 = 0$ if one end of it is $(2, 3)$.

A.

B.

C.

D.

Answer: The other end of the diameter is `B(6, 5)

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13. Find the equation of the circum - circle of the traingle formed by the line $ax + by + c = 0(abc \neq)$ and the co-ordinate axes.

A.

B.

C.

D.

Answer: $ab\left(x^2 + y^2\right) + (bx + ay) = 0$

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14. Find the equation of the circle which passes through the vertices of the triangle formed by $L_1 = x + y + 1 = 0$

$L_2 = 3x + y + 5 = 0$ and $L_3 = 2x + y - 5 = 0$

A.

B.

C.

D.

Answer: i.e., $x^2 + y^2 - 30x - 10y + 25 = 0$

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15. Find the centre of the circle passing through the points $(0, 0), (2, 0)$ and $(0, 2)$.

A.

B.

C.

D.

Answer: Thus the center of the required circle is (1,1)`

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16. Obtain the parametric equations of the circle $x^2 + y^2 = 1$

A.

B.

C.

D.

Answer:

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17. Obtain the parametric equation of the circle represented by

$x^2 + y^2 + 6x + 8y - 96 = 0$

A.

B.

C.

D.

Answer: $0 \leq \theta \leq 2\pi$

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18. Locate the position of the point $(2, 4)$ with respect to the circle.

$x^2 + y^2 - 4x - 6y + 11 = 0$

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19. Find the length of the tangent form $(1, 3)$ to the circle $x^2 + y^2 - 2x + 4y - 11 = 0$.

A.

B.

C.

D.

Answer: $= 3$

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20. If a point P is moving such that the length of tangents drawn from P to

$x^2 + y^2 - 2x + 4y - 20 = 0 \quad \_\_\_(1).$

and $x^2 + y^2 - 2x - 8y + 1 = 0 \quad \_\_\_(2).$

are in the ratio $2:1$

Then show that the equation of the locus of P is $x^2 + y^2 - 2x - 12y + 8 = 0$

A.

B.

C.

D.

Answer: $x^2y^2 - 2x - 12y + 8 = 0$

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21. If $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle then show that the straight line $lx + my + n = 0$

(i) touches the circle $S = 0$ if

$$(g^2 + f^2 - c) = \frac{(gl + mf - n)^2}{(l^2 + m^2)}$$

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22. If $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ repre-

sents a circle then show that the straight

line $lx + my + n = 0$

(ii) meet the circle $S = 0$ in two points if

$$g^2 + f^2 - c > \frac{(gl + mf - n)^2}{(l^2 + m^2)}$$

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23. If $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle then show that the straight line $lx + my + n = 0$

(iii) will not meet the circle if

$$g^2 + f^2 - c < \frac{(gl + mf - n)^2}{(l^2 + m^2)}$$

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24. Find the length of the chord intercepted by the circle $x^2 + y^2 + 8x - 4y - 16 = 0$ on the line $3x - y + 4 = 0$.

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25. Find the equation of tangents to $x^2 + y^2 - 4x + 6y - 12 = 0$ which are parallel to $x + 2y - 8 = 0$.

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26. Show that the circle $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ touches the

(i) X- axis if $g^2 = c$

(ii) Y - axis if $f^2 = c$.

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27. Find the equation of the tangent to

$x^2 + y^2 - 6x + 4y - 12 = 0 \quad \text{at} \quad (-1, 1)$

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28. Find the equation of the tangent to

$x^2 + y^2 - 2x + 4y = 0 \quad \text{at}(3, -1)$ Also find the equation of tangent parallel to it.

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29. If $4x - 3y + 7 = 0$ is a tangent ot the circle repesented by $x^2 + y^2 - 6x + 4y - 12 = 0$, then find its point of contact.

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30. Find the equations of circles which touch $2x - 3y + 1 = 0$ at (1,1) and having radius $\sqrt{13}$

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31. Show that the line $5x + 12y - 4 = 0$

touches the circle

$x^2 + y^2 - 6x + 4y + 12 = 0$

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32. If the parametric values of two points

A and B lying on the circle

$x^2 + y^2 - 6x + 4y - 12 = 0$

are 30° and 60° respectively,

then find the equation of the chord

joining A and B

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33. Find the equation of the tangent at the point 30° (parametric value of θ) of the circle is $x^2 + y^2 + 4x + 6y - 39 = 0$.

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34. Find the area of the triangle formed by the tangent at $P(x_1, y_1)$ to the circle $x^2 + y^2 = a^2$ with co-ordinate axes where $x_1, y_1 \neq 0$.

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35. Find the equation of the momal to the circle $x^2 + y^2 - 4x - 6y + 11 = 0$ at $(3, 2)$. Also find the other point where the normal meets the circle.

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36. Find the area of the triangle formed by the normal at $(3, -4)$ to the circle

$x^2 + y^2 - 22x - 4y + 25 = 0$ with the co-ordinate axes.

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37. Show that the line $lx + my + n = 0$ is a normal to the circle $S = 0$ if and only if $gl + mf = n$

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38. Fing the condition that the tangents drawn from the exterior point (g, f) to $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ are perpendicular to each other.

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39. If θ_1, θ_2 are the angles of inclination of tangents through a point P to the circle $x^2 + y^2 = a^2$ then find the locus of P when $\cot\theta_1 + \cot\theta_2 = k$.

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40. Find the chord of contact of $(2, 5)$ with repect ot the circle

$x^2 + y^2 - 5x + 4y - 2 = 0.$

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41. If the chord of contact of a point P with respect to the circle $x^2 +_y^2 = a^2$ cut the circle at A and B such that $A\hat{O}B = 90^\circ$ then show that P lies on the circle

$x^2 + Y^2 2a^2$

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42. Find the equation of the polar of $(2, 3)$ with respect to the circle $x^2 + y^2 + 6x + 8y - 96 = 0$

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43. Find the pole of $x + y + 2 = 0$ with respect to the circle $x^2 + y^2 - 4x + 6y - 12 = 0.$

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44. Show that the poles of the tangents to the circle $x^2 + y^2 = a^2$ with respect to the circle $(x + a)^2 + y^2 = 2a^2$ lie on $y^2 + 4ax = 0$.

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45. Show that $(4, -2)$ and $(3, -6)$ are conjugate with respect to the circle $x^2 + y^2 - 24 = 0$.

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46. if $(4, k)$ and $(2, 3)$ are conjugate points with respect to the circle $x^2 + y^2 = 17$ then find k.

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47. Show thet the lines $2x + 3y + 11 = 0$ and $2x - 2y - 1 = 0$ are conjugate with respect to the circle $x^2 + y^2 + 4x + 6y + 12 = 0$

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48. Show that the area of the triangle formed by the two tangents through $P(x_1, y_1)$ to the circle $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ and the chord of contact of P with respect to $S = 0$is $\frac{r(S_{11})^{3/2}}{S_{11} + r^2}$ where r is the radius of the circle.

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49. Find the mid point of the chord intercepted by

$x^2 + y^2 - 2x - 10y + 1 = 0$ ___(1)

on the line $x - 2y + 7 = -0.$ _____(2)

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50. Find the locus of mid-points of the chorde of

$x^2 + y^2 = a^2$ from the points

lying on the line $lx + my + n = 0.$

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51. Show that the four common tangents can be drawn for the circles given by

$x^2 + y^2 - 14x + 6y + 33 = 0 \quad \_\_\_\_(1)$

and $x^2 + y^2 + 30x - 2y + 1 = 0 \quad \_\_\_\_\_(2)$

and find the internal and external centres of similitude.

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52. Prove that the circles $x^2 + y^{20 - 8x - 6y + 21 = 0}$ and$x^2 + y^2 - 2y - 15 = 0$ have

exactly two common tangents. Also find

the point of intersection of those tangents.

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53. Show that the circles

$x^2 + y^2 - 4x - 6y - 12 = 0$ and

$x^2 + y^2 + 6x + 18y + 26 = 0$ touch each

other. Also find the point of contact and

common tangent at this point of contact.

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54. Show that the circles

$x^2 + y^2 - 4x - 6y - 12 = 0$ and

$5(x^2 + y^2) - 8x - 14y - 32 = 0$ touch each

other and find their point of contact.

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55. Find the equation of the pair of tangents

from $(10, 4)$ to the circle $x^2 + y^2 = 25$.

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56. Find the equation ot all possible common tangents of the circles $x^2 + y^2 - 2x - 6y + 6 = 0$ and $x^2 + y^2 = 1$.

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Exercise 1 A

1. Find the equation of the circle with centre C and redius r where.

$C = (2, -3), r = 4$

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2. Find the equation of the circle with centre

C and redius r where.

$C = (-1, 2), r = 5$

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3. Find the equation of the circle with centre

C and redius r where.

$C = (a, -b), r = a + b$

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4. Find the equation of the circle with centre

C and redius r where.

$C = (- a, \ - b), r = \sqrt{a^2 - b^2} (|a| > |b|)$

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5. Find the equation of the circle with centre

C and redius r where.

$C = (\cos \alpha, \sin \alpha), r = 1$

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6. Find the equation of the circle with centre

C and redius r where.

$C = (-7, -3), r = 4$

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7. Find the equation of the circle with centre

C and redius r where.

$C = \left(-\frac{1}{2}, -9\right), r = 5$

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8. Find the equation of the circle with centre

C and redius r where.

$$c = \left(\frac{5}{2}, -\frac{4}{3}\right), r = 6$$

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9. Find the equation of the circle with centre

C and redius r where.

$$C = (1, 7), r = \frac{5}{2}$$

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10. Find the equation of the circle with centre C and redius r where.

$C = (0, 0), r = 9$

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11. Find the equation of the circle passing through the orgin and having the centre at (-4,-3)

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12. Find the equation of the circle passing through $(2, -1)$ having the centre at $(2, 3)$.

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13. Find the equation of the circle passing the through $(-2, 3)$ centre at $(0, 0)$.

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14. Find the equation of the circle passing through $(3, 4)$ having and the centre at

$(-3, 4)$.

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15. Find the value of 'a' if

$2x^2 + ay^2 - 3x + 2y - 1 = 0$ represents a

circle and also find its radius.

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16. Find the values of a, b, if $ax^2 + bxy + 3y^2 -$

$5x + 2y - 3 = 0$ represents a circle. Also find

the radius and center of the circle.

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17. If $x^2 + y^2 + 2gx + 2fy - 12 = 0$ represents a circle with centre $(2, 3)$, find g, f and its radius.

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18. If $x^2 + y^2 + 2gx + 2fy = 0$ represents a circle with cerntre $(-4, -3)$ then find g, f

and the radius of the circle.

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19. If $x^2 + y^2 - 4x + 6y + c = 0$ represents a circle with radius 6 then find the value of c.

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20. Find the centre and radius of each of the circles whose equations are given below.

(i) $x^2 + y^2 - 4x - 8y - 41 = 0$

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21. Find the centre and radius of each of the circles whose equations are given below.

$3x^2 + 3y^2 - 5x - 6y + 4 = 0$

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22. Find the centre and radius of each of the circles whose equations are given below.

$3x^2 + 3y^2 - 6x - 12y - 1 = 0$

Find the radius and centre of the circle.

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23. Find the centre and radius of each of the circles whose equations are given below.

$x^2 + y^2 + 6x + 8y - 96 = 0$

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24. Find the centre and radius of each of the circles whose equations are given below.

$2x^2 + 2y^2 - 4x + 6y - 3 = 0$

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25. Find the centre and radius of each of the circles whose equations are given below.

$2x^2 + 2y^2 - 3x + 2y - 1 = 0$

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26. Find the centre and radius of each of the circles whose equations are given below.

$$\sqrt{1+m^2}\left(x^2+y^2\right)-2cx-2mcy=0$$

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27. Find the centre and radius of each of the circles whose equations are given below.

$$x^2+y^2+2ax-2by+b^2=0$$

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28. Find the equations of the circles for which the points given below are the end points of a diameter.

$(1, 2), (4, 6)$

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29. Find the equations of the circles for which the points given below are the end points of a diameter.

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

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30. Find the equations of the circles for which the points given below are the end points of a diameter.

$(1, 2), (8, 6)$

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31. Find the equations of the circles for which the points given below are the end points of a diameter.

$(4, 2), (1, 5)$

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32. Find the equations of the circles for which the points given below are the end points of a diameter.

$(7, -3), (3, 5)$

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33. Find the equations of the circles for which the points given below are the end points

of a diameter.

$(1, 1), (2, -1)$

34. Find the equations of the circles for which the points given below are the end points of a diameter.

$(0, 0), (2, 7)$

35. Find the equations of the circles for which the points given below are the end points of a diameter.

$(3, 1), (2, 7)$

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36. Obtain the parametric equation of each of the following circles.

$x^2 + y^2 = 4$

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37. Obtain the parametric equation of each of the following circles.

$4\left(x^2 + y^2\right) = 9$

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38. Obtain the parametric equation of each of the following circles.

$2x^2 + 2y^2 = 7$

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39. Obtain the parametric equation of each of the following circles.

$(x-3)^2+(y-4)^2=8^2$

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40. Obtain the parametric equation of each of the following circles.

$x^2+y^2-4x-6y-12=0$

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41. Obtain the parametric equation of each of the following circles.

$x^2 + y^2 - 6x + 4y - 12 = 0$

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42. If the abscissae of points A, B are the roots of the equation, $x^2 + 2ax - b^2 = 0$ and ordinates of A, B are roots of $y^2 + 2py - q^2 = 0$, then find the equation of a circle for which $\overline{AB}$ is a diameter.

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43. Show that $A(3, -1)$ lies on the circle $x^2 +_y^2 - 2x + 4y = 0$. Also find the other end of the diameter through A.

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44. Show that $A(-3, 0)$ lies on $x^2 + y^2 + 8x + 12y + 15 = 0$ and find the other end of diameter thorugh A.

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45. Find the equation of a circle which passes through $(2, -3)$ and $(-4, 5)$ and having the centre on $4x + 3y + 1 = 0$

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46. Find the equation of a circle which passes through $(4, 1)(6, 5)$ and having the centre on $4x + 3y - 24 = 0$

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47. Find the equation of a circle which is concentirc with $x^2 + y^2 - 6x - 4y - 12 = 0$ and passing through $(-2, 14)$.

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48. Find the equation of the circle whose centre lies on the X- axis and passing through $(-2, 3)$ and $(4, 5)$

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49. If ABCD is a square then show that the points A, B, C and D are concyclic.

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50. Find the equation of circle passing through each of the following three points.

$(3, 4), (3, 2), (1, 4)$

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51. Find the equation of circle passing through each of the following three points.

$(1, 2), (3, -4), (5, -6)$

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52. Find the equation of circle passing through each of the following three points.

$(2, 1), (5, 5), (-6, 7)$

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53. Find the equation of circle passing through each of the following three points.

$(5, 7), (8, 1), (1, 3)$

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54. Find the equation of the circle passing through $(0, 0)$ and making intercepts $4, 3$ on X- axis and Y - axis respectively

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55. Find the equation of the circle passing through $(0, 0)$ and Making intercept 4 units on Y- axis.

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56. Show that the following four points in each jof the following are concyclic and find the equation of the circle on which they lie.

$(1, 1), (-6, 0), (-2, 2), (-2-8)1$

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57. Show that the following four points in each jof the following are concyclic and find the equation of the circle on which they lie.

$(1, 2), (3, -4), (5, -6), (19, 8)$

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58. Show that the following four points in each jof the following are concyclic and find the equation of the circle on which

they lie.

$(1, -6), (5, 2), (7, 0), (-1, -4)$

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59. Show that the following four points in each jof the following are concyclic and find the equation of the circle on which they lie.

$(9, 1), (7, 9), (-2, 12), (6, 10)$

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60. If $(2, 0), (0, 1), (4, 5)$ and $(0, c)$ are concyclic, and then find c.

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61. Find the equation of the circum circle of the triangle formed by the straight lines given in each of the following:

$2x + y = 4, x + y = 6, x + 2y = 5$

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62. Find the equation of the circum circle of the triangle formed by the straight lines given in each of the following:

$x - 3y - 1 = 0, x + y + 1 = 0,$

$2x + 3y + 4 = 0$

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63. Find the equation of the circum circle of the triangle formed by the straight lines given in each of the following:

$5x - 3y + 4 = 0, 2x + 3y - 5 = 0,$

$x + y = 0$

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64. Find the equation of the circum circle of the triangle formed by the straight lines given in each of the following:

$x - y - 2 = 0,$

$2x - 3y + 4 = 0,$

$3x - y + 6 = 0$

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65. Show that the locus of the point of intersection of the lines $x \cos \alpha + Y \sin \alpha = a, x \sin \alpha - y \cos \alpha = b$($\alpha$ is a parameter) is a circle.

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66. Show that the locus of a point such that the ratio of distance of it from two given points is constant $k(\neq \pm 1)$ is a circle.

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Exercise 1 B

1. Locate the position of the point P with

resect to the circle $S = 0$ when

$P(3, 4)$ and $S \equiv x^2 + y^2 - 4x - 6y - 12 = 0$

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2. Locate the position of the point P with

resect to the circle $S = 0$ when

$P(1, 5)$ and $S \equiv x^2 + y^2 - 2x - 4y + 3 = 0$

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3. Locate the position of the point P with

resect to the circle $S = 0$ when

$P(4, 2)$ and $S \equiv 2x^2 + 2y^2 - 5x - 4y - 3 = 0$

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4. Locate the position of the point P with

resect to the circle $S = 0$ when

$P(2, -1)$ and $S \equiv x^2 + y^2 - 2x - 4y + 3 = 0$

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5. Find the power of the point P with respect

to the circle $S = 0$ when

$P = (5, -6)$, and $S \equiv x^2 + y^2 + 8x + 12y + 15$

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6. Find the power of the point P with respect

to the circle $S = 0$ when

$P = (-1, 1)$ and $S \equiv x^2 + y^2 - 6x + 4y - 12$

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7. Find the power of the point P with respect

to the circle $S = 0$ when

$P = (2, 3)$ and SS=x^(2)+y^(2)-2x+8y-23=0`

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8. Find the power of the point P with respect

to the circle $S = 0$ when

$P = (-2, 4)$ and $S \equiv x^2 + y^2 + 4x - 6y - 12$

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9. Fing the length of tangent from P to the ltbr., circle $S = 0$ when

$P = (-2, 5)$ and $S \equiv x^2 + y^2 - 25$

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10. Fing the length of tangent from P to the , circle $S = 0$ when

$P = (0, 0), S \equiv x^2 + y^2 - 14x + 2y + 25$

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11. Fing the length of tangent from P to the ltbr., circle $S = 0$ when

$P = (2, 5)$ and $S \equiv x^2 + y^2 - 5x + 4y - 5$

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12. If the length of the tangent from $(5, 4)$ to the circle $x^2 + y^2 + 2ky = 0$ is 1 the n find k.

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13. If the length of the tangent from $(2, 5)$ to the circle $x^2 + y^2 - 5x + 4y + k = 0$ is $\sqrt{37}$ then find k.

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14. If a point P is moving such that the lengths of tangents drawn from P to the circles $x^2 + Y^2 - 4x - 6y - 12 = 0$ and $x^2 + y^2 + 6x + 18y + 26 = 0$ are in the ratio $2:3$, then find jthe equation of the locus of P.

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15. If a point P is moving such that the lengths of the tangents drawn form P to the circles $x^2 + y^2 + 8x + 12y + 15 = 0$and $x^2 + y^2 - 4x - 6y - 12 = 0$ are equal then find the equation of the locus of P

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Exercise 1 C

1. Find the equation of the tangent at P of the circle $S = 0$ where P and S are given by

$P = (7, -5), S \equiv x^2 + y^2 - 6x + 4y - 12$

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2. Find the equation of the tangent at P of the circle $S = 0$ where P and S are given by

$P = (-1, 1), S \equiv x^2 + y(2) - 6x + 4y - 12$

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3. Find the equation of the tangent at P of the circle $S = 0$ where P and S are given by

$P = (-6, -9) S \equiv x^2 + y^2 + 4x + 6y - 39$

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4. Find the equation of the tangent at P of the circle $S = 0$ where P and S are given by

$P = (3, 4), S \equiv x^2 + y^2 - 4x - 6y + 11$

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5. Find the equation of the normal at P of the circle $S = 0$ where P and S are given by

$P = (3, -4), S \equiv x^2 + y^2 + x + y - 24$

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6. Find the equation of the normal at P of the circle $S = 0$ where P and S are given by

$P = (3, 5), S \equiv x^2 + y^2 - 10x - 2y + 6$

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7. Find the equation of the normal at P of the circle $S = 0$ where P and S are given by

$P = (1, 3), S \equiv 3\left(x^2 + y^2\right) - 19x - 29y + 76$

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8. Find the equation of the normal at P of the circle $S = 0$ where P and S are given by

$P = (1, 2), S \equiv x^2 + y^2 - 22x - 4y + 25$

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9. Find the length of the chord intercepted by the circle $x^2 + y^2 - x + 3y - 22 = 0$ on the line $y = x - 3$

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10. Find the length of the chord intercepted by the circle $x^2 + y^2 - 8x - 2y - 8 = 0$ on the line $x + y + 1 = 0$

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11. Fins the length of the cord formed by

$x^2 + y^2 = a^2$ on the line

$x \cos \alpha + y \sin \alpha = p.$

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12. Find the equation of circle with centre

$(2, 3)$ and touching the line $3x - 4y + 1 = 0$

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13. Find the equation of the circle with centre $(-3, 4)$ and touching $y-$ axis.

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14. Find the equation of tangents of the circle $x^2 + y^2 - 8x - 2y + 12 = 0$ at the points whose ordinates are 1.

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15. Find the equation of tangents of the circle $x^2 + y^2 - 10 = 0$ at the points whose abscissae are 1.

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16. If $x^2 + y^2 = c^2$ and $\frac{x}{a} + \frac{y}{b} = 1$ intersect at

A and B, the find $\overline{AB}$. Hence deduce the condition, the line touches the circle.

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17. The lilne $y = mx + x$ and the circle $x^2 + y^2 = a^2$ intersect at A and B. If $AB = 2\lambda$, then show that : $c^2 = \left(1 + m^2\right)\left(a^2 - \lambda^2\right)$.

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18. Find the equation of the circle with centre $(-2, 3)$ cutting a chord length 2 units on $3x + 4y + 4 = 0$

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19. Find the equation of tangent and normal at $(3, 2)$ of the circle $x^2 + y^2 - x - 3y - 4 = 0$.

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20. Find the equation of the tangent and normal at $(1, 1)$ to the circle $2x^2 + 2y^2 - 2x - 5y + 3 = 0$

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21. Prove that the tangent at $(3, -2)$ of the circle $x^2 + y^2 = 13$ touches the circle $x^2 + y^2 + 2x - 10y - 26 = 0$ and find its point of contact.

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22. Show that the tangent at $(-1, 2)$ of the circle $x^2 + y^2 - 4x - 8y + 7 = 0$ touches the circle $x^2 + y^2 + 4x + 6y = 0$ and also find its point of contact.

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23. find the equation of the tajngents ot the circle $x^2 + y^2 - 4x + 6y - 12 = 0$ which are parallel to $x + y - 8 = 0$

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24. Find the equations of the tangent of the circle $x^2 + y^2 + 2x - 2y - 3 = 0$ which are perpendicular to $3x - y + 4 = 0$

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25. Find the equation of the tangents to the circle $x^2 + y^2 - 4x - 6y + 3 = 0$ which makes an angle 45° with X - axis.

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26. Find the equation of the circle passing through $(-1, 0)$ and touching $x + y - 7 = 0$ at $(3, 4)$

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27. Find the equations of the circles passing through $(-1, 1)$ touching the lines $4x + 3y + 5 - 0$ and $3x - 4y - 10 = 0$

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28. Show that $x + y + 1 = 0$ touches the circle $x^2 + y^2 - 3x + 7y + 14 = 0$ and find its point of contact.

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Exercise 1 D

1. Find the condition that the tangents drawn from $(0, 0)$ to $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ be perpendicular to each lt brgt other.

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2. Find the chord of contact of $(0, 5)$ with respect to the circle

$x^2 + y^2 - 5x + 4y - 2 = 0$

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3. Find the chord of contact of $(1, 1)$ to the circle $x^2 + y^2 = 9$.

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4. Find the polar of $(1, 2)$ with respect to $x^2 + y^2 = 7$

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5. Find the polar of $(3, -1)$ with respect to

$2x^2 + 2y^2 = 11$

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6. Find the polar of $(1, -2)$ with respect of

$x^2 + y^2 - 10x - 10y + 25 = 0$

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7. Find the pole of $ax + by + c = 0 (c \neq 0)$

with respect to $x^2 + y^2 = r^2$

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8. Find the pole of $3x + 4y - 045 = 0$ with respect to$x^2 + y^2 - 6x8y + 5 = 0$

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9. Find the pole of $x - 2y + 22 = 0$ with respect to $x^2 + y^2 - 5x + 8y + 6 = 0$

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10. Show that the points $(-6, 1)$ and $(2, 3)$ are conjugate points with respect ot the circle

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11. Show that the points $(4, 2)(3, -5)$ are conjugate points with respect to the circle $x^2 + y^2 - 3x - 5y + 1 = 0$

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12. Find the value of k if $kx + 3y - 1 = 0$,

$2x + y + 5 = 0$ are conjugate lines with

respect to the circle

$x^2 + y^2 - 2x - 4y - 4 = 0.$

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13. Find the value of k if $x + y - 5 = 0$

$2x + ky - 8 = 0$ are conjugate with respect

to the circle $x^2 + y^2 - 2x - 2y - 1 = 0$

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14. Find the value of k if the points $(1, 3)$ and $(2, k)$ are coujuate with respect to the circle $x^2 + y^2 = 35$.

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15. Find the value of k if the points (4,2) and (k-3) are conjugate points with respect to the circle $x^2 + y^2 - 5x + 8y + 6 = 0$

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16. Find the angle between the tangents drawn from $(3, 2)$ to the circle $x^2 + y^2 - 6x + 4y - 2 = 0$

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17. Find the angle between the pair of tangents drawn from $(1, 3)$ to the circle $x^2 + y^2 - 2x + 4y - 11 = 0$

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18. Find the angle between the pair of tangents drawn from $(0, 0)$ to the circle $x^2 + y^2 - 14x + 2y + 25 = 0$.

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19. Show that the locus of P where the tangents drawn from P to the circle $x^2 + y^2 = a^2$ include an angle α is $x^2 + y^2 = a^2 \cos ec^2 \frac{\alpha}{2}$

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20. Find the locus of P if the tangents drawn from P to $x^2 + y^2 = a^2$ are perpendicular to each othe.

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21. Find the slope of the polar of $(1, 3)$ with respect to the circle $x^2 + y^2 - 4x - 4y - 4 = 0$ Also find the distance from the centre to it.

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22. If $ax + by + c = 0$ is the polar of $(1, 1)$ with respect to the circle $x^2 + y^2 - 2x + 2y + 1 = 0$ and H. C. F. of a, b, c is equal to one then find $a^2 + b^2 + c^2$.

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23. Find the coordinates of the point of intersection of tangents at the points where $x + 4y - 14 = 0$ meets the circle $x^2 + y^2 - 2x + 2y - 5 = 0$

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24. (prove that) If the polar of the points on the circle

$x^2 + y^2 = a^2$ with respect to the circle

$x^2 + y^2 = b^2$ touches the circle $x^2 + y^2 = c^2$

then prove that a, b, c, are in Geometrical progression.

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25. Tangents are drawn to the circle

$x^2 + y^2 = 16$

from the point $P(3, 5)$. Find the area

of the triangle formend by these tangents

and the chord of contact of P.

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26. Find the locus of the point whpse polars

with respect to the circles $x^2 + y^2 - 4x -$

$4y - 8 = 0$ and $x^2 + y^2 - 2x + 6y - 2 = 0$

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27. Find the locus of the foot of the perpendircular drawn from the origin to any chord of the circle $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ which subtends a right angle at the origin.

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Exercise 1 E

1. Discuss the relative position of the following pair of circles.

$x^2 + y^2 - 4x - 6y - 12 = 0$

$x^2 + y^2 + 6x + 18y + 26 = 0.$

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2. Discuss the relative position of the following pair of circles.

$x^2 + y^2 + 6x + 6y + 14 = 0$

$x^2 + y^2 - 2x - 4y - 4 = 0.$

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3. Discuss the relative position of the following pair of circles.

$(x-2)^2+(y+1)^2=9, (x+1)^2+(y-3)^2=4$

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4. Discuss the relative position of the following pair of circles.

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

$x^2y^2+4x-6y-3=0$

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5. Find the number of possible common tangents that exist for the following pairs of circles.

$x^2 + y^2 + 6x + 6y + 14 = 0$

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

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6. Find the number of possible common tangents that exist for the following pairs of circles.

$x^2 + y^2 - 4x - 2y + 1 = 0,$

$x^2 + y^2 - 6x - 4y + 4 = 0$

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7. Find the number of possible common tangents that exist for the following pairs of circles.

$x^2 + y^2 - 4x + 2y - 4 = 0,$

$x^2 + y^2 + 2x - 6y + 6 = 0$

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8. Find the number of possible common tangents that exist for the following pairs of circles.

$x^2 + y^2 = 4, x^2 + y^2 - 6x - 8y + 16 = 0$

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9. Find the number of possible common tangents that exist for the following pairs of circles.

$x^2 + y^2 + 4x - 6y - 3 = 0$

$x^2 + y^2 + 4x - 2y + 4 = 0.$

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10. Find the internal centre of similitude for the circles $x^2 + y^2 + 6x - 2y + 1 = 0$ and $x^2 + y^2 - 2x - 6y + 9 = 0$.

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11. Find the external centre of similitude for the circles $x^2 + y^2 - 2x - 6y + 9 = 0$ and $x^2 + y^2 = 4$

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12. Show that the circle

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

$x^2 + y^2 + 2x - 8y + 13 = 0$ touch each other. Find the point of contact and the equation of common tangent at their point of contact.

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13. Show thet

$x^2 + y^2 - 6x - 9y + 13 = 0, x^2 + y^2$

$-2x - 16y = 0$ touch each other. Find the point of contact and the equation of common tangent at their point of contact.

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14. Find the equation of the circle which touches the circle $x^2 + y^2 - 2x - 4y - 20 = 0$ externally at $(5, 5)$ with radius 5.

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15. Find the direct common tangents of the circles.

$x^2 + y^2 + 22x - 4y - 100 = 0$ and

$x^2 + y^2 - 22x + 4y + 100 = 0.$

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16. Find the transverse common tangents of the circles $x^2 + y^2 - 4x - 10y + 28 = 0$ and

$x^2 + y^2$

$+4x - 6y + 4 = 0.$

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17. Find the pair of tangents from $(4, 10)$ to the circle $x^2 + y^2 = 25$.

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18. Find the pair of tangents drawn from $(0, 0)$ to $x^2 + y^2 + 10x + 10y + 40 = 0$.

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19. Find thhe equation of the circle which touches $x^2 + y^2 - 4x + 6y - 12 = 0$ at $(-1, 1)$ internally with a radius of 2.

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20. Find all common tangents of the following pairs of circles.

$x^2 + y^2 = 9$ and $x^2 + y^2 - 16x + 2y + 49 = 0$

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21. Find all common tangents of the following pairs of circles.

$x^2 + y^2 + 4x + 2y - 4 = 0$ and

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

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22. Find the pair of tangents drawn from $(3, 2)$ to the circle $x^2 + y^2 - 6x + 4y - 2 = 0$

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23. Find the pair of tangents drawn from $(1, 3)$ to the circle $x^2 + y^2 - 2x + 4y - 11 = 0$ and also find the angle between them.

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24. Find the pair of tangents form the origin to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ and hence deduce a condition for these tangents to be perpendicular.

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25. From a point on the circle

$x^2 + y^2 + 2gx + 2fy + c = 0$ two tangents are

drawn to the circle $x^2 + y^2 2gx + 2fy + c$

$\sin^2 \alpha + \left(g^2 + f^2\right) \cos^2 \alpha = 0 (0 < \alpha < \pi / 2).$

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