1. The condition that the chord $x \cos \alpha + y \sin \alpha - p = 0$ of $x^2 + y^2 - a^2 = 0$ may subtend a right angle at the centre of circle is
(a*) $a^2 = 2p^2$ (b) $p^2 = 2a^2$ (c) $a = 2p$ (d) $p = 2a$

2. The locus of the centre of the circles which touch both the circles $x^2 + y^2 = a^2$ and $x^2 + y^2 = 4ax$ externally has the equation
(a*) $12 (x - a)^2 - 4y^2 = 3a^2$ (b) $9 (x - a)^2 - 5y^2 = 2a^2$
(c) $8x^2 - 3 (y - a)^2 = 9a^2$ (d) none of these

3. A variable chord is drawn through the origin to the circle $x^2 + y^2 - 2ax = 0$. The locus of the centre of the circle drawn on this chord as diameter is
(a) $x^2 + y^2 + ax = 0$ (b*) $x^2 + y^2 - ax = 0$
(c) $x^2 + y^2 + ay = 0$ (d) $x^2 + y^2 - ay = 0$

4. The number of real tangents that can be drawn from (2, 2) to the circle $x^2 + y^2 - 6x - 4y + 3 = 0$ is
(a*) 0 (b) 1 (c) 2 (d) 3

5. The number of common tangents of the circles $x^2 + y^2 - 2x - 1 = 0$ and $x^2 + y^2 - 2y - 7 = 0$ is
(a*) 1 (b) 2 (c) 3 (d) 4

6. If a circle passing through (1, 2) and cuts the circle $x^2 + y^2 = 4$ orthogonally then the equation of the locus of its centre is
(a*) $2x + 4y - 9 = 0$ (b) $2x + 4y + 9 = 0$
(c) $2x - 4y + 9 = 0$ (d) none of these

7. If a circle passes through the point (1, 2) and cuts the circle $x^2 + y^2 = 4$ orthogonally, then the equation of the locus of its centre is
(a) $x^2 + y^2 - 3x - 8y + 1 = 0$ (b) $x^2 + y^2 - 2x - 6y - 7 = 0$
(c*) $2x + 4y - 9 = 0$ (d) $2x + 4y - 1 = 0$

8. The radius of the circle passing through the point (6, 2), two of whose diameters are $x + y = 6$ and $x + 2y = 4$ is
(a) 10 (b*) $2\sqrt{5}$ (c) 6 (d) 4

9. Circles are drawn through the point (2, 0) to cut intercepts of length 5 units on the x–axis. If their centres lie in the first quadrant, then their equation is
(a) $x^2 + y^2 - 9x + 2ky + 14 = 0$ (b) $3x^2 + 3y^2 + 27x - 2ky + 42 = 0$
(c*) $x^2 + y^2 - 9x - 2ky + 14 = 0$ (d) $x^2 + y^2 - 2kx - 9y + 14 = 0$

10. The slope of the tangent at the point (h, h) of the circle $x^2 + y^2 = a^2$ is
(a) 0 (b) 1 (c*) – 1 (d) depends on h

11. A circle passes through the origin and has its centre on $y = x$. If it cuts $x^2 + y^2 - 4x - 6y + 10 = 0$ orthogonally, then the equation of the circle is
(a*) $x^2 + y^2 - x - y = 0$ (b) $x^2 + y^2 - 6x - 4y = 0$
(c) $x^2 + y^2 - 2x - 2y = 0$ (d) $x^2 + y^2 + 2x + 2y = 0$

12. The radical centre of three circles described on the three sides of a triangle as diameter is the
(a) orthocentre (b) circumcentre
(c*) incentre (d) centroid (e) triangle

13. The number of common tangents to the circles $x^2 + y^2 - x = 0$, $x^2 + y^2 + x = 0$ is
(a) 2 (b) 1 (c) 4 (d*) 3

14. The length of the tangent from (0, 0) to the circle $2(x^2 + y^2) + x - y + 5 = 0$ is
(a) $\sqrt{5}$ (b) $\frac{\sqrt{5}}{2}$ (c) $\sqrt{2}$ (d*) $\sqrt{\frac{5}{2}}$

15. A circle touches the x–axis and also touches the circle with centre (0, 3) and radius 2. The locus of the centre of the circle is
(a) a circle (b*) a parabola (c) an ellipse (d) a hyperbola

16. The locus of the centre of the circle which cuts the circles $x^2 + y^2 + 2g_1x + 2f_1y + c_1 = 0$ and $x^2 + y^2 + 2g_2x + 2f_2y + c_2 = 0$ orthogonally is
(a) an ellipse (b*) the radical axis of the given circles
(c) a conic (d) another circle

17. If a circle passes through the point (1, 2) and cuts the circle $x^2 + y^2 = 4$ orthogonally, then the equation of the locus of its centre is
(a) $x^2 + y^2 - 3x - 8y + 1 = 0$ (b) $x^2 + y^2 - 2x - 6y - 7 = 0$
(c*) $2x + 4y - 9 = 0$ (d) $2x + 4y - 1 = 0$

18. The equation of the circle having its centre on the line $x + 2y - 3 = 0$ and passing through the point of intersection of the circles $x^2 + y^2 - 2x - 4y + 1 = 0$ and $x^2 + y^2 - 4x - 2y + 4 = 0$ is
(a*) $x^2 + y^2 - 6x + 7 = 0$ (b) $x^2 + y^2 - 3x + 4 = 0$
(c) $x^2 + y^2 - 2x - 2y + 1 = 0$ (d) $x^2 + y^2 + 2x - 4y + 4 = 0$

19. The angle between the tangents drawn from the origin to the circle $(x - 7)^2 + (y + 1)^2 = 25$ is
(a) $\pi/3$ (b) $\pi/6$ (c*) $\pi/2$ (d) $\pi/8$

20. The equation of the circumcircle of the triangle formed by the lines $y + \sqrt{3}x = 6$, $y - \sqrt{3}x = 6$ and $y = 0$ is
(a) $x^2 + y^2 - 4y = 0$ (b) $x^2 + y^2 + 4x = 0$
(c*) $x^2 + y^2 - 4y - 12 = 0$ (d) $x^2 + y^2 + 4x = 12$

21. The equation of a circle with origin as centre and passing through the vertices of an equilateral triangle whose median is of length 3a is
(a) $x^2 + y^2 = 9a^2$ (b) $x^2 + y^2 = 16a^2$
(c*) $x^2 + y^2 = 4a^2$ (d) $x^2 + y^2 = a^2$

22. The radius of the circle passing through the point (6, 2), two of whose diameters are $x + y = 6$ and $x + 2y = 4$ is
(a) 10 (b*) $2\sqrt{5}$ (c) 6 (d) 4

23. The equation $x^2 + y^2 + 4x + 6y + 13 = 0$ represents
(a) a circle (b) a pair of two straight lines
(c) a pair of coincident straight lines (d*) a point

24. To which of the following circles, the line $y - x + 3 = 0$ is normal at the point $\left(3+\frac{3}{\sqrt{2}}, \frac{3}{\sqrt{2}}\right)$

(a) $\left(x-3-\frac{3}{\sqrt{2}}\right)^2+\left(y-\frac{3}{\sqrt{2}}\right)^2=9$ a circle (b) $\left(x-\frac{3}{\sqrt{2}}\right)^2+\left(y-\frac{3}{\sqrt{2}}\right)^2=9$

(c) $x^2 + (y - 3)^2 = 9$ (d*) $(x - 3)^2 + y^2 = 9$

25. Circles are drawn through the point (2, 0) to cut intercepts of length 5 units on the x–axis. If their centres lie in the first quadrant, then their equation is

(a) $x^2 + y^2 - 9x + 2ky + 14 = 0$ (b) $3x^2 + 3y^2 + 27x - 2ky + 42 = 0$

(c*) $x^2 + y^2 - 9x - 2ky + 14 = 0$ (d)$x^2 + y^2 - 2kx - 9y + 14 = 0$

26. The equation of the circle which touches both the axes and the straight line $4x + 3y = 6$ in the first quadrant and lies below it is

(a*) $4x^2 + 4y^2 - 4x - 4y + 1 = 0$ (b) $x^2 + y^2 - 6x - 6y + 9 = 0$

(c) $x^2 + y^2 - 6x - y + 9 = 0$ (d) $4(x^2 + y^2 - x - 6y) + 1 = 0$

27. The slope of the tangent at the point (h, h) of the circle $x^2 + y^2 = a^2$ is

(a) 0 (b) 1 (c*) – 1 (d) depends on h

28. The circles $x^2 + y^2 - 10x + 16 = 0$ and $x^2 + y^2 = r^2$ intersect each other in two distinct points if

(a) $r < 2$ (b) $r > 8$ (c*) $2 < r < 8$ (d) $2 \le r \le 8$

29. The locus of the centre of a circle which touches externally the circle $x^2 + y^2 - 6x - 6y + 14 = 0$ and also touches the y–axis is given by the equation

(a) $x^2 - 6x - 10y + 14 = 0$ (b) $x^2 - 10x - 6y + 14 = 0$

(c) $y^2 - 6x - 10y + 14 = 0$ (d*) $y^2 - 10x - 6y + 14 = 0$

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

(a) $2ax + 2by - (a^2 + b^2 + p^2) = 0$ (b) $2ax + 2by - (a^2 - b^2 + p^2) = 0$

(c) $x^2 + y^2 - 3ax - 4by + (a^2 + b^2 - p^2) = 0$ (d) $x^2 + y^2 - 2ax - 3by + (a^2 - b^2 - p^2) = 0$