1. The locus of the mid–point of the chords of the circle $x^2 + y^2 = 4$ which subtends a right angle at the origin is
(a) $x + y = 2$ (b) $x^2 + y^2 = 1$ (c*) $x^2 + y^2 = 2$ (d) $x + y = 1$

2. Two circles $x^2 + y^2 = 6$ and $x^2 + y^2 – 6x + 8 = 0$ are given. Then the equation of the circle through their point of intersection and the point (1, 1) is
(a) $x^2 + y^2 – 6x + 4 = 0$ (b*) $x^2 + y^2 – 3x + 1 = 0$
(c) $x^2 + y^2 – 4y + 2 = 0$ (d) none of these

3. The equation of the circle described on the common chord of the circles $x^2 + y^2 + 2x = 0$ and $x^2 + y^2 + 2y = 0$ as diameter is
(a) $x^2 + y^2 + x – y = 0$ (b) $x^2 + y^2 – x – y = 0$
(c) $x^2 + y^2 – x + y = 0$ (d*) $x^2 + y^2 + x + y = 0$

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

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

6. 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

7. Consider the circles $x^2 + (y – 1)^2 = 9$, $(x – 1)^2 + y^2 = 25$. They are such that
(a) these circles touch each other
(b*) one of these circles lies entirely inside the other
(c) each of these circles lies outside the other
(d) they intersect in two points

8. 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*) $\sqrt{\frac{5}{2}}$

9. 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

10. The circles $x^2 + y^2 – 4x – 6y – 12 = 0$ and $x^2 + y^2 + 4x + 6y + 4 = 0$
(a) touch externally (b) touch internally
(c*) intersect at two points (d) do not intersect

11. The equation of the unit circle concentric with $x^2 + y^2 + 8x + 4y – 8 = 0$ is
(a) $x^2 + y^2 – 8x + 4y – 8 = 0$ (b*) $x^2 + y^2 – 8x + 4y + 8 = 0$
(c) $x^2 + y^2 – 8x + 4y – 28 = 0$ (d) $x^2 + y^2 – 8x + 4y + 19 = 0$

12. 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

13. The length of the tangent to the circle $x^2 + y^2 - 2x - y - 7 = 0$ from $(-1, -3)$ is
(a) $\sqrt{8}$ (b*) $2\sqrt{2}$ (c) 4 (d) 8

14. Given that the circles $x^2 + y^2 - 2x + 6y + 6 = 0$ and $x^2 + y^2 - 5x + 6y + 15 = 0$ touch, the equation to their common tangent is
(a*) $x = 3$ (b) $y = 6$ (c) $7x - 12y - 21 = 0$ (d) $7x + 12y + 21 = 0$

15. The two circles $x^2 + y^2 - 2x - 2y = 7$ and $3(x^2 + y^2) - 8x + 29y = 0$
(a) touch externally (b) touch internally
(c*) cut each other orthogonally (d) do not cut each other

16. The centre of the circle passing through (0, 0) and (1, 0) and touching the circle $x^2 + y^2 = 9$ is
(a) (3/2, 1/2) (b) (1/2, 3/2) (c) (1/2, 1/2) (d*) $(1/2, \pm\sqrt{2})$

17. Equation of the circle with centre $\left(\frac{a}{2}, \frac{b}{2}\right)$ and radius $\sqrt{\frac{a^2+b^2}{4}}$ is
(a) $x^2 + y^2 - ax - by = (a + b)^2$ (b) $x^2 - y^2 - ax - by = (a + b)^2$
(c) $x^2 + y^2 - ax - by = \frac{a^2+b^2}{4}$ (d) $x^2 + y^2 - ax - by = 0$

18. The equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a circle if
(a) $a = h = 2, b = 0$ (b) $b = h = 2, a = 0$
(c) $a = b = 2, h = 0$ (d) none of these

19. Tangents are drawn from the origin to a circle with centre at $(2, -1)$. If the equation of one of the tangents is $3x + y = 0$, the equation of the other tangent is
(a) $3x - y = 0$ (b) $x + 3y = 0$ (c) $x - 3y = 0$ (d) $x + 2y = 0$

20. A line meets the coordinate axes in A and B. A circle is circumscribed abut the triangle OAB. If the distances from A and B of the tangent to the circle at the origin be m and n, then the diameter of the circle is
(a) $m(m + n)$ (b) $m + n$ (c) $n(m + n)$ (d) $m^2 + n^2$

21. If a cicle passes through the point (3, 4) and cuts the circle $x^2 + y^2 = a^2$ orthogonally, the equation of the locus of its centre is
(a) $3x + 4y - a^2 = 0$ (b) $6x + 8y = a^2 + 25$
(c) $6x + 8y + a^2 + 25 = 0$ (d) $3x + 4y = a^2 + 25$

22. The equation of the circle passing through the origin, having its centre on the line $x + y = 4$ and cutting the circle $x^2 + y^2 - 4x + 2y + 4 = 0$ orthogonally is
(a) $x^2 + y^2 - 2x - 6y = 0$ (b) $x^2 + y^2 - 6x - 2y = 0$
(c) $x^2 + y^2 - 4x - 4y = 0$ (d) $x^2 + y^2 - 8x = 0$

23. The circle passing through three distinct points (1, t), (t, 1) and (t, t) passes through the point
(a) (1, 1) (b) (– 1, – 1) (c) (– 1, 1) (d) (1, – 1)

24. If OA and OB are tangents from the origin to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ and C is the centre of the circle, then area of the quadrilateral OACB is
(a) $\frac{1}{2}\sqrt{c(g^2+f^2-c)}$ (b) $\sqrt{c(g^2+f^2-c)}$
(c) $c\sqrt{g^2+f^2-c}$ (d) $\sqrt{\frac{g^2+f^2-c}{c}}$

25. If the line $y = x + 3$ meets the circle $x^2 + y^2 = a^2$ at A and B, then equation of the circle on AB as diameter is
(a) $x^2 + y^2 + 3x – 3y – a^2 + 9 = 0$ (b) $x^2 + y^2 – 3x + 3y – a^2 – 9 = 0$
(c) $x^2 + y^2 + 3x + 3y + a^2 – 9 = 0$ (d) $x^2 + y^2 – 3x + 3y – a^2 + 9 = 0$

26. The radius of the circle passing through the point (6,2), two of whose diameter, are $x + y = 6$ and $x + 2y = 4$ is
(a) 0 (b) $2\sqrt{5}$ (c) 6 (d) 4

27. The equation of the circle through (1, 1) and the points of intersection of $x^2 + y^2 + 13x – 3y = 0$ and $2x^2 + 2y^2 + 4x – 7y – 25 = 0$ is
(a) $4x^2 + 4y^2 – 30x – 10y – 32 = 0$ (b) $4x^2 + 4y^2 + 30x – 13y – 25 = 0$
(c) $4x^2 + 4y^2 – 43x + 10y + 25 = 0$ (d) none of these

28. The abscissae of two points A and B are the roots of the equation $x^2 + 2ax – b^2 = 0$, and their ordinates are the roots of the equation $x^2 + 2px – q^2 = 0$. The radius of the circle with AB as diameter is
(a) $\sqrt{a^2+b^2+p^2+q^2}$ (b) $\sqrt{a^2+p^2}$
(c) $\sqrt{b^2+q^2}$ (d) none of these

29. The locus of the point of intersection of the tangents to the circle $x = r\cos\theta$, $y = r\sin\theta$ at points whose parametric angles differ by $\pi/3$ is
(a) $x^2 + y^2 = 4\ (2-\sqrt{3})\, r^2$ (b) $3(x^2 + y^2) = 1$
(c) $x^2 + y^2 = (2-\sqrt{3})\ r^2$ (d) $3(x^2 + y^2) = 4r^2$

30. If the two circles $x^2 + y^2 + 2gx + 2fy = 0$ and $x^2 + y^2 + 2g_1x + 2f_1y = 0$ touch each other, then
(a) $f_1g = fg_1$ (b) $ff_1 = gg_1$
(c) $f^2 + g^2 = f_1^2 + g_1^2$ (d) none of these