Entry Test MCQs: Conic Sections - Exercise 6.3 (Chapter 6, Mathematics Part-II, Class 12)

These 20 multiple-choice questions are designed for an entry test, focusing on circle properties (normals, tangents, circumcenter, mean proportional) and parabolas (standard forms, vertex, focus, directrix) from Exercise 6.3. Distractors reflect common errors for conceptual clarity.

MCQs: Conic Sections - Circles and Parabolas

1. The normal to the circle $x^2 + y^2 = r^2$ at point (x_1, y_1) always passes through:

(a) (x_1, y_1)

(b) $(0, 0)$

(c) $(-x_1, -y_1)$

(d) $(r, 0)$

Answer: b) Normal equation: $x_1 y = y_1 x$, satisfies $(0, 0)$.

2. The slope of the normal to $x^2 + y^2 = 25$ at $(4, 3)$ is:

(a) $-\frac{4}{3}$

(b) $\frac{3}{4}$

(c) $-\frac{3}{4}$

(d) $\frac{4}{3}$

Answer: b) Tangent slope: $-\frac{4}{3}$, normal slope: $\frac{3}{4}$.

3. A line from the center $(0, 0)$ of $x^2 + y^2 = r^2$ perpendicular to the tangent at (x_1, y_1) passes through:

(a) $(0, 0)$

(b) (x_1, y_1)

(c) $(-x_1, -y_1)$

(d) $(r, 0)$

Answer: b) Perpendicular slope: $\frac{y_1}{x_1}$, equation: $y = \frac{y_1}{x_1} x$, passes through (x_1, y_1).

4. In a right triangle with vertices $O(0, 0)$, $A(a, 0)$, $B(0, b)$, the circumcenter is:

(a) (a, b)

(b) $\left(\frac{a}{2}, \frac{b}{2}\right)$

(c) $(0,0)$

   (d) $\left(\frac{a}{2}, 0\right)$

   Answer: b) Midpoint of hypotenuse AB: $\left(\frac{a}{2}, \frac{b}{2}\right)$.

5. The perpendicular from point (a, b) on circle $x^2 + y^2 = r^2$ to diameter $(-r, 0)$ to $(r, 0)$ has length:

   (a) a

   (b) b

   (c) r

   (d) $\sqrt{a^2 + b^2}$

   Answer: b) Perpendicular at $(a, 0)$, length: $|b|$.

6. For the circle $x^2 + y^2 = r^2$, the product of segments AQ and QB of diameter AB split by perpendicular from (a, b) equals:

   (a) a^2

   (b) b^2

   (c) r^2

   (d) $r^2 - a^2$

   Answer: b) $|AQ| = r + a$, $|QB| = r - a$, product: $(r + a)(r - a) = r^2 - a^2 = b^2$.

7. The chord of contact from $(4, 5)$ to the circle $2x^2 + 2y^2 - 8x + 12y + 21 = 0$ is:

   (a) $4x + 16y + 35 = 0$

   (b) $4x - 16y + 35 = 0$

   (c) $8x + 16y - 35 = 0$

   (d) $4x + 8y + 35 = 0$

   Answer: a) Divide by 2, use $xx_1 + yy_1 - 2(x + x_1) + 3(y + y_1) + \frac{21}{2} = 0$, get $4x + 16y + 35 = 0$.

8. The parabola $y^2 = 4ax$ has its focus at:

   (a) $(a, 0)$

   (b) $(0, a)$

   (c) $(0, 0)$

   (d) $(-a, 0)$

   Answer: a) Standard form: focus at $(a, 0)$.

9. The directrix of the parabola $x^2 = -4ay$ is:

   (a) $y = a$

   (b) $y = -a$

   (c) $x = a$

   (d) $x = -a$

Answer: b) Standard form: directrix $y = -a$.

10. The vertex of the parabola $(y-2)^2 = 4(x-1)$ is:

    (a) $(1,2)$

    (b) $(2,1)$

    (c) $(0,0)$

    (d) $(1,-2)$

    Answer: a) Form $(y-k)^2 = 4a(x-h)$, vertex: $(h,k) = (1,2)$.

11. The latus rectum of the parabola $y^2 = 8x$ has length:

    (a) 4

    (b) 8

    (c) 2

    (d) 16

    Answer: b) Form $y^2 = 4ax$, $4a = 8$, latus rectum length: $4a = 8$.

12. The axis of the parabola $x^2 = 4ay$ is:

    (a) $x = 0$

    (b) $y = 0$

    (c) $x = a$

    (d) $y = a$

    Answer: a) Axis is perpendicular to directrix, through focus: $x = 0$.

13. The normal to $x^2 + y^2 + 2x - 4y - 21 = 0$ at $(-6,3)$ passes through:

    (a) $(-1,2)$

    (b) $(1,-2)$

    (c) $(6,-3)$

    (d) $(0,0)$

    Answer: a) Center: $(-1,2)$, normal passes through center.

14. In a right triangle with vertices $(0,0)$, $(3,0)$, $(0,4)$, the circumradius is:

    (a) 5

    (b) $\frac{5}{2}$

    (c) 4

    (d) 3

    Answer: b) Circumcenter: $\left(\frac{3}{2}, \frac{4}{2}\right)$, radius: $\sqrt{\left(\frac{3}{2}\right)^2 + \left(\frac{4}{2}\right)^2} = \frac{5}{2}$.

15. The perpendicular from $(3,4)$ on $x^2 + y^2 = 25$ to diameter $(-5,0)$ to $(5,0)$ splits it into segments with product:

    (a) 16

(b) 25

(c) 9

(d) 7

Answer: a) $|AQ| = 5 + 3 = 8$, $|QB| = 5 - 3 = 2$, product: $8 \cdot 2 = 16$.

16. The parabola $(x - 1)^2 = -8(y + 2)$ opens:

(a) Up

(b) Down

(c) Right

(d) Left

Answer: b) Form $(x - h)^2 = -4a(y - k)$, negative sign indicates downward opening.

17. The focus of $(y - 3)^2 = 12(x - 2)$ is:

(a) $(5, 3)$

(b) $(2, 3)$

(c) $(3, 5)$

(d) $(2, 5)$

Answer: a) Form $(y - k)^2 = 4a(x - h)$, $4a = 12$, $a = 3$, focus: $(h + a, k) = (5, 3)$.

18. The directrix of $y^2 = -16x$ is:

(a) $x = 4$

(b) $x = -4$

(c) $y = 4$

(d) $y = -4$

Answer: a) Form $y^2 = -4ax$, $4a = 16$, $a = 4$, directrix: $x = a = 4$.

19. The slope of the tangent at (x_1, y_1) on $x^2 + y^2 = r^2$ is:

(a) $\frac{x_1}{y_1}$

(b) $-\frac{x_1}{y_1}$

(c) $\frac{y_1}{x_1}$

(d) $-\frac{y_1}{x_1}$

Answer: b) Differentiate: $\frac{dy}{dx} = -\frac{x_1}{y_1}$.

20. The latus rectum of $x^2 = -12y$ has length:

(a) 12

(b) 6

(c) 3

(d) 24

Answer: a) Form $x^2 = -4ay$, $4a = 12$, latus rectum: $4a = 12$.