Conic Sections

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The centre and radius of the circle $x^2 + y^2 + 12x + 4y - 41 = 0$ are:
(a) (−6, −2), 81 **(b)** (6, 2), 9 **(c)** (−12, −4), 9 **(d)** (−6, −2), 9

2. The focus of the parabola $x^2 = 36y$ is:
(a) (0, 9) **(b)** (9, 0) **(c)** (0, −9) **(d)** (0, 36)

3. The eccentricity of the ellipse $x^2/25 + y^2/169 = 1$ is:
(a) 12/5 **(b)** 5/13 **(c)** 12/13 **(d)** 13/12

4. The foci of the hyperbola $x^2/9 - y^2/16 = 1$ are:
(a) (±4, 0) **(b)** (0, ±5) **(c)** (±5, 0) **(d)** (±3, 0)

5. A circle is the set of points in a plane that are:
(a) at a fixed distance from a fixed point
(b) whose distances from two points add to a constant
(c) at a fixed distance from a fixed line
(d) equidistant from a point and a line

6. The length of the latus rectum of $x^2/625 + y^2/576 = 1$ is:
(a) 48/25 **(b)** 625/12 **(c)** 576/25 **(d)** 1152/25

7. The equation of the circle with centre (−6, 1) and radius 9 is:
(a) $x^2 + y^2 + 12x - 2y - 44 = 0$ **(b)** $x^2 + y^2 + 6x - y - 44 = 0$
(c) $x^2 + y^2 - 12x + 2y - 44 = 0$ **(d)** $x^2 + y^2 + 12x - 2y + 118 = 0$

8. Assertion (A): For the ellipse $x^2/169 + y^2/144 = 1$, the foci are at (±5, 0).
Reason (R): For an ellipse, $c^2 = a^2 + b^2$.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. Find the centre and radius of the circle $x^2 + y^2 + 14x - 12y + 49 = 0$.

10. Find the equation of the circle with centre (−1, 1) that passes through (−5, 4).

11. For the parabola $y^2 = -36x$, find the focus, the axis, the equation of the directrix and the length of the latus rectum.

12. Find the equation of the parabola with vertex at the origin, focus (0, 9) and directrix $y = -9$.

13. For the ellipse $x^2/64 + y^2/289 = 1$, find the foci, the vertices, the lengths of the major and minor axes, the eccentricity and the length of the latus rectum.

14. Find the equation of the ellipse with vertices (0, ±25) and foci (0, ±7).

15. For the hyperbola $x^2/64 - y^2/225 = 1$, find the foci, the vertices, the eccentricity and the length of the latus rectum.

16. Find the equation of the hyperbola with foci (±17, 0) and vertices (±15, 0).

Section C — Word problems — 4 × 4 = 16 marks

17. Find the equation of the circle passing through (−13, −2), (−15, 4), (1, −4).

18. Find the equation of the ellipse whose foci are (±4, 0) and whose major axis has length 10. Find also its eccentricity and latus rectum.

19. Find the equation of the hyperbola with foci (0, ±17) and transverse axis of length 16. Find also its eccentricity.

20. A parabola has its vertex at the origin, its axis along the x-axis, and passes through (2, 2). Find its equation, its focus and its directrix.

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Answer key

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Q	Answer	Working
1	**(d) (−6, −2), 9**	complete the squares
2	**(a) (0, 9)**	4a = 36, so a = 9
3	**(c) 12/13**	c = √(169 − 25) = 12; e = c/a
4	**(c) (±5, 0)**	$c^2 = a^2 + b^2 = 25$
5	**(a) at a fixed distance from a fixed point**	—
6	**(d) 1152/25**	$2b^2/a = 2 \times 576 \div 25$
7	**(a) $x^2 + y^2 + 12x - 2y - 44 = 0$**	$(x + 6)^2 + (y - 1)^2 = 81$
8	**(c) A is true, but R is false.**	A is true: c = √(169 − 144) = 5. R is false.
9	**Centre (−7, 6), radius 6**	$(x + 7)^2 + (y - 6)^2 = 36$
10	**$x^2 + y^2 + 2x - 2y - 23 = 0$**	radius = $\sqrt{(4^2 + 3^2)} = 5$
11	**Focus (−9, 0); axis: the x-axis (y = 0); directrix x = 9; latus rectum 36**	4a = −36
12	**$x^2 = 36y$**	a = 9
13	**Foci (0, ±15); vertices (0, ±17); major axis 34, minor axis 16; e = 15/17; latus rectum 128/17**	$c^2 = a^2 - b^2 = 225$
14	**$x^2/576 + y^2/625 = 1$**	$b^2 = a^2 - c^2 = 625 - 49 = 576$
15	**Foci (±17, 0); vertices (±8, 0); e = 17/8; latus rectum 225/4**	$c^2 = a^2 + b^2 = 289$
16	**$x^2/225 - y^2/64 = 1$**	$b^2 = c^2 - a^2 = 289 - 225 = 64$
17	**$x^2 + y^2 + 10x - 8y - 59 = 0$ (centre (−5, 4), radius 10)**	substitute each point in $x^2 + y^2 + Dx + Ey + F = 0$ and solve for D, E, F
18	**$x^2/25 + y^2/9 = 1$; e = 4/5; latus rectum 18/5**	a = 5, c = 4, $b^2 = 9$
19	**$y^2/64 - x^2/225 = 1$; e = 17/8**	a = 8, c = 17, $b^2 = c^2 - a^2 = 225$
20	**$y^2 = 2x$; focus (1/2, 0); directrix x = −1/2**	$y^2 = 4ax$: $2^2 = 4a \times 2$

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