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Co-ordinate Geometry — JEE (Main) Pattern Topic Test

FREE SAMPLE TEST · MATHEMATICS · PATTERN OF JEE (MAIN)

DURATION	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
60 minutes	100	25 (20 + 5)	

GENERAL INSTRUCTIONS

1. This question paper has two sections, A and B. All 25 questions are compulsory.
2. Section A has TWENTY (20) multiple-choice questions. Each has FOUR options, (1), (2), (3) and (4), of which ONLY ONE is correct.
3. Section B has FIVE (05) questions whose answer is a numerical value. Enter the value rounded off to the nearest integer.
4. Marking scheme for both sections: +4 for a correct answer, −1 for an incorrect answer, 0 if the question is not attempted.
5. Use of a calculator, log tables or any other aid is not allowed.
6. The answer key and worked solutions are at the end of this booklet. Attempt the paper in 60 minutes before you look at them.

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Topics covered: Straight lines · Centres of a triangle · Circles · Parabola · Ellipse and hyperbola

SECTION A (Q1–20) · Multiple choice · +4 / 0 / −1

Each question has FOUR options. ONLY ONE of them is correct.

1. The distance between the parallel lines $3x + 4y - 7 = 0$ and $6x + 8y + 11 = 0$ is

(1) 5/2

(2) 7/10

(3) 18/5

(4) 5/4

2. The image of the point (1, 2) in the line $3x + y + 5 = 0$ is

(1) (−2, 1)

(2) (5, 0)

(3) (−5, 0)

(4) (−5, 1)

3. The line through the point of intersection of $2x + 3y = 5$ and $x - y = 0$ that is perpendicular to $3x - 4y = 1$ is

(1) $3x + 4y = 7$

(2) $4x + 3y = 7$

(3) $4x - 3y = 1$

(4) $3x - 4y + 1 = 0$

4. The orthocentre of the triangle with vertices (0, 0), (4, 0) and (1, 3) is

(1) (1, 3)

(2) (2, 1)

(3) (5/3, 1)

(4) (1, 1)

5. The circumcentre of the triangle with vertices (1, 1), (5, 1) and (1, 7) is

(1) (3, 4)

(2) (7/3, 3)

(3) (3, 1)

(4) (1, 4)

6. Two vertices of a triangle are (1, 2) and (3, −1), and its centroid is (2, 1). The third vertex is

(1) (2, 1)

(2) (0, 2)

(3) (2, 2)

(4) (6, 0)

7. The lines $x + 2y - 3 = 0$, $3x - y + 5 = 0$ and $kx + y - 1 = 0$ are concurrent. Then k is equal to

(1) −1

(2) 2

(3) 0

(4) 1

8. The centre and the radius of the circle $x^2 + y^2 - 6x + 8y - 11 = 0$ are

(1) $(-3, 4)$ and 6

(2) $(3, -4)$ and 6

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

(4) $(3, -4)$ and 36

9. The circle passing through the points (0, 0), (4, 0) and (0, 6) is

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

(2) $x^2 + y^2 + 4x + 6y = 0$

(3) $x^2 + y^2 - 2x - 3y = 0$

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

10. The length of the tangent from the point (5, 3) to the circle $x^2 + y^2 - 2x + 4y - 4 = 0$ is

(1) 4

(2) 32

(3) $4\sqrt{2}$

(4) $2\sqrt{2}$

11. The line $y = x + c$ touches the circle $x^2 + y^2 = 8$ exactly when c is

(1) $\pm 2\sqrt{2}$

(2) ± 4

(3) ± 8

(4) ± 2

12. The number of common tangents of the circles $x^2 + y^2 = 9$ and $x^2 + y^2 - 8x + 7 = 0$ is

(1) 1

(2) 3

(3) 4

(4) 2

13. The focus and the directrix of the parabola $x^2 = -12y$ are

(1) focus (0, 3), directrix $y = -3$

(2) focus $(-3, 0)$, directrix $x = 3$

(3) focus $(0, -3)$, directrix $y = 3$

(4) focus $(0, -3)$, directrix $y = -3$

14. A chord of the parabola $y^2 = 4x$ passes through its focus and makes an angle of $60°$ with the x-axis. The length of this chord is

(1) 16/3

(2) 4

(3) 8

(4) $16/\sqrt{3}$

15. The eccentricity of the ellipse $9x^2 + 25y^2 = 225$ is

(1) 3/5

(2) 5/4

(3) 3/4

(4) 4/5

16. The ellipse with foci $(\pm 3, 0)$ that passes through the point $(0, 4)$ is

(1) $x^2/16 + y^2/25 = 1$

(2) $x^2/25 + y^2/16 = 1$

(3) $x^2/25 + y^2/9 = 1$

(4) $x^2/9 + y^2/16 = 1$

17. The latus rectum of a hyperbola is half its transverse axis. Its eccentricity is

(1) $\sqrt{3}$

(2) $\sqrt{2}$

(3) $\sqrt{(3/2)}$

(4) 3/2

18. The foci of the hyperbola $16x^2 - 9y^2 = 144$ are

(1) $(\pm 3, 0)$

(2) $(0, \pm 5)$

(3) $(\pm 4, 0)$

(4) $(\pm 5, 0)$

19. Statement I: The line $3x + 4y = 25$ touches the circle $x^2 + y^2 = 25$.
Statement II: The point $(2, 3)$ lies inside the ellipse $x^2/16 + y^2/9 = 1$.
In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are true

(2) Statement I is true but Statement II is false

(3) Statement I is false but Statement II is true

(4) Both Statement I and Statement II are false

20. Assertion A: The lines $2x + 3y = 7$ and $4x + 6y = 9$ do not meet.
Reason R: Two lines with equal slopes are either parallel or the same line.
In the light of the above statements, choose the correct answer from the options given below:

(1) Both A and R are true and R is the correct explanation of A

(2) Both A and R are true but R is NOT the correct explanation of A

(3) A is true but R is false

(4) A is false but R is true

SECTION B (Q21–25) · Numerical value · +4 / 0 / −1

The answer to each question is a NUMERICAL VALUE. Enter it rounded off to the nearest integer.

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21. The area of the triangle formed by the lines $y = x$, $y = -x$ and $y = 4$ is _____.

Answer: _____

22. The radius of the circle with centre (2, 3) that touches the line $3x + 4y + 7 = 0$ is _____.

Answer: _____

23. The number of points (x, y) with integer coordinates that lie strictly inside the circle $x^2 + y^2 = 10$ is _____.

Answer: _____

24. If L is the length of the latus rectum of the ellipse $4x^2 + 9y^2 = 36$, then 3L is equal to _____.

Answer: _____

25. A hyperbola $x^2 - y^2 = k$ ($k > 0$) has eccentricity $\sqrt{2}$ and the distance between its foci is 16. Then k is equal to _____.

Answer: _____

END OF THE QUESTION PAPER

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
(1)	(3)	(2)	(4)	(1)	(3)	(4)	(2)	(1)	(3)

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
(2)	(4)	(3)	(1)	(4)	(2)	(3)	(4)	(2)	(1)

Q21	Q22	Q23	Q24	Q25
16	5	29	8	32

WORKED SOLUTIONS

Q1. Answer (1). Write the second line as $3x + 4y + 11/2 = 0$. The distance is $|-7 - 11/2|/\sqrt{(3^2 + 4^2)} = (25/2)/5 = 5/2$.

Q2. Answer (3). The image is $(1, 2) - 2t(3, 1)$ with $t = (3 + 2 + 5)/(3^2 + 1^2) = 1$: $(1 - 6, 2 - 2) = (-5, 0)$.

Q3. Answer (2). The lines meet at (1, 1). A line perpendicular to $3x - 4y = 1$ has the form $4x + 3y = k$; through (1, 1), $k = 7$.

Q4. Answer (4). The altitude from (1, 3) to the side on the x-axis is $x = 1$. The side from (4, 0) to (1, 3) has slope -1, so the altitude from (0, 0) is $y = x$. They meet at (1, 1).

Q5. Answer (1). The sides from (1, 1) are horizontal and vertical, so the angle there is 90°. The circumcentre of a right triangle is the mid-point of the hypotenuse: $((5 + 1)/2, (1 + 7)/2) = (3, 4)$.

Q6. Answer (3). $(1 + 3 + x)/3 = 2$ and $(2 - 1 + y)/3 = 1$ give $x = 2$ and $y = 2$.

Q7. Answer (4). The first two lines meet at $(-1, 2)$. The third passes through it when $-k + 2 - 1 = 0$, so $k = 1$.

Q8. Answer (2). Completing squares: $(x - 3)^2 + (y + 4)^2 = 11 + 9 + 16 = 36$. Centre $(3, -4)$, radius 6.

Q9. Answer (1). $x^2 + y^2 + 2gx + 2fy + c = 0$ through (0, 0) gives $c = 0$; through (4, 0), $16 + 8g = 0$, $g = -2$; through (0, 6), $36 + 12f = 0$, $f = -3$.

Q10. Answer (3). The squared length is $S(5, 3) = 25 + 9 - 10 + 12 - 4 = 32$, so the length is $\sqrt{32} = 4\sqrt{2}$.

Q11. Answer (2). The distance from the centre (0, 0) to $x - y + c = 0$ must equal the radius: $|c|/\sqrt{2} = 2\sqrt{2}$, so $c = \pm 4$.

Q12. Answer (4). Centres (0, 0) and (4, 0), radii 3 and 3. The distance 4 lies between $|3 - 3| = 0$ and $3 + 3 = 6$, so the circles cut in two points and have 2 common tangents.

Q13. Answer (3). $x^2 = -4ay$ with $a = 3$ opens downwards: focus $(0, -a) = (0, -3)$ and directrix $y = a = 3$.

Q14. Answer (1). A focal chord at angle θ to the axis of $y^2 = 4ax$ has length $4a\,\mathrm{cosec}^2\theta = 4 \times 4/3 = 16/3$ ($a = 1$). (Directly: the line $y = \sqrt{3}(x - 1)$ meets the parabola at $x = 3$ and $x = 1/3$, and the focal distances $x + 1$ add up to $4 + 4/3$.)

Q15. Answer (4). $x^2/25 + y^2/9 = 1$: $a = 5$, $b = 3$, $e = \sqrt{(1 - 9/25)} = 4/5$.

Q16. Answer (2). The foci are on the x-axis with $c = 3$. (0, 4) is an end of the minor axis, so $b = 4$ and $a^2 = b^2 + c^2 = 25$: $x^2/25 + y^2/16 = 1$.

Q17. Answer (3). $2b^2/a = (1/2)(2a)$ gives $b^2 = a^2/2$, so $e^2 = 1 + b^2/a^2 = 3/2$ and $e = \sqrt{(3/2)}$.

Q18. Answer (4). $x^2/9 - y^2/16 = 1$: $a^2 = 9$, $b^2 = 16$, $c^2 = a^2 + b^2 = 25$. Foci $(\pm 5, 0)$.

Q19. Answer (2). Statement I: the distance from (0, 0) to the line is $25/5 = 5$, the radius, so it is a tangent: true. Statement II: $4/16 + 9/9 = 5/4 > 1$, so (2, 3) lies outside the ellipse: false.

Q20. Answer (1). Both lines have slope $-2/3$, and $4x + 6y = 9$ is $2x + 3y = 9/2$, not $2x + 3y = 7$. So they are parallel and distinct: A is true and R explains it.

Q21. Answer 16. The vertices are $(0, 0)$, $(4, 4)$ and $(-4, 4)$: base 8 along $y = 4$ and height 4, so the area is $(1/2) \times 8 \times 4 = 16$.

Q22. Answer 5. The radius is the distance from the centre to the line: $|6 + 12 + 7|/5 = 5$.

Q23. Answer 29. Count $x^2 + y^2 < 10$: for $x = 0$, $y = -3, \ldots, 3$ (7 points); $x = \pm 1$, $y = -2, \ldots, 2$ (10); $x = \pm 2$, $y = -2, \ldots, 2$ (10); $x = \pm 3$, $y = 0$ (2). Total 29.

Q24. Answer 8. $x^2/9 + y^2/4 = 1$: $a = 3$, $b = 2$. $L = 2b^2/a = 8/3$, so $3L = 8$.

Q25. Answer 32. $x^2/k - y^2/k = 1$ has $a^2 = b^2 = k$ and $e = \sqrt{2}$. The distance between the foci is $2ae = 2\sqrt{k} \times \sqrt{2} = 16$, so $\sqrt{(2k)} = 8$ and $k = 32$.

All questions are original and © Master Testing Agency. Free to download and use for personal practice; not for resale. Every answer in this paper was checked independently by computer: lines, triangles and circles in exact arithmetic, equations tested on points, and conics tested through their focus–directrix and focal-distance definitions on sample points.