

CIRCLES

EE1030 : MATRIX THEORY

Indian Institute of Technology Hyderabad
(EE24BTECH11026)

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I. JEE ADVANCED/IIT-JEE

(2006-5M,-2)

A. Comprehension Based Question

1) *Passage* : 1

$ABCD$ is a square of side length 2 units. C_1 is the circle touching all the sides of the square $ABCD$ and C_2 is the *circumcircle* of square $ABCD$. L is a fixed line in same plane and R is a fixed point.

- 1) If P is any point of C_1 and Q is another point on C_2 , then $\frac{PA^2+PB^2+PC^2+PD^2}{QA^2+QB^2+QC^2+QD^2}$
(2006-5M,-2)

- a) 0.75
- b) 1.25
- c) 1
- d) 0.5

- 2) If a circle is such that it touches the line L and the circle C_1 externally, such that both the circles are on the same side of the line, then locus of centre of the circle (2006-5M,-2)

- a) ellipse
- b) hyperbola
- c) parabola
- d) circle

- 3) A line L' through A is drawn parallel to BD . Point S moves such that its distances from the line BD and the vertex A are equal. If locus of S cuts L' at T_2 and T_3 and AC at T_1 , then area of $\Delta T_1 T_2 T_3$ is

- a) $1/2$ sq.units
- b) $2/3$ sq.units
- c) 1 sq.units
- d) 2 sq.units

2) *Passage* : 2

A circle C of radius 1 unit is inscribed in an equilateral triangle PQR . The points of contact of C with sides PQ, QR, RP are D, E, F respectively. The line PQ is given by the equation $\sqrt{3}x + y - 6 = 0$ and the point D is $(3\sqrt{3}/2, 3/2)$. Further, it is given that the origin and the centre of C are on same side of line PQ .

- 4) The equation of circle C is (2008)

- a) $(x - 2\sqrt{3})^2 + (y - 1)^2 = 1$
- b) $(x - 2\sqrt{3})^2 + (y + 1/2)^2 = 1$
- c) $(x - \sqrt{3})^2 + (y - 1)^2 = 1$
- d) $(x - \sqrt{3})^2 + (y + 1)^2 = 1$

B. Assertion & Reason Type Questions

- 1) Tangents are drawn from point $(17, 7)$ to the circle $x^2 + y^2 = 169$.

STATEMENT-1: The tangents are mutually perpendicular because

STATEMENT-2: The locus of all points from which mutually perpendicular tangents can

be drawn to a given circle is $x^2 + y^2 = 338$.
(2007-3M)

- a) Statement-1 is True, statement-2 is True; Statement-2 is a correct explanation for Statement-1.
- b) Statement-1 is True, statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
- c) Statement-1 is True, Statement-2 is False
- d) Statement-1 is False, Statement-2 is True.

2) Consider $L_1 : 2x + 3y + p - 3 = 0$
 $L_2 : 2x + 3y + p + 3 = 0$
 where p is a real number, and $C : x^2 + y^2 + 6x - 10y + 30 = 0$
 STATEMENT-1: If line L_1 is a chord of circle C , then line L_2 is not always a diameter of circle C
 and
 STATEMENT-2: If line L_1 is a diameter of circle C , then line L_2 is not a chord of circle C .
 (2008)

- a) Statement-1 is True, statement-2 is True; Statement-2 is a correct explanation for Statement-1.
- b) Statement-1 is True, statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
- c) Statement-1 is True, Statement-2 is False
- d) Statement-1 is False, Statement-2 is True.

C. Integer Value Correct Type

- 1) The centres of two circles C_1 and C_2 each of unit radius are at a distance of 6 units from each other. Let P be the midpoint of the line segment joining the centres of C_1 and C_2 and C be a circle touching circles C_1 and C_2 externally. If a common tangent to C_1 and C passing through P is also a common tangent to C_2 and C , then the radius of circle C is

(2009)

- 2) The straight line $2x - 3y = 1$ divides the circular region $x^2 + y^2 \leq 6$ into two parts. If S is $\{ (2, 3/4), (5/2, 3/4), (1/4, -1/4), (1/8, 1/4) \}$ then the number of point(s) in S lying inside the smaller part is (2011)
- 3) For how many values of p , the circle $x^2 + y^2 + 2x + 4y - p = 0$ and the coordinate axes have exactly three common points? (JEE Adv. 2017)
- 4) Let the point B be the reflection of the point $A(2, 3)$ with respect to the line $8x - 6y - 23 = 0$. Let T_A and T_B be circles of radii 2 and 1 with centres A and B respectively. Let T be a common tangent to the circles T_A and T_B such that both the circles are on the same side of T . If C is the point of intersection of T and the line passing through A and B , then the length of the line segment AC is (JEE Adv. 2019)

II. JEE MAIN / AIEEE

- 1) If the chord $y = mx + 1$ of the circle $x^2 + y^2 = 1$ subtends an angle of measure 45° at the major segment of the circle then the value of m is (2002)
- a) $2 \pm \sqrt{2}$
- b) $-2 \pm \sqrt{2}$
- c) $-1 \pm \sqrt{2}$
- d) none of this
- 2) The centres of a set of circles, each of radius 3, lie on the circle $x^2 + y^2 = 25$. The locus of any point in the set is (2002)

- a) $4 \leq x^2 + y^2 \leq 64$
- b) $x^2 + y^2 \leq 25$
- c) $x^2 + y^2 \geq 25$

d) $3 \leq x^2 + y^2 \leq 9$

- 3) The centre of the circle passing through $(0,0)$ and $(1,0)$ and touching the circle $x^2 + y^2 = 9$ is (2002)

a) $(1/2, 1/2)$

b) $(1/2, -\sqrt{2})$

c) $(3/2, 1/2)$

d) $(1/2, 3/2)$

- 4) The equation of a circle with origin as a centre and passing through equilateral triangle whose median is of length $3a$ is (2002)

a) $x^2 + y^2 = 9a^2$

b) $x^2 + y^2 = 16a^2$

c) $x^2 + y^2 = 4a^2$

d) $x^2 + y^2 = a^2$

- 5) If the two circles $(x - 1)^2 + (y - 3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect in two distinct points, then (2003)

a) $r > 2$

b) $2 < r < 8$

c) $r < 2$

d) $r = 2$