

11 - TWO DIMENSIONAL GEOMETRY
(Answers at the end of all questions)

(1) Area of the greatest rectangle that can be inscribed in an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is
(a) $2ba$ (b) ab (c) \sqrt{ab} (d) $\frac{a}{b}$ [AIEEE 2005]

(2) Let P be the point (1, 0) and Q the point on the locus $y^2 = 8x$. The locus of midpoint of PQ is
(a) $y^2 - 4x + 2 = 0$ (b) $y^2 + 4x + 2 = 0$
(c) $x^2 + 4y + 2 = 0$ (d) $x^2 - 4y + 2 = 0$ [AIEEE 2005]

(3) The line parallel to the X-axis and passing through the intersection of the lines $ax + 2by + 3b = 0$ and $bx - 2ay - 3a = 0$, where $(a, b) \neq (0, 0)$ is
(a) below the X-axis at a distance $\frac{3}{2}$ from it
(b) below the X-axis at a distance $\frac{2}{3}$ from it
(c) above the X-axis at a distance $\frac{3}{2}$ from it
(d) above the X-axis at a distance $\frac{2}{3}$ from it [AIEEE 2005]

(4) The locus of a point $P(\alpha, \beta)$ moving under the condition that the line $y = \alpha x + \beta$ is a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is
(a) an ellipse (b) a circle (c) a parabola (d) a hyperbola [AIEEE 2005]

(5) If non-zero numbers a, b, c are in H.P., then the straight line $\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes through a fixed point. That point is
(a) $(-1, 2)$ (b) $(-1, -2)$ (c) $(1, -2)$ (d) $(1, -\frac{1}{2})$ [AIEEE 2005]

(6) If a vertex of a triangle is (1, 1) and the midpoint of two sides through this vertex are (-1, 2) and (3, -2), then the centroid of the triangle is
(a) $(-1, \frac{7}{3})$ (b) $(-\frac{1}{3}, \frac{7}{3})$ (c) $(1, \frac{7}{3})$ (d) $(\frac{1}{3}, \frac{7}{3})$ [AIEEE 2005]

(7) If the circles $x^2 + y^2 + 2ax + cy + a = 0$ and $x^2 + y^2 - 3ax + dy - 1 = 0$ intersect in two distinct points P and Q, then the line $5x + by - a = 0$ passes through P and Q for

- (a) exactly one value of a (b) no value of a
(c) infinitely many values of a (d) exactly two values of a [AIEEE 2005]

(8) A circle touches the X-axis and also touches the circle with centre at (0, 3) and radius 2. The locus of the centre of the circle is

- (a) an ellipse (b) a circle (c) a hyperbola (d) a parabola [AIEEE 2005]

(9) If a circle passes through the point (a, b) and cuts the circle $x^2 + y^2 = p^2$ orthogonally, then the equation of the locus of its centre is

- (a) $x^2 + y^2 - 3ax - 4by + (a^2 + b^2 - p^2) = 0$
(b) $2ax + 2by - (a^2 - b^2 + p^2) = 0$
(c) $x^2 + y^2 - 2ax - 3by + (a^2 - b^2 - p^2) = 0$
(d) $2ax + 2by - (a^2 + b^2 + p^2) = 0$ [AIEEE 2005]

(10) An ellipse has OB as semi minor axis, F and F' its foci and the angle FBF' is a right angle. Then the eccentricity of the ellipse is

- (a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{1}{\sqrt{3}}$ [AIEEE 2005]

(11) If the pair of lines $ax^2 + 2(a + b)xy + by^2 = 0$ lie along diameters of a circle and divide the circle into four sectors such that the area of one of the sectors is thrice the area of another sector, then

- (a) $3a^2 - 10ab + 3b^2 = 0$ (b) $3a^2 - 2ab + 3b^2 = 0$
(c) $3a^2 + 10ab + 3b^2 = 0$ (d) $3a^2 + 2ab + 3b^2 = 0$ [AIEEE 2005]

(12) Let A(2, -3) and B(-2, 1) be the vertices of a triangle ABC. If the centroid of this triangle moves on the line $2x + 3y = 1$, then the locus of the vertex C is the line.

- (a) $2x + 3y = 9$ (b) $2x - 3y = 7$
(c) $3x + 2y = 5$ (d) $3x - 2y = 3$ [AIEEE 2004]

(13) The equation of the straight line passing through the point (4, 3) and making intercepts on the coordinate axes whose sum is -1 is

(a) $\frac{x}{2} + \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

(b) $\frac{x}{2} - \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

(c) $\frac{x}{2} + \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$

(d) $\frac{x}{2} - \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$

[AIEEE 2004]

(14) If the sum of the slopes of the lines given by $x^2 - 2xy - 7y^2 = 0$ is four times their product, the c has the value

(a) 1 (b) -1 (c) 2 (d) -2 [AIEEE 2004]

(15) If one of the lines given by $6x^2 - cxy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals

(a) 1 (b) -1 (c) 2 (d) -3 [AIEEE 2004]

(16) If a circle passes through the point (a, b) and cuts the circle $x^2 + y^2 = 4$ orthogonally, then the locus of its centre is

(a) $2ax + 2by + (a^2 + b^2 + 4) = 0$ (b) $2ax + 2by - (a^2 + b^2 + 4) = 0$

(c) $2ax - 2by + (a^2 + b^2 + 4) = 0$ (d) $2ax - 2by - (a^2 + b^2 + 4) = 0$

[AIEEE 2004]

(17) A variable circle passes through the fixed point A(p, q) and touches the X-axis. The locus of the other end of the diameter through A is

(a) $(x - p)^2 = 4qy$ (b) $(x - q)^2 = 4py$

(c) $(y - p)^2 = 4qx$ (d) $(y - q)^2 = 4px$

[AIEEE 2004]

(18) If the lines $2x + 3y + 1 = 0$ and $3x - y - 4 = 0$ lie along diameters of a circle of circumference 10π , then the equation of the circle is

(a) $x^2 + y^2 - 2x + 2y - 23 = 0$ (b) $x^2 + y^2 - 2x - 2y - 23 = 0$

(c) $x^2 + y^2 + 2x + 2y - 23 = 0$ (d) $x^2 + y^2 + 2x - 2y - 23 = 0$

[AIEEE 2004]

(19) The intercept on the line $y = x$ by the circle $x^2 + y^2 - 2x = 0$ is AB. Equation of the circle on AB as a 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) $x^2 + y^2 + x - y = 0$

[IIEEE 2004]

(20) If $a \neq 0$ and the line $2bx + 3cy + 4d = 0$ passes through the points of intersection of the parabolas $y^2 = 4ax$ and $x^2 = 4ay$, then

- (a) $d^2 + (2b + 3c)^2 = 0$ (b) $d^2 + (3b + 2c)^2 = 0$
 (c) $d^2 + (2b - 3c)^2 = 0$ (d) $d^2 + (3b - 2c)^2 = 0$

[AIEEE 2004]

(21) The eccentricity of an ellipse, with its centre at the origin, is $\frac{1}{2}$. If one of the directrices is $x = 4$, then the equation of the ellipse is

- (a) $3x^2 + 4y^2 = 1$ (b) $3x^2 + 4y^2 = 12$
 (c) $4x^2 + 3y^2 = 12$ (d) $4x^2 + 3y^2 = 1$

[AIEEE 2004]

(22) Locus of centroid of the triangle whose vertices are $(a \cos t, a \sin t)$, $(b \sin t, -b \cos t)$ and $(1, 0)$ where t is a parameter is

- (a) $(3x - 1)^2 + (3y)^2 = a^2 - b^2$ (b) $(3x + 1)^2 + (3y)^2 = a^2 - b^2$
 (c) $(3x + 1)^2 + (3y)^2 = a^2 + b^2$ (d) $(3x - 1)^2 + (3y)^2 = a^2 + b^2$

[AIEEE 2003]

(23) If the equation of the locus of a point equidistant from the points (a_1, b_1) and (a_2, b_2) is

- (a) $\sqrt{a_1^2 + b_1^2 - a_2^2 - b_2^2}$ (b) $a_1^2 - a_2^2 + b_1^2 - b_2^2$
 (c) $\frac{1}{2}(a_1^2 + a_2^2 + b_1^2 + b_2^2)$ (d) $\frac{1}{2}(a_1^2 + b_2^2 - a_1^2 - b_1^2)$

[AIEEE 2003]

(24) If the pair of straight lines $x^2 - 2pxy - y^2 = 0$ and $x^2 - 2qxy - y^2 = 0$ be such that each pair bisects the angle between the other pair, then

- (a) $p = q$ (b) $p = -q$ (c) $pq = 1$ (d) $pq = -1$

[AIEEE 2003]

(25) If the system of linear equations $x + 2ay + az = 0$, $x + 3by + bz = 0$ and $x + 4cy + cz = 0$ has a non-zero solution, then a, b, c

- (a) are in A. P. (b) are in G. P.
(c) are in H. P. (d) satisfy $a + 2b + 3c = 0$

[AIEEE 2003]

(26) The area of the region bounded by the curves $y = |x - 1|$ and $y = 3 - |x|$ is

- (a) 2 sq. units (b) 3 sq. units (c) 4 sq. units (d) 6 sq. units [AIEEE 2003]

(27) The equation of the straight line joining the origin to the point of intersection of $y - x + 7 = 0$ and $y + 2x - 2 = 0$ is

- (a) $3x + 4y = 0$ (b) $3x - 4y = 0$
(c) $4x - 3y = 0$ (d) $4x + 3y = 0$

[AIEEE 2003]

(28) 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

- (a) $r < 2$ (b) $r = 2$ (c) $r > 2$ (d) $2 < r < 8$ [AIEEE 2003]

(29) The lines $2x - 3y = 5$ and $3x - 4y = 7$ are diameters of a circle having radius 7 units. The equation of the circle is

- (a) $x^2 + y^2 - 2x + 2y = 62$ (b) $x^2 + y^2 + 2x - 2y = 62$
(c) $x^2 + y^2 - 2x + 2y = 47$ (d) $x^2 + y^2 + 2x - 2y = 47$

[AIEEE 2003]

(30) If normal at the point $(bt_1^2, 2bt_1)$ on a parabola meets the parabola again at the point $(bt_2^2, 2bt_2)$, then

- (a) $t_2 = -t_1 - \frac{2}{t_1}$ (b) $t_2 = -t_1 + \frac{2}{t_1}$
(c) $t_2 = t_1 - \frac{2}{t_1}$ (d) $t_2 = t_1 + \frac{2}{t_1}$

[AIEEE 2003]

(31) If x_1, x_2, x_3 and y_1, y_2, y_3 are both in G.P. with the same common ratio, then the points (x_1, y_1) , (x_2, y_2) and (x_3, y_3) lie on

- (a) a circle (b) an ellipse (c) a straight line (d) a hyperbola [AIEEE 2003]

(32) If the tangent on the point $(2 \sec \phi, 3 \tan \phi)$ of the hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$ is parallel to $3x - y + 6 = 0$, then the value of ϕ is

- (a) 30° (b) 45° (c) 60° (d) 75° [AIEEE 2003]

(33) The equation of the normal to the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ at $(4, 0)$ is

- (a) $x = 0$ (b) $x = 1$ (c) $y = 0$ (d) $2x - 3y = 1$ [AIEEE 2003]

(34) The square of length of tangent from $(3, -4)$ on the circle $x^2 + y^2 - 4x - 6y + 3 = 0$ is

- (a) 20 (b) 30 (c) 40 (d) 50 [AIEEE 2002]

(35) The equation of straight line passing through the intersection of the lines $x - 2y = 1$ and $x + 3y = 2$ and parallel to $3x + 4y = 0$ is

- (a) $3x + 4y + 5 = 0$ (b) $3x + 4y - 10 = 0$
(c) $3x + 4y - 5 = 0$ (d) $3x + 4y + 6 = 0$ [AIEEE 2002]

(36) The medians BE and AD of a triangle with vertices $A(0, b)$, $B(0, 0)$ and $C(a, 0)$ are perpendicular to each other if

- (a) $a = \frac{b}{2}$ (b) $b = \frac{a}{2}$ (c) $ab = 1$ (d) $a = \pm\sqrt{2b}$ [AIEEE 2002]

(37) The equation of the curve through the point $(1, 0)$, whose slope is $\frac{y-1}{x^2+x}$, is

- (a) $(y-1)(x+1) + 2x = 0$ (b) $2x(y-1) + x + 1 = 0$
(c) $x(y-1)(x+1) + 2 = 0$ (d) $x(y+1) + y(x+1) = 0$ [AIEEE 2002]

(38) The angle between the lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ is

- (a) $\tan^{-1} \left[\frac{a_1b_1 - a_2b_2}{a_1a_2 + b_1b_2} \right]$ (b) $\tan^{-1} \left[\frac{a_1b_2 + a_2b_1}{a_1a_2 - b_1b_2} \right]$
(c) $\cot^{-1} \left[\frac{a_1b_1 - a_2b_2}{a_1a_2 + b_1b_2} \right]$ (d) $\cot^{-1} \left[\frac{a_1a_2 + b_1b_2}{a_1b_2 - a_2b_1} \right]$ [AIEEE 2002]

(39) The equation of the tangent to the parabola $y^2 = 9x$, which passes through the point (4, 10), is

- (a) $x + 4y + 1 = 0$ (b) $9x + 4y + 4 = 0$
 (c) $x - 4y + 36 = 0$ (d) $9x - 4y + 4 = 0$

[AIEEE 2002]

(40) A square of side a lies above the X-axis and has one vertex at the origin. The side passing through the origin makes an angle α ($0 < \alpha < \pi/4$) with the positive direction of X-axis. The equation of its diagonal not passing through the origin is

- (a) $y(\cos \alpha - \sin \alpha) - x(\sin \alpha - \cos \alpha) = a$
 (b) $y(\cos \alpha + \sin \alpha) + x(\sin \alpha - \cos \alpha) = a$
 (c) $y(\cos \alpha + \sin \alpha) + x(\sin \alpha + \cos \alpha) = a$
 (d) $y(\cos \alpha + \sin \alpha) - x(\sin \alpha - \cos \alpha) = a$

[AIEEE 2002]

(41) The distance between the pair of parallel lines $9x^2 - 24xy + 16y^2 - 12x + 16y - 12 = 0$ is

- (a) 5 (b) 8 (c) $\frac{8}{5}$ (d) $\frac{5}{8}$

[AIEEE 2002]

(42) The equation of a circle passing through (1, 0) and (0, 1) and having the smallest possible radius, is

- (a) $x^2 + y^2 - x - y = 0$ (b) $x^2 + y^2 + x + y = 0$
 (c) $2x^2 + y^2 - 2x - y = 0$ (d) $x^2 + 2y^2 - x - 2y = 0$

[AIEEE 2002]

(43) If distance between the foci of an ellipse is equal to its minor axis, then eccentricity of the ellipse is

- (a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\frac{1}{\sqrt{4}}$ (d) $\frac{1}{\sqrt{6}}$

[AIEEE 2002]

(44) The equation of an ellipse, whose major axis = 8 and eccentricity = $\frac{1}{2}$, is

- (a) $3x^2 + 4y^2 = 12$ (b) $3x^2 + 4y^2 = 48$
 (c) $4x^2 + 3y^2 = 48$ (d) $3x^2 + 9y^2 = 12$

[AIEEE 2002]

(45) For the hyperbola $3x^2 - y^2 = 4$, the eccentricity is

- (a) 1 (b) 2 (c) -2 (d) 5

[AIEEE 2002]

(Answers at the end of all questions)

(46) The eccentricity of the hyperbola $\frac{\sqrt{1999}}{3} (x^2 - y^2) = 1$ is

- (a) $\sqrt{3}$ (b) $\sqrt{2}$ (c) 2 (d) $2\sqrt{2}$

[IIT 2002]

(47) The minimum area of the triangle formed by any tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with the co-ordinate axes is

- (a) ab (b) $\frac{a^2 + b^2}{2}$ (c) $\frac{a^2 + b^2}{4}$ (d) $\frac{a^2 + b^2 - ab}{3}$

[IIT 2005]

(48) The tangent drawn to the parabola $y = x^2 + 6$ at the point $(1, 7)$ touches the circle $x^2 + y^2 + 16x + 12y + c = 0$ at the point whose co-ordinates are

- (a) $(-6, -7)$ (b) $(-10, -15)$ (c) $(-9, -7)$ (d) $(13, 7)$

[IIT 2005]

(49) If $x = |a + b\omega + c\omega^2|$, where a, b, c are variable integers and ω is the cube root of unity other than 1, then the minimum value of x =

- (a) 0 (b) 1 (c) 2 (d) 3

[IIT 2005]

(50) Locus of the circle touching X-axis and the circle $x^2 + (y - 1)^2 = 1$ externally is

- (a) $\{(x, y); x^2 = 4y\} \cup \{(0, y); y \leq 0\}$
 (b) $\{(x, y); x^2 = y\} \cup \{(0, y); y \leq 0\}$
 (c) $\{(x, y); x^2 = 4y\} \cup \{(x, y); y \leq 0\}$
 (d) $\{(x, y); x^2 + (y - 1)^2 = 4\} \cup \{(0, y); y \geq 0\}$

[IIT 2005]

(51) Angle between the tangents drawn from $(1, 4)$ to the parabola $y^2 = 4x$ is

- (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{4}$

[IIT 2004]

(52) Area of the triangle formed by the line $x + y = 3$ and the angle bisector of the pair of lines $x^2 - y^2 + 2y = 1$ is

- (a) 1 (b) 3 (c) 2 (d) 4

[IIT 2004]

(53) Diameter of the given circle $x^2 + y^2 - 2x - 6y + 6 = 0$ is the chord of another circle C having centre $(2, 1)$. The radius of the circle C is

- (a) $\sqrt{3}$ (b) 2 (c) 3 (d) 1 [IIT 2004]

(54) If the system of equations $2x - y - z = 2$, $x - 2y + z = 4$ and $x + y + \lambda z = 4$ has no solution, then λ is equal to

- (a) -2 (b) 3 (c) 0 (d) -3 [IIT 2004]

(55) The point at which the line $2x + \sqrt{6}y = 2$ touches the curve $x^2 - 2y^2 = 4$ is

- (a) $(4, -\sqrt{6})$ (b) $(\sqrt{6}, 1)$ (c) $\left(\frac{1}{2}, \frac{1}{\sqrt{6}}\right)$ (d) $\left(\frac{\pi}{6}, \pi\right)$ [IIT 2004]

(56) Locus of mid-points of segment of tangents to ellipse $x^2 + 2y^2 = 2$ intercepted between the axes is

- (a) $\frac{1}{2x^2} + \frac{1}{4y^2} = 1$ (b) $\frac{1}{4x^2} + \frac{1}{2y^2} = 1$
(c) $\frac{x^2}{2} + \frac{y^2}{4} = 1$ (d) $\frac{x^2}{4} + \frac{y^2}{2} = 1$ [IIT 2004]

(57) Orthocentre of triangle whose vertices are $(0, 0)$, $(3, 4)$ and $(4, 0)$ is

- (a) $\left(3, \frac{7}{3}\right)$ (b) $\left(3, \frac{5}{4}\right)$ (c) $(5, -2)$ (d) $\left(3, \frac{3}{4}\right)$ [IIT 2003]

(58) Which one of the following is independent of α in the hyperbola $(0 < \alpha < \frac{\pi}{2})$

$$\frac{x^2}{\cos^2 \alpha} - \frac{y^2}{\sin^2 \alpha} = 1$$

- (a) eccentricity (b) abscissa of foci (c) directrix (d) vertex [IIT 2003]

(59) The focal chord of $y^2 = 16x$ is a tangent to the curve $(x - 6)^2 + y^2 = 2$, then the possible values of the slope of this chord are

- (a) $(1, -1)$ (b) $(-1/2, 2)$ (c) $(-2, 1/2)$ (d) $(1/2, 2)$ [IIT 2003]

(60) A triangle is formed by the co-ordinates, $(0, 0)$, $(0, 21)$ and $(21, 0)$. Find the numbers of integral co-ordinate strictly inside the triangle (integral co-ordinate has both x and y).

- (a) 190 (b) 105 (c) 231 (d) 205

[IIT 2003]

(61) A square is formed by two pairs of straight lines given by $y^2 - 14y + 45 = 0$ and $x^2 - 8x + 12 = 0$. The centre of the circle inscribed in it is

- (a) $(7, 4)$ (b) $(4, 7)$ (c) $(3, 7)$ (d) $(\frac{3}{8}, 4)$

[IIT 2003]

(62) The tangents are drawn to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ at the ends of a latus rectum. The area of the quadrilateral so formed is

- (a) 27 (b) $\frac{27}{2}$ (c) $\frac{27}{4}$ (d) $\frac{27}{55}$

[IIT 2003]

(63) A tangent is drawn at the point $(3\sqrt{3}\cos\theta, \sin\theta)$ $0 < \theta < \frac{\pi}{2}$ to the ellipse $\frac{x^2}{27} + \frac{y^2}{1} = 1$. The least value of the sum of the intercepts made by the tangent on the co-ordinate axes is attained at

- (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{8}$ (d) $\frac{\pi}{4}$

[IIT 2003]

(64) If $P = (-1, 0)$, $Q = (0, 0)$ and $R = (3, 3\sqrt{3})$ are three points, then the equation of the bisector of the angle PQR is

- (a) $\frac{\sqrt{3}}{2}x + y = 0$ (b) $x + \sqrt{3}y = 0$
 (c) $\sqrt{3}x + y = 0$ (d) $x + \frac{\sqrt{3}}{2}y = 0$

[IIT 2002]

(65) If the tangent at the point P on the circle $x^2 + y^2 + 6x + 6y = 2$ meets the straight line $5x - 2y + 6 = 0$ at a point Q on the Y-axis, then the length of PQ is

- (a) 4 (b) $2\sqrt{5}$ (c) 5 (d) $3\sqrt{5}$

[IIT 2002]

(66) A straight line through the origin O meets the parallel lines $4x + 2y = 9$ and $2x + y + 6 = 0$ at points P and Q respectively. Then the point O divides the segment PQ in the ratio

- (a) 1 : 2 (b) 3 : 4 (c) 2 : 1 (d) 4 : 3

[IIT 2002]

(67) If $a > 2b > 0$, then the positive value of m for which $y = mx - b\sqrt{1+m^2}$ is a common tangent to $x^2 + y^2 = b^2$ and $(x - a)^2 + y^2 = b^2$ is

- (a) $\frac{2b}{\sqrt{a^2 - 4b^2}}$ (b) $\frac{\sqrt{a^2 - 4b^2}}{2b}$ (c) $\frac{2b}{a - 2b}$ (d) $\frac{b}{a - 2b}$

[IIT 2002]

(68) The locus of the mid-point of the line segment joining the focus to a moving point on the parabola $y^2 = 4ax$ is another parabola with directrix

- (a) $x = -a$ (b) $x = -\frac{a}{2}$ (c) $x = 0$ (d) $x = \frac{a}{2}$

[IIT 2002]

(69) The equation of the common tangent to the curves $y^2 = 8x$ and $xy = -1$ is

- (a) $3y = 9x + 2$ (b) $y = 2x + 1$ (c) $2y = x + 8$ (d) $y = x + 2$

[IIT 2002]

(70) The number of values of k for which the system of equations $(k + 1)x + 8y = 4k$ and $kx + (k + 3)y = 3k - 1$ has infinitely many solutions is

- (a) 0 (b) 1 (c) 2 (d) infinite

[IIT 2002]

(71) The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ at the point (1, 1) and the co-ordinate axes, lies in the first quadrant. If its area is 2, then the value of b is

- (a) -1 (b) 3 (c) -3 (d) 1

[IIT 2001]

(72) The equation of the common tangent touching the circle $(x - 3)^2 + y^2 = 9$ and the parabola $y^2 = 4x$ above the X-axis is

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

[IIT 2001]

(73) The number of integer values of m , for which the x -coordinate of the point of intersection of the lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is

- (a) 2 (b) 0 (c) 4 (d) 1

[IIT 2001]

(74) If \overline{AB} is a chord of the circle $x^2 + y^2 = r^2$ subtending a right angle at the centre, then the locus of the centroid of the triangle PAB as P moves on the circle is

- (a) a parabola (b) a circle (c) an ellipse (d) a pair of straight lines

[IIT 2001]

(75) The equation of the directrix of the parabola $y^2 + 4y - 4x + 2 = 0$ is

- (a) $x = -1$ (b) $x = 1$ (c) $x = \frac{3}{2}$ (d) $x = \frac{3}{2}$

[IIT 2001]

(76) Area of the parallelogram formed by the lines $y = mx$, $y = mx + 1$, $y = nx$ and $y = nx + 1$ equals

- (a) $\frac{|m + n|}{(m - n)^2}$ (b) $\frac{2}{|m + n|}$ (c) $\frac{1}{|m + n|}$ (d) $\frac{1}{|m - n|}$

[IIT 2001]

(77) If $x + y = k$ is normal to $y^2 = 12x$, then k is

- (a) 3 (b) 9 (c) -9 (d) -3

[IIT 2000]

(78) The triangle PQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates $(3, 4)$ and $(-4, 3)$ respectively, then $\angle QPR$ is equal to

- (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

[IIT 2000]

(79) Let PS be the median of the triangle with vertices $P(2, 2)$, $Q(6, -1)$ and $R(7, 3)$. The equation of the line passing through $(1, -1)$ and parallel to PS is

- (a) $2x - 9y = 7$ (b) $2x - 9y = 11$
(c) $2x + 9y = 11$ (d) $2x + 9y = -7$

[IIT 2000]

(80) The incentre of the triangle with vertices $(1, \sqrt{3})$, $(0, 0)$ and $(2, 0)$ is

- (a) $\left(1, \frac{\sqrt{3}}{2}\right)$ (b) $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$ (c) $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$ (d) $\left(1, \frac{1}{\sqrt{3}}\right)$ [IIT 2000]

(81) If the circles $x^2 + y^2 + 2x + 2ky + 6 = 0$ and $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally, then k is

- (a) 2 or $-\frac{3}{2}$ (b) -2 or $-\frac{3}{2}$ (c) 2 or $\frac{3}{2}$ (d) -2 or $\frac{3}{2}$ [IIT 2000]

(82) If the line $x - 1 = 0$ is the directrix of the parabola $y - kx + 8 = 0$, then one of the values of k is

- (a) $\frac{1}{8}$ (b) 8 (c) 4 (d) $\frac{1}{4}$ [IIT 2000]

(83) If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in G.P. with the same common ratio, then the points (x_1, y_1) , (x_2, y_2) and (x_3, y_3)

- (a) lie on a straight line (b) lie on an ellipse
(c) lie on a circle (d) are vertices of a triangle [IIT 1999]

(84) The curve described parametrically by $x = t^2 + t + 1$, $y = t^2 - t + 1$ represents

- (a) a pair of straight lines (b) an ellipse
(c) a parabola (d) a hyperbola [IIT 1999]

(85) Let $P(a \sec \theta, b \tan \theta)$ and $Q(a \sec \phi, b \tan \phi)$, where $\theta + \phi = \frac{\pi}{2}$, be two points on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. If (h, k) is the point of intersection of the normals at P and Q , then k is equal to

- (a) $\frac{a^2 + b^2}{a}$ (b) $-\frac{a^2 + b^2}{a}$ (c) $\frac{a^2 + b^2}{b}$ (d) $-\frac{a^2 + b^2}{b}$ [IIT 1999]

(86) If two distinct chords drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$ (where $pq \neq 0$) are bisected by the X-axis, then

- (a) $p^2 = q^2$ (b) $p^2 = 8q^2$ (c) $p^2 < 8q^2$ (d) $p^2 > 8q^2$ [IIT 1999]

(87) Let PQR be a right-angled isosceles triangle, right-angled at P (2, 1). If the equation of the line QR is $2x + y = 3$, then the equation representing the pair of lines PQ and RS is

- (a) $3x^2 - 3y^2 + 8xy + 20x + 10y + 25 = 0$
 (b) $3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$
 (c) $3x^2 - 3y^2 + 8xy + 10x + 15y + 20 = 0$
 (d) $3x^2 - 3y^2 - 8xy - 10x - 15y - 20 = 0$

[IIT 1999]

(87) If two distinct chords drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$ (where $pq \neq 0$) are bisected by the X-axis, then

- (a) $p^2 = q^2$ (b) $p^2 = 8q^2$ (c) $p^2 < 8q^2$ (d) $p^2 > 8q^2$

[IIT 1999]

(88) If $x = 9$ is the chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the corresponding pair of tangents is

- (a) $9x^2 - 8y^2 + 18x - 9 = 0$ (b) $9x^2 - 8y^2 - 18x + 9 = 0$
 (c) $9x^2 - 8y^2 - 18x - 9 = 0$ (d) $9x^2 - 8y^2 + 18x + 9 = 0$

[IIT 1999]

(89) Let L_1 be a straight line passing through the origin and L_2 be the straight line $x + y = 1$. If the intercepts made by the circle $x^2 + y^2 - x + 3y = 0$ on L_1 and L_2 are equal, then which of the following equations can represent L_1 ?

- (a) $x + y = 0$ (b) $x - y = 0$ (c) $x + 7y = 0$ (d) $x - 7y = 0$

[IIT 1999]

(90) On the ellipse $x^2 + 9y^2 = 1$, the points at which the tangents are parallel to the line $8x = 9 - ae$

- (a) $\left(\frac{2}{5}, \frac{1}{5}\right)$ (b) $\left(-\frac{2}{5}, \frac{1}{5}\right)$ (c) $\left(-\frac{2}{5}, -\frac{1}{5}\right)$ (d) $\left(\frac{2}{5}, -\frac{1}{5}\right)$

[IIT 1999]

(91) If the diagonals of a parallelogram PQRS are along the lines $x + 3y = 4$ and $6x - 2y = 7$, then PQRS must be a

- (a) rectangle (b) square (c) cyclic quadrilateral (d) rhombus

[IIT 1998]

(92) The number of common tangents to the circles $x^2 + y^2 - 6x - 8y = 24$ and $x^2 + y^2 = 4$ is

- (a) 0 (b) 1 (c) 3 (d) 4

[IIT 1998]

(93) If $P = (x, y)$, $Q = (3, 0)$ and $R = (-3, 0)$ and $16x^2 + 25y^2 = 400$, then $PQ + PR =$
(a) 8 (b) 6 (c) 10 (d) 12 [IIT 1998]

(94) If $P(1, 2)$, $Q(4, 6)$, $R(5, 7)$ and $S(a, b)$ are the vertices of a parallelogram PQRS, then
(a) $a = 2, b = 4$ (b) $a = 3, b = 4$
(c) $a = 2, b = 3$ (d) $a = 3, b = 5$ [IIT 1998]

(95) If the vertices P, Q, R of a triangle PQR are rational points, which of the following points of the triangle PQR is/are always rational point(s)?
(a) centroid (b) incentre (c) circumcentre (d) orthocentre [IIT 1998]

(96) The number of values of c such that the straight line $y = mx + c$ touches the curve $\frac{x^2}{4} + y^2 = 1$ is
(a) 0 (b) 1 (c) 2 (d) infinite [IIT 1998]

(97) If the circle $x^2 + y^2 = a^2$ intersects the hyperbola $xy = c^2$ in four points $P(x_1, y_1)$, $Q(x_2, y_2)$, $R(x_3, y_3)$, $S(x_4, y_4)$, then
(a) $x_1 + x_2 + x_3 + x_4 = 0$ (b) $y_1 + y_2 + y_3 + y_4 = 0$
(c) $x_1 x_2 x_3 x_4 = c^4$ (d) $y_1 y_2 y_3 y_4 = c^4$ [IIT 1998]

(98) The angle between a pair of tangents drawn from a point P to the circle $x^2 + y^2 + 4x - 6y + 9 \sin^2 \alpha + 13 \cos^2 \alpha = 0$ is 2α . The equation of the locus of the point P is
(a) $x^2 + y^2 + 4x - 6y + 4 = 0$ (b) $x^2 + y^2 + 4x - 6y - 9 = 0$
(c) $x^2 + y^2 + 4x - 6y - 4 = 0$ (d) $x^2 + y^2 + 4x - 6y + 9 = 0$ [IIT 1996]

(99) The orthocentre of the triangle formed by the lines $xy = 0$ and $x + y = 1$ is
(a) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{3}, \frac{1}{3}\right)$ (c) $(0, 0)$ (d) $\left(\frac{1}{4}, \frac{1}{4}\right)$ [IIT 1995]

(100) The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having its centre at (0, 3) is

(a) 4 (b) 3 (c) $\sqrt{12}$ (d) $\frac{7}{2}$ [IIT 1995]

(101) Consider a circle with its centre lying on the focus of the parabola $y^2 = 2px$ such that it touches the directrix of the parabola. Then a point of intersection of the circle and the parabola is

(a) $\left(\frac{p}{2}, p\right)$ (b) $\left(\frac{p}{2}, -p\right)$ (c) $\left(-\frac{p}{2}, p\right)$ (d) $\left(-\frac{p}{2}, -p\right)$ [IIT 1995]

(102) The locus of the centre of a circle which touches externally the circle $x^2 + y^2 - 6x - 6y + 14 = 0$ and also touches the Y axis is given by the equation

(a) $x^2 - 6x - 10y + 14 = 0$ (b) $x^2 - 10x - 6y + 14 = 0$
(c) $y^2 - 6x - 10y + 14 = 0$ (d) $y^2 - 10x - 6y + 14 = 0$ [IIT 1993]

(103) The centre of a circle passing through the points (0, 0), (1, 0) and touching the circle $x^2 + y^2 = 9$ is

(a) $\left(\frac{3}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{2}, \frac{3}{2}\right)$ (c) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (d) $\left(\frac{1}{2}, -2\frac{1}{2}\right)$ [IIT 1992]

(104) If the sum of the distances of a point from two perpendicular lines is 1, then its locus is

(a) square (b) circle
(c) straight line (d) two intersecting lines [IIT 1992]

(105) Line L has intercepts a and b on the co-ordinate axes. When the axes are rotated through a given angle, keeping the origin fixed, the same line has intercepts p and q. Then

(a) $a^2 + b^2 = p^2 + q^2$ (b) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2} + \frac{1}{q^2}$
(c) $a^2 + p^2 = b^2 + q^2$ (d) $\frac{1}{a^2} + \frac{1}{p^2} = \frac{1}{b^2} + \frac{1}{q^2}$ [IIT 1990]

(106) 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

- (a) $2 < r < 8$ (b) $r < 2$ (c) $r = 2$ (d) $r > 2$ [IIT 1989]

(107) The lines $2x - y = 5$ and $3x - 4y = 7$ are diameters of a circle of area 154 sq. units, then the equation of this circle is

- (a) $x^2 + y^2 + 2x - 2y = 62$ (b) $x^2 + y^2 + 2x - 2y = 47$
 (c) $x^2 + y^2 + 2x + 2y = 47$ (d) $x^2 + y^2 - 2x + 2y = 62$ [IIT 1989]

(108) Let $g(x)$ be a function defined on $(-1, 1)$. If the area of the equilateral triangle with two of its vertices at $(0, 0)$ and $[x, g(x)]$ is $\frac{\sqrt{3}}{4}$, then the function $g(x)$ is

- (a) $g(x) = \pm \sqrt{1 - x^2}$ (b) $g(x) = \sqrt{1 - x^2}$
 (c) $g(x) = -\sqrt{1 - x^2}$ (d) $g(x) = \sqrt{1 + x^2}$ [IIT 1989]

(109) If $P = (1, 0)$, $Q = (-1, 0)$ and $R = (2, 0)$ are three given points, then the locus of the point S satisfying the relation $SQ^2 + SR^2 = 2SP^2$, is

- (a) a straight line parallel to X-axis (b) a circle passing through the origin
 (c) a circle with the centre at the origin
 (d) a straight line parallel to Y-axis [IIT 1988]

(110) If a circle passes through the point (a, b) and cuts the circle $x^2 + y^2 = k^2$ orthogonally, then the equation of the locus of its centre is

- (a) $2ax + 2by - (a^2 + b^2 - k^2) = 0$
 (b) $2ax + 2by - (a^2 - b^2 + k^2) = 0$
 (c) $x^2 + y^2 - 3ax - 4by + (a^2 + b^2 - k^2) = 0$
 (d) $x^2 + y^2 - 2ax - 3by + (a^2 - b^2 - k^2) = 0$ [IIT 1988]

(111) The equation of the tangents drawn from the origin to the circle $x^2 + y^2 - 2rx - 2hy + h^2 = 0$, are

- (a) $x = 0$ (b) $(h^2 - r^2)x - 2rhy = 0$
 (c) $y = 0$ (d) $(h^2 - r^2)x + 2rhy = 0$ [IIT 1988]

(112) If the line $ax + by + c = 0$ is a normal to the curve $xy = 1$, then

- (a) $a > 0, b > 0$ (b) $a > 0, b < 0$
 (c) $a < 0, b > 0$ (d) $a < 0, b < 0$ (e) none of these [IIT 1986]

(113) The points $\left(0, \frac{8}{3}\right)$, $(1, 3)$ and $(82, 30)$ are vertices of

- (a) an obtuse angled triangle (b) an acute angled triangle
 (c) a right angled triangle (d) an isosceles triangle
 (e) none of these [IIT 1986]

(114) All points lying inside the triangle formed by the points $(1, 3)$, $(5, 0)$ and $(-1, 2)$ satisfy

- (a) $3x + 2y \geq 0$ (b) $2x + y - 13 \geq 0$ (c) $2x - 3y - 12 \leq 0$
 (d) $-2x + y \geq 0$ (e) none of these [IIT 1986]

(115) Three lines $px + qy + r = 0$, $qx + ry + p = 0$ and $rx + py + q = 0$ are concurrent if

- (a) $p + q + r = 0$ (b) $p^2 + q^2 + r^2 = pq + qr + rp$
 (c) $p^3 + q^3 + r^3 = 3pqr$ (d) none of these [IIT 1985]

(116) The locus of the midpoints of a chord 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) $x + y = 1$ [IIT 1984]

(117) The centre of the circle passing through the point $(0, 1)$ and touching the curve $y = x^2$ at $(2, 4)$ is

- (a) $\left(\frac{-16}{5}, \frac{27}{10}\right)$ (b) $\left(\frac{-16}{7}, \frac{53}{10}\right)$
 (c) $\left(\frac{-16}{5}, \frac{53}{10}\right)$ (d) none of these [IIT 1983]

(118) The straight line $x + y = 0$, $3x + y - 4 = 0$, $x + 3y - 4 = 0$ form a triangle which is

- (a) isosceles (b) right angled
 (c) equilateral (d) none of these [IIT 1983]

(119) If AB is a diameter of a circle and C is any point on the circumference of the circle, then

- (a) the area of triangle ABC is maximum when it is isosceles
- (b) the area of triangle ABC is minimum when it is isosceles
- (c) the perimeter of triangle ABC is minimum when it is isosceles
- (d) none of these

[IIT 1983]

(120) The equation of the circle passing through (1, 1) and the points of intersection of the circles $x^2 + y^2 + 13x - 3y = 0$ and $2x^2 + 2y^2 + 4x - 7y - 25 = 0$ is

- (a) $4x^2 + 4y^2 - 30x - 10y - 25 = 0$
- (b) $4x^2 + 4y^2 + 30x - 13y - 25 = 0$
- (c) $4x^2 + 4y^2 - 17x + 10y + 25 = 0$
- (d) none of these

[IIT 1983]

(121) The equation $\frac{x^2}{1-r} - \frac{y^2}{1+r} = 1, r > 1$ represents

- (a) an ellipse
- (b) a hyperbola
- (c) a circle
- (d) none of these

[IIT 1981]

(122) Given the four lines with the equations, $x + 2y - 3 = 0$, $3x + 4y - 7 = 0$, $2x + 3y - 4 = 0$ and $4x - 5y - 6 = 0$

- (a) they are all concurrent
- (b) they are the sides of a quadrilateral
- (c) none of these

[IIT 1980]

(123) The points $(-a, -b)$, $(0, 0)$, (a, b) and (a^2, ab) are

- (a) collinear
- (b) vertices of a parallelogram
- (c) vertices of a rectangle
- (d) none of these

[IIT 1979]

11 - TWO DIMENSIONAL GEOMETRY
(Answers at the end of all questions)

Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	a	a	d	c	c	b	d	d	a	d	a	d	c	d	b	a	a	a	a
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
b	d	d	d	c	c	d	d	c	a	c	a	c	c	c	d	a	d	c	d
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
c	a	a	b	b	b	a	a	b	a	b	c	c	a	a	a	d	b	a	a
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
b	a	a	c	c	b	a	c	d	b	c	c	a	b	d	d	b	c	d	d
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	
c	c	a	c	d	d	b	b	a, c	b, d	d	b	c	c	a	c	a,b,c,d	d	c	
100	101	102	103	104	105	106	107	108	109	110	111	112	113						
c	a,b	d	d	a	b	d	c	a,b,c	d	a	a,b	b,c	e						
114	115	116	117	118	119	120	121	122	123										
a,b,c	a,b,c	c	c	a	a	b	d	c	a										

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