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]

(Answers at the end of all questions)

(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 $x^2 - 2cxy - 7y^2 = 0$ 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 $6x^2 - xy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals

(a) 1 (b) - 1 (c) 3 (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 $10\,\pi$, 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) $x^2 + y^2 + x - y = 0$ [AIEEE 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 directices 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]

(Answers at the end of all questions)

(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 he 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]

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(Answers at the end of all questions)

(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) $2\sqrt{2}$ [AIEEE 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 coordinates 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) $\{ (x, y);\ x^2 = 4y \} \cup \{ (0, y);\ y \le 0 \}$
(b) $\{ (x, y);\ x^2 = y \} \cup \{ (0, y);\ y \le 0 \}$
(c) $\{ (x, y);\ x^2 = 4y \} \cup \{ (x, y);\ y \le 0 \}$
(d) $\{ (x, y);\ x^2 + (y - 1)^2 = 4 \} \cup \{ (0, y);\ y \ge 0 \}$ [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 segments 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) (3, $\left(3, \frac{3}{4} \right)$ [IIT 2003]

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

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

(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) (d) $\left(\frac{3}{8}, 4 \right)$ [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]

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(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) $\dfrac{2b}{\sqrt{a^2 - 4b^2}}$ (b) $\dfrac{\sqrt{a^2 - 4b^2}}{2b}$ (c) $\dfrac{2b}{a - 2b}$ (d) $\dfrac{b}{a - 2b}$ [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) $x = -\dfrac{a}{2}$ (c) $x = 0$ (d) $x = \dfrac{a}{2}$ [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 $y^2 - kx + 8 = 0$, 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]

(Answers at the end of all questions)

(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 $4x^2 + 9y^2 = 1$, the points at which the tangents are parallel to the line $8x = 9y$ are

(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]

(Answers at the end of all questions)

(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) $a^2 + p^2 = b^2 + q^2$ (b) $\frac{1}{a^2} + \frac{1}{p^2} = \frac{1}{b^2} + \frac{1}{q^2}$ [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 $\sqrt{\frac{3}{4}}$, 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]

(Answers at the end of all questions)

(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) $4x^2 + 4y^2 + 30x \blacklozenge 13y - 25 = 0$
(c) $4x^2 + 4y^2 - 17x + 10y + 25 = 0$ (d) none of these [IIT 1983]

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

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	[illegible]	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, [illegible]	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							