CONIC SECTION
DPP

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DPP-1

Q.1 If on a given base, a triangle be described such that the sum of the tangents of the base angles is a constant, then the locus of the vertex is :
(A) a circle (B) a parabola (C) an ellipse (D a hyperbola

Q.2 The locus of the point of trisection of all the double ordinates of the parabola $y^2 = lx$ is a parabola whose latus rectum is
(A) $\frac{l}{9}$ (B) $\frac{2l}{9}$ (C) $\frac{4l}{9}$ (D) $\frac{l}{36}$

Q.3 Let a variable circle is drawn so that it always touches a fixed line and also a given circle, the line not passing through the centre of the circle. The locus of the centre of the variable circle, is
(A) a parabola (B) a circle (C) an ellipse (D) a hyperbola

Q.4 The vertex A of the parabola $y^2 = 4ax$ is joined to any point P on it and PQ is drawn at right angles to AP to meet the axis in Q. Projection of PQ on the axis is equal to
(A) twice the latus rectum (B) the latus rectum
(C) half the latus rectum (D) one fourth of the latus rectum

Q.5 Two unequal parabolas have the same common axis which is the x-axis and have the same vertex which is the origin with their concavities in opposite direction. If a variable line parallel to the common axis meet the parabolas in P and P' the locus of the middle point of PP' is
(A) a parabola (B) a circle (C) an ellipse (D) a hyperbola

Q.6 The straight line $y = m(x - a)$ will meet the parabola $y^2 = 4ax$ in two distinct real points if
(A) $m \in R$ (B) $m \in [-1, 1]$
(C) $m \in (-\infty, 1] \cup [1, \infty)R$ (D) $m \in R - \{0\}$

Q.7 All points on the curve $y^2 = 4a\left(x + a\sin\frac{x}{a}\right)$ at which the tangent is parallel to x-axis lie on
(A) a circle (B) a parabola (C) an ellipse (D) a line

Q.8 Locus of trisection point of any arbitrary double ordinate of the parabola $x^2 = 4by$, is
(A) $9x^2 = by$ (B) $3x^2 = 2by$ (C) $9x^2 = 4by$ (D) $9x^2 = 2by$

Q.9 The equation of the circle drawn with the focus of the parabola $(x - 1)^2 - 8y = 0$ as its centre and touching the parabola at its vertex is :
(A) $x^2 + y^2 - 4y = 0$ (B) $x^2 + y^2 - 4y + 1 = 0$
(C) $x^2 + y^2 - 2x - 4y = 0$ (D) $x^2 + y^2 - 2x - 4y + 1 = 0$

Q.10 The length of the latus rectum of the parabola, $y^2 - 6y + 5x = 0$ is
(A) 1 (B) 3 (C) 5 (D) 7

Q.11 Which one of the following equations represented parametrically, represents equation to a parabolic profile?
(A) $x = 3\cos t$; $y = 4\sin t$ (B) $x^2 - 2 = -2\cos t$; $y = 4\cos^2\frac{t}{2}$
(C) $\sqrt{x} = \tan t$; $\sqrt{y} = \sec t$ (D) $x = \sqrt{1 - \sin t}$; $y = \sin\frac{t}{2} + \cos\frac{t}{2}$

Q.12 The length of the intercept on y – axis cut off by the parabola, $y^2 - 5y = 3x - 6$ is
(A) 1 (B) 2 (C) 3 (D) 5

Q.13 A variable circle is described to pass through (1, 0) and touch the line y = x. The locus of the centre of the circle is a parabola, whose length of latus rectum, is

(A) 2 (B) $\sqrt{2}$ (C) $\frac{1}{\sqrt{2}}$ (D) 1

Q.14 Angle between the parabolas $y^2 = 4b(x - 2a + b)$ and $x^2 + 4a(y - 2b - a) = 0$ at the common end of their latus rectum, is

(A) $\tan^{-1}(1)$ (B) $\cot^{-1}1 + \cot^{-1}\frac{1}{2} + \cot^{-1}\frac{1}{3}$

(C) $\tan^{-1}\left(\sqrt{3}\right)$ (D) $\tan^{-1}(2) + \tan^{-1}(3)$

Q.15 A point P on a parabola $y^2 = 4x$, the foot of the perpendicular from it upon the directrix, and the focus are the vertices of an equilateral triangle, find the area of the equilateral triangle.

Q.16 Given $y = ax^2 + bx + c$ represents a parabola. Find its vertex, focus, latus rectum and the directrix.

Q.17 Prove that the locus of the middle points of all chords of the parabola $y^2 = 4ax$ passing through the vetex is the parabola $y^2 = 2ax$.

Q.18 Prove that the equation to the parabola, whose vertex and focus are on the axis of x at distances a and a' from the origin respectively, is $y^2 = 4(a' - a)(x - a)$.

Q.19 Prove that the locus of the centre of a circle, which intercepts a chord of given length 2a on the axis of x and passes through a given point on the axis of y distant b from the origin, is the curve

Q.20 A variable parabola is drawn to pass through A & B, the ends of a diameter of a given circle with centre at the origin and radius c & to have as directrix a tangent to a concentric circle of radius 'a' (a >c) ; the axes being AB & a perpendicular diameter, prove that the locus of the focus of the parabola is the standard ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where $b^2 = a^2 - c^2$.

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DPP-2

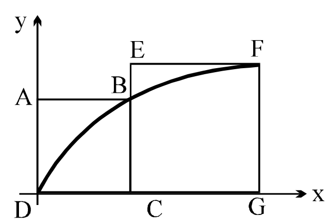
Q.1 If a focal chord of $y^2 = 4ax$ makes an angle α, $\alpha \in (0, \pi/4]$ with the positive direction of x-axis, then minimum length of this focal chord is

(A) 6a (B) 2a (C) 8a (D) None

Q.2 OA and OB are two mutually perpendicular chords of $y^2 = 4ax$, 'O' being the origin. Line AB will always pass through the point

(A) (2a, 0) (B) (6a, 0) (C) (8a, 0) (D) (4a, 0)

Q.3 ABCD and EFGC are squares and the curve $y = k\sqrt{x}$ passes through the origin D and the points B and F. The ratio $\frac{FG}{BC}$ is



(A) $\frac{\sqrt{5}+1}{2}$ (B) $\frac{\sqrt{3}+1}{2}$ (C) $\frac{\sqrt{5}+1}{4}$ (D) $\frac{\sqrt{3}+1}{4}$

Q.4 From an external point P, pair of tangent lines are drawn to the parabola, $y^2 = 4x$. If θ_1 & θ_2 are the inclinations of these tangents with the axis of x such that, $\theta_1 + \theta_2 = \frac{\pi}{4}$, then the locus of P is :

(A) x – y + 1 = 0 (B) x + y – 1 = 0 (C) x – y – 1 = 0 (D) x + y + 1 = 0

Q.5 Maximum number of common chords of a parabola and a circle can be equal to

(A) 2 (B) 4 (C) 6 (D) 8

Q.6 PN is an ordinate of the parabola $y^2 = 4ax$. A straight line is drawn parallel to the axis to bisect NP and meets the curve in Q. NQ meets the tangent at the vertex in apoint T such that AT = kNP, then the value of k is (where A is the vertex)
(A) 3/2 (B) 2/3 (C) 1 (D) none

Q.7 Let A and B be two points on a parabola $y^2 = x$ with vertex V such that VA is perpendicular to VB and θ is the angle between the chord VA and the axis of the parabola. The value of $\frac{|VA|}{|VB|}$ is
(A) $\tan\theta$ (B) $\tan^3\theta$ (C) $\cot^2\theta$ (D) $\cot^3\theta$

Q.8 Minimum distance between the curves $y^2 = x - 1$ and $x^2 = y - 1$ is equal to
(A) $\frac{3\sqrt{2}}{4}$ (B) $\frac{5\sqrt{2}}{4}$ (C) $\frac{7\sqrt{2}}{4}$ (D) $\frac{\sqrt{2}}{4}$

Q.9 The length of a focal chord of the parabola $y^2 = 4ax$ at a distance b from the vertex is c, then
(A) $2a^2 = bc$ (B) $a^3 = b^2c$ (C) $ac = b^2$ (D) $b^2c = 4a^3$

Q.10 The straight line joining any point P on the parabola $y^2 = 4ax$ to the vertex and perpendicular from the focus to the tangent at P, intersect at R, then the equaiton of the locus of R is
(A) $x^2 + 2y^2 - ax = 0$ (B) $2x^2 + y^2 - 2ax = 0$ (C) $2x^2 + 2y^2 - ay = 0$ (D) $2x^2 + y^2 - 2ay = 0$

Q.11 Locus of the feet of the perpendiculars drawn from vertex of the parabola $y^2 = 4ax$ upon all such chords of the parabola which subtend a right angle at the vertex is
(A) $x^2 + y^2 - 4ax = 0$ (B) $x^2 + y^2 - 2ax = 0$ (C) $x^2 + y^2 + 2ax = 0$ (D) $x^2 + y^2 + 4ax = 0$

More than one are correct:

Q.12 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 & 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) $\left(-\frac{p}{2}, -p\right)$

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DPP-3

Q.1 y-intercept of the common tangent to the parabola $y^2 = 32x$ and $x^2 = 108y$ is
(A) – 18 (B) – 12 (C) – 9 (D) – 6

Q.2 The points of contact Q and R of tangent from the point P (2, 3) on the parabola $y^2 = 4x$ are
(A) (9, 6) and (1, 2) (B) (1, 2) and (4, 4) (C) (4, 4) and (9, 6) (D) (9, 6) and $(\frac{1}{4}, 1)$

Q.3 Length of the normal chord of the parabola, $y^2 = 4x$, which makes an angle of $\frac{\pi}{4}$ with the axis of x is:
(A) 8 (B) $8\sqrt{2}$ (C) 4 (D) $4\sqrt{2}$

Q.4 If the lines $(y - b) = m_1(x + a)$ and $(y - b) = m_2(x + a)$ are the tangents to the parabola $y^2 = 4ax$, then
(A) $m_1 + m_2 = 0$ (B) $m_1m_2 = 1$ (C) $m_1m_2 = -1$ (D) $m_1 + m_2 = 1$

Q.5 If the normal to a parabola $y^2 = 4ax$ at P meets the curve again in Q and if PQ and the normal at Q makes angles α and β respectively with the x-axis then $\tan\alpha(\tan\alpha + \tan\beta)$ has the value equal to
(A) 0 (B) – 2 (C) $-\frac{1}{2}$ (D) – 1

Q.6 C is the centre of the circle with centre (0, 1) and radius unity. P is the parabola $y = ax^2$. The set of values of 'a' for which they meet at a point other than the origin, is

(A) $a > 0$ (B) $a \in \left(0, \frac{1}{2}\right)$ (C) $\left(\frac{1}{4}, \frac{1}{2}\right)$ (D) $\left(\frac{1}{2}, \infty\right)$

Q.7 PQ is a normal chord of the parabola $y^2 = 4ax$ at P, A being the vertex of the parabola. Through P a line is drawn parallel to AQ meeting the x–axis in R. Then the length of AR is :

(A) equal to the length of the latus rectum
(B) equal to the focal distance of the point P
(C) equal to twice the focal distance of the point P
(D) equal to the distance of the point P from the directrix.

Q.8 Length of the focal chord of the parabola $y^2 = 4ax$ at a distance p from the vertex is :

(A) $\frac{2a^2}{p}$ (B) $\frac{a^3}{p^2}$ (C) $\frac{4a^3}{p^2}$ (D) $\frac{p^2}{a}$

Q.9 The triangle PQR of area 'A' is inscribed in the parabola $y^2 = 4ax$ such that the vertex P lies at the vertex of the parabola and the base QR is a focal chord. The modulus of the difference of the ordinates of the points Q and R is :

(A) $\frac{A}{2a}$ (B) $\frac{A}{a}$ (C) $\frac{2A}{a}$ (D) $\frac{4A}{a}$

Q.10 The roots of the equation $m^2 - 4m + 5 = 0$ are the slopes of the two tangents to the parabola $y^2 = 4x$. The tangents intersect at the point

(A) $\left(\frac{4}{5}, \frac{1}{5}\right)$ (B) $\left(\frac{1}{5}, \frac{4}{5}\right)$ (C) $\left(-\frac{1}{5}, \frac{4}{5}\right)$

(D) point of intersection can not be found as the tangents are not real

Q.11 Through the focus of the parabola $y^2 = 2px$ $(p > 0)$ a line is drawn which intersects the curve at $A(x_1, y_1)$ and $B(x_2, y_2)$. The ratio $\frac{y_1 y_2}{x_1 x_2}$ equals

(A) 2 (B) – 1 (C) – 4 (D) some function of p

Q.12 If the line $2x + y + K = 0$ is a normal to the parabola, $y^2 + 8x = 0$ then K =

(A) – 16 (B) – 8 (C) – 24 (D) 24

Q.13 The normal chord of a parabola $y^2 = 4ax$ at the point whose ordinate is equal to the abscissa, then angle subtended by normal chord at the focus is :

(A) $\pi/4$ (B) $\tan^{-1}\sqrt{2}$ (C) $\tan^{-1} 2$ (D) $\pi/2$

Q.14 The point(s) on the parabola $y^2 = 4x$ which are closest to the circle, $x^2 + y^2 - 24y + 128 = 0$ is/are

(A) (0, 0) (B) $\left(2, 2\sqrt{2}\right)$ (C) (4, 4) (D) none

More than one are correct:

Q.15 Let $y^2 = 4ax$ be a parabola and $x^2 + y^2 + 2bx = 0$ be a circle. If parabola and circle touch each other externally then :

(A) $a > 0, b > 0$ (B) $a > 0, b < 0$ (C) $a < 0, b > 0$ (D) $a < 0, b < 0$

Q.16 The straight line $y + x = 1$ touches the parabola :

(A) $x^2 + 4y = 0$ (B) $x^2 - x + y = 0$ (C) $4x^2 - 3x + y = 0$ (D) $x^2 - 2x + 2y = 0$

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DPP-4

Q.1 TP & TQ are tangents to the parabola, $y^2 = 4ax$ at P & Q. If the chord PQ passes through the fixed point $(-a, b)$ then the locus of T is :

(A) $ay = 2b(x - b)$ (B) $bx = 2a(y - a)$ (C) $by = 2a(x - a)$ (D) $ax = 2b(y - b)$

Q.2 Through the vertex O of the parabola, $y^2 = 4ax$ two chords OP & OQ are drawn and the circles on OP & OQ as diameters intersect in R. If θ_1, θ_2 & ϕ are the angles made with the axis by the tangents at P & Q on the parabola & by OR then the value of, $\cot\theta_1 + \cot\theta_2 =$

(A) $-2\tan\phi$ (B) $-2\tan(\pi - \phi)$ (C) 0 (D) $2\cot\phi$

Q.3 If a normal to a parabola $y^2 = 4ax$ makes an angle ϕ with its axis, then it will cut the curve again at an angle

(A) $\tan^{-1}(2\tan\phi)$ (B) $\tan^{-1}\left(\frac{1}{2}\tan\phi\right)$ (C) $\cot^{-1}\left(\frac{1}{2}\tan\phi\right)$ (D) none

Q.4 Tangents are drawn from the points on the line $x - y + 3 = 0$ to parabola $y^2 = 8x$. Then the variable chords of contact pass through a fixed point whose coordinates are :

(A) (3, 2) (B) (2, 4) (C) (3, 4) (D) (4, 1)

Q.5 If the tangents & normals at the extremities of a focal chord of a parabola intersect at (x_1, y_1) and (x_2, y_2) respectively, then :

(A) $x_1 = x_2$ (B) $x_1 = y_2$ (C) $y_1 = y_2$ (D) $x_2 = y_1$

Q.6 If two normals to a parabola $y^2 = 4ax$ intersect at right angles then the chord joining their feet passes through a fixed point whose co-ordinates are :

(A) $(-2a, 0)$ (B) $(a, 0)$ (C) $(2a, 0)$ (D) none

Q.7 The equation of a straight line passing through the point (3, 6) and cutting the curve $y = \sqrt{x}$ orthogonally is

(A) $4x + y - 18 = 0$ (B) $x + y - 9 = 0$ (C) $4x - y - 6 = 0$ (D) none

Q.8 The tangent and normal at P(t), for all real positive t, to the parabola $y^2 = 4ax$ meet the axis of the parabola in T and G respectively, then the angle at which the tangent at P to the parabola is inclined to the tangent at P to the circle passing through the points P, T and G is

(A) $\cot^{-1}t$ (B) $\cot^{-1}t^2$ (C) $\tan^{-1}t$ (D) $\tan^{-1}t^2$

Q.9 A circle with radius unity has its centre on the positive y-axis. If this circle touches the parabola $y = 2x^2$ tangentially at the points P and Q then the sum of the ordinates of P and Q, is

(A) 15/4 (B) 15/8 (C) $2\sqrt{15}$ (D) 5

Q.10 Normal to the parabola $y^2 = 8x$ at the point P (2, 4) meets the parabola again at the point Q. If C is the centre of the circle described on PQ as diameter then the coordinates of the image of the point C in the line $y = x$ are

(A) $(-4, 10)$ (B) $(-3, 8)$ (C) $(4, -10)$ (D) $(-3, 10)$

Q.11 Two parabolas $y^2 = 4a(x - l_1)$ and $x^2 = 4a(y - l_2)$ always touch one another, the quantities l_1 and l_2 are both variable. Locus of their point of contact has the equation

(A) $xy = a^2$ (B) $xy = 2a^2$ (C) $xy = 4a^2$ (D) none

Q.12 A pair of tangents to a parabola is are equally inclined to a straight line whose inclination to the axis is α. The locus of their point of intersection is :

(A) a circle (B) a parabola (C) a straight line (D) a line pair

Q.13 In a parabola $y^2 = 4ax$ the angle θ that the latus rectum subtends at the vertex of the parabola is

(A) dependent on the length of the latus rectum

(B) independent of the latus rectum and lies between $5\pi/6$ & π

(C) independent of the latus rectum and lies between $3\pi/4$ & $5\pi/6$

(D) independent of the latus rectum and lies between $2\pi/3$ & $3\pi/4$

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DPP-5

Q.1 Normals are drawn at points A, B, and C on the parabola $y^2 = 4x$ which intersect at P(h, k). The locus of the point P if the slope of the line joining the feet of two of them is 2, is

(A) $x + y = 1$ (B) $x - y = 3$ (C) $y^2 = 2(x - 1)$ (D) $y^2 = 2\left(x - \frac{1}{2}\right)$

Q.2 Tangents are drawn from the point $(-1, 2)$ on the parabola $y^2 = 4x$. The length, these tangents will intercept on the line $x = 2$ is :

(A) 6 (B) $6\sqrt{2}$ (C) $2\sqrt{6}$ (D) none of these

Q.3 Which one of the following lines cannot be the normals to $x^2 = 4y$?

(A) $x - y + 3 = 0$ (B) $x + y - 3 = 0$ (C) $x - 2y + 12 = 0$ (D) $x + 2y + 12 = 0$

Q.4 An equation of the line that passes through $(10, -1)$ and is perpendicular to $y = \frac{x^2}{4} - 2$ is

(A) $4x + y = 39$ (B) $2x + y = 19$ (C) $x + y = 9$ (D) $x + 2y = 8$

Paragraph for question nos. 5 to 6

Consider the parabola $y^2 = 8x$

Q.5 Area of the figure formed by the tangents and normals drawn at the extremities of its latus rectum is

(A) 8 (B) 16 (C) 32 (D) 64

Q.6 Distance between the tangent to the parabola and a parallel normal inclined at 30° with the x-axis, is

(A) $\frac{16}{3}$ (B) $\frac{16\sqrt{3}}{9}$ (C) $\frac{2}{3}$ (D) $\frac{16}{\sqrt{3}}$

Paragraph for question nos. 7 to 9

Tangents are drawn to the parabola $y^2 = 4x$ from the point P(6, 5) to touch the parabola at Q and R. C_1 is a circle which touches the parabola at Q and C_2 is a circle which touches the parabola at R. Both the circles C_1 and C_2 pass through the focus of the parabola.

Q.7 Area of the ΔPQR equals

(A) 1/2 (B) 1 (C) 2 (D) 1/4

Q.8 Radius of the circle C_2 is

(A) $5\sqrt{5}$ (B) $5\sqrt{10}$ (C) $10\sqrt{2}$ (D) $\sqrt{210}$

Q.9 The common chord of the circles C_1 and C_2 passes through the

(A) incentre (B) circumcentre (C) centroid (D) orthocentre of the ΔPQR

Paragraph for question nos. 10 to 12

Tangents are drawn to the parabola $y^2 = 4x$ at the point P **which is the upper end of latus rectum**.

Q.10 Image of the parabola $y^2 = 4x$ in the tangent line at the point P is

(A) $(x + 4)^2 = 16y$ (B) $(x + 2)^2 = 8(y - 2)$ (C) $(x + 1)^2 = 4(y - 1)$ (D) $(x - 2)^2 = 2(y - 2)$

Q.11 Radius of the circle touching the parabola $y^2 = 4x$ at the point P and passing through its focus is

(A) 1 (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) 2

Q.12 Area enclosed by the tangent line at P, x-axis and the parabola is

(A) $\frac{2}{3}$ (B) $\frac{4}{3}$ (C) $\frac{14}{3}$ (D) none

More than one are correct:

Q.13 Let P, Q and R are three co-normal points on the parabola $y^2 = 4ax$. Then the correct statement(s) is/are
(A) algebraic sum of the slopes of the normals at P, Q and R vanishes
(B) algebraic sum of the ordinates of the points P, Q and R vanishes
(C) centroid of the triangle PQR lies on the axis of the parabola
(D) circle circumscribing the triangle PQR passes through the vertex of the parabola

Q.14 Variable chords of the parabola $y^2 = 4ax$ subtend a right angle at the vertex. Then :
(A) locus of the feet of the perpendiculars from the vertex on these chords is a circle
(B) locus of the middle points of the chords is a parabola
(C) variable chords passes through a fixed point on the axis of the parabola
(D) none of these

Q.15 Through a point P (– 2, 0), tangents PQ and PR are drawn to the parabola $y^2 = 8x$. Two circles each passing through the focus of the parabola and one touching at Q and other at R are drawn. Which of the following point(s) with respect to the triangle PQR lie(s) on the common chord of the two circles?
(A) centroid (B) orthocentre (C) incentre (D) circumcentre

Q.16 TP and TQ are tangents to parabola $y^2 = 4x$ and normals at P and Q intersect at a point R on the curve. The locus of the centre of the circle circumscribing ΔTPQ is a parabola whose

(A) vertex is (1, 0). (B) foot of directrix is $\left(\frac{7}{8}, 0\right)$.

(C) length of latus-rectum is $\frac{1}{4}$. (D) focus is $\left(\frac{9}{8}, 0\right)$.

Match the column:

Q.17 Consider the parabola $y^2 = 12x$

	Column-I		Column-II
(A)	Tangent and normal at the extremities of the latus rectum intersect the x axis at T and G respectively. The coordinates of the middle point of T and G are	(P)	(0, 0)
(B)	Variable chords of the parabola passing through a fixed point K on the axis, such that sum of the squares of the reciprocals of the two parts of the chords through K, is a constant. The coordinate of the point K are	(Q)	(3, 0)
		(R)	(6, 0)
(C)	All variable chords of the parabola subtending a right angle at the origin are concurrent at the point		
(D)	AB and CD are the chords of the parabola which intersect at a point E on the axis. The radical axis of the two circles described on AB and CD as diameter always passes through	(S)	(12, 0)

Subjective:

Q.18 Let $L_1 : x + y = 0$ and $L_2 : x - y = 0$ are tangent to a parabola whose focus is S(1, 2).
If the length of latus-rectum of the parabola can be expressed as $\frac{m}{\sqrt{n}}$ (where m and n are coprime) then find the value of $(m + n)$.

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DPP-6

Q.1 Let 'E' be the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ & 'C' be the circle $x^2+y^2=9$. Let P & Q be the points (1 , 2) and (2, 1) respectively. Then :

(A) Q lies inside C but outside E (B) Q lies outside both C & E

(C) P lies inside both C & E (D) P lies inside C but outside E.

Q.2 The eccentricity of the ellipse $(x-3)^2+(y-4)^2=\frac{y^2}{9}$ is

(A) $\frac{\sqrt{3}}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{3\sqrt{2}}$ (D) $\frac{1}{\sqrt{3}}$

Q.3 An ellipse has OB as a semi minor axis where 'O' is the origin. F, F′ are its foci and the angle FBF′ is a right angle. Then the eccentricity of the ellipse i

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{1}{2}$ (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{1}{4}$

Q.4 There are exactly two points on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ whose distance from the centre of the ellipse are greatest and equal to $\sqrt{\frac{a^2+2b^2}{2}}$. Eccentricity of this ellipse is equal to

(A) $\frac{\sqrt{3}}{2}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\frac{1}{\sqrt{2}}$ (D) $\sqrt{\frac{2}{3}}$

Q.5 A circle has the same centre as an ellipse & passes through the foci F_1 & F_2 of the ellipse, such that the two curves intersect in 4 points. Let 'P' be any one of their point of intersection. If the major axis of the ellipse is 17 & the area of the triangle PF_1F_2 is 30, then the distance between the foci is :

(A) 11 (B) 12 (C) 13 (D) none

Q.6 The latus rectum of a conic section is the width of the function through the focus. The positive difference between the lengths of the latus rectum of $3y=x^2+4x-9$ and $x^2+4y^2-6x+16y=24$ is

(A) 1/2 (B) 2 (C) 3/2 (D) 5/2

Q.7 Imagine that you have two thumbtacks placed at two points, A and B. If the ends of a fixed length of string are fastened to the thumbtacks and the string is drawn taut with a pencil, the path traced by the pencil will be an ellipse. The best way to maximise the area surrounded by the ellipse with a fixed length of string occurs when

I the two points A and B have the maximum distance between them.

II two points A and B coincide.

III A and B are placed vertically.

IV The area is always same regardless of the location of A and B.

(A) I (B) II (C) III (D) IV

Q.8 An ellipse having foci at (3, 3) and (– 4, 4) and passing through the origin has eccentricity equal to

(A) 3/7 (B) 2/7 (C) 5/7 (D) 3/7

Q.9 Let $S(5, 12)$ and $S'(-12, 5)$ are the foci of an ellipse passing through the origin. The eccentricity of ellipse equals

(A) $\frac{1}{2}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\frac{1}{\sqrt{2}}$ (D) $\frac{2}{3}$

More than one are correct:

Q.10 Consider the ellipse $\frac{x^2}{\tan^2\alpha}+\frac{y^2}{\sec^2\alpha}=1$ where $\alpha \in (0, \pi/2)$.
Which of the following quantities would vary as α varies?
(A) degree of flatness
(B) ordinate of the vertex
(C) coordinates of the foci
(D) length of the latus rectum

Q.11 Extremities of the latera recta of the ellipses $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ $(a > b)$ having a given major axis 2a lies on
(A) $x^2 = a(a - y)$
(B) $x^2 = a(a + y)$
(C) $y^2 = a(a + x)$
(D) $y^2 = a(a - x)$

Subjective:

Q.12 Consider two concentric circles $S_1 : |z| = 1$ and $S_2 : |z| = 2$ on the Argand plane. A parabola is drawn through the points where 'S_1' meets the real axis and having arbitrary tangent of 'S_2' as its directrix. If the locus of the focus of drawn parabola is a conic C then find the area of the quadrilateral formed by the tangents at the ends of the latus-rectum of conic C.

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DPP-7

Q.1 Point 'O' is the centre of the ellipse with major axis AB & minor axis CD. Point F is one focus of the ellipse. If OF = 6 & the diameter of the inscribed circle of triangle OCF is 2, then the product (AB) (CD) is equal to
(A) 65
(B) 52
(C) 78
(D) none

Q.2 The y-axis is the directrix of the ellipse with eccentricity $e = 1/2$ and the corresponding focus is at (3, 0), equation to its auxilary circle is
(A) $x^2 + y^2 - 8x + 12 = 0$
(B) $x^2 + y^2 - 8x - 12 = 0$
(C) $x^2 + y^2 - 8x + 9 = 0$
(D) $x^2 + y^2 = 4$

Q.3 Which one of the following is the common tangent to the ellipses, $\frac{x^2}{a^2+b^2}+\frac{y^2}{b^2}=1$ and $\frac{x^2}{a^2}+\frac{y^2}{a^2+b^2}=1$?
(A) $ay = bx + \sqrt{a^4 - a^2b^2 + b^4}$
(B) $by = ax - \sqrt{a^4 + a^2b^2 + b^4}$
(C) $ay = bx - \sqrt{a^4 + a^2b^2 + b^4}$
(D) $by = ax + \sqrt{a^4 - a^2b^2 + b^4}$

Q.4 $x - 2y + 4 = 0$ is a common tangent to $y^2 = 4x$ & $\frac{x^2}{4}+\frac{y^2}{b^2}=1$. Then the value of b and the other common tangent are given by :
(A) $b = \sqrt{3}$; $x + 2y + 4 = 0$
(B) $b = 3$; $x + 2y + 4 = 0$
(C) $b = \sqrt{3}$; $x + 2y - 4 = 0$
(D) $b = \sqrt{3}$; $x - 2y - 4 = 0$

Q.5 If α & β are the eccentric angles of the extremities of a focal chord of an standard ellipse, then the eccentricity of the ellipse is :
(A) $\frac{\cos\alpha + \cos\beta}{\cos(\alpha+\beta)}$
(B) $\frac{\sin\alpha - \sin\beta}{\sin(\alpha-\beta)}$
(C) $\frac{\cos\alpha - \cos\beta}{\cos(\alpha-\beta)}$
(D) $\frac{\sin\alpha + \sin\beta}{\sin(\alpha+\beta)}$

Q.6 An ellipse is inscribed in a circle and a point within the circle is chosen at random. If the probability that this point lies outside the ellipse is 2/3 then the eccentricity of the ellipse is :

(A) $\frac{2\sqrt{2}}{3}$ (B) $\frac{\sqrt{5}}{3}$ (C) $\frac{8}{9}$ (D) $\frac{2}{3}$

Q.7 Consider the particle travelling clockwise on the elliptical path $\frac{x^2}{100}+\frac{y^2}{25}=1$. The particle leaves the orbit at the point (–8, 3) and travels in a straight line tangent to the ellipse. At what point will the particle cross the y-axis?

(A) $\left(0, \frac{25}{3}\right)$ (B) $\left(0, -\frac{25}{3}\right)$ (C) (0, 9) (D) $\left(0, \frac{7}{3}\right)$

Q.8 The Locus of the middle point of chords of an ellipse $\frac{x^2}{16}+\frac{y^2}{25}=1$ passing through P(0, 5) is another ellipse E. The coordinates of the foci of the ellipse E, is

(A) $\left(0, \frac{3}{5}\right)$ and $\left(0, \frac{-3}{5}\right)$ (B) (0, – 4) and (0, 1)

(C) (0, 4) and (0, 1) (D) $\left(0, \frac{11}{2}\right)$ and $\left(0, \frac{-1}{2}\right)$

Paragraph for question nos. 9 to 11

Consider the curve $C: y^2-8x-4y+28=0$. Tangents TP and TQ are drawn on C at P(5, 6) and Q(5, – 2). Also normals at P and Q meet at R.

Q.9 The coordinates of circumcentre of ΔPQR, is

(A) (5, 3) (B) (5, 2) (C) (5, 4) (D) (5, 6)

Q.10 The area of quadrilateral TPRQ, is

(A) 8 (B) 16 (C) 32 (D) 64

Q.11 Angle between a pair of tangents drawn at the end points of the chord y + 5t = tx + 2 of curve C $\forall t \in R$, is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

More than one are correct:

Q.12 If a number of ellipse be described having the same major axis 2a but a variable minor axis then the tangents at the ends of their latera recta pass through fixed points which can be

(A) (0, a) (B) (0, 0) (C) (0, – a) (D) (a, a)

****

Q.1 The normal at a variable point P on an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ of eccentricity e meets the axes of the ellipse in Q and R then the locus of the mid-point of QR is a conic with an eccentricity e' such that :
(A) e' is independent of e
(B) $e' = 1$
(C) $e' = e$
(D) $e' = 1/e$

Q.2 The area of the rectangle formed by the perpendiculars from the centre of the standard ellipse to the tangent and normal at its point whose eccentric angle is $\pi/4$ is :

(A) $\frac{(a^2-b^2)ab}{a^2+b^2}$ (B) $\frac{(a^2-b^2)}{(a^2+b^2)ab}$ (C) $\frac{(a^2-b^2)}{ab(a^2+b^2)}$ (D) $\frac{a^2+b^2}{(a^2-b^2)ab}$

Q.3 If P is any point on ellipse with foci S_1 & S_2 and eccentricity is $\frac{1}{2}$ such that

$\angle PS_1S_2 = \alpha$, $\angle PS_2S_1 = \beta$, $\angle S_1PS_2 = \gamma$, then $\cot\frac{\alpha}{2}$, $\cot\frac{\gamma}{2}$, $\cot\frac{\beta}{2}$ are in

(A) A.P. (B) G.P. (C) H.P. (D) ***NOT*** A.P., G.P. & H.P.

Paragraph for question nos. 4 to 6

Consider the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ and the parabola $y^2 = 2x$. They intersect at P and Q in the first and fourth quadrants respectively. Tangents to the ellipse at P and Q intersect the x-axis at R and tangents to the parabola at P and Q intersect the x-axis at S.

Q.4 The ratio of the areas of the triangles PQS and PQR, is
(A) 1 : 3 (B) 1 : 2 (C) 2 : 3 (D) 3 : 4

Q.5 The area of quadrilateral PRQS, is

(A) $\frac{3\sqrt{15}}{2}$ (B) $\frac{15\sqrt{3}}{2}$ (C) $\frac{5\sqrt{3}}{2}$ (D) $\frac{5\sqrt{15}}{2}$

Q.6 The equation of circle touching the parabola at upper end of its latus rectum and passing through its vertex, is

(A) $2x^2 + 2y^2 - x - 2y = 0$
(B) $2x^2 + 2y^2 + 4x - \frac{9}{2}y = 0$
(C) $2x^2 + 2y^2 + x - 3y = 0$
(D) $2x^2 + 2y^2 - 7x + y = 0$

Paragraph for question nos. 7 to 11

Let the two foci of an ellipse be $(-1, 0)$ and $(3, 4)$ and the foot of perpendicular from the focus $(3, 4)$ upon a tangent to the ellipse be $(4, 6)$.

Q.7 The foot of perpendicular from the focus $(-1, 0)$ upon the same tangent to the ellipse is

(A) $\left(\frac{12}{5}, \frac{34}{5}\right)$ (B) $\left(\frac{7}{3}, \frac{11}{3}\right)$ (C) $\left(2, \frac{17}{4}\right)$ (D) $(-1, 2)$

Q.8 The equation of auxiliary circle of the ellipse is
(A) $x^2 + y^2 - 2x - 4y - 5 = 0$
(B) $x^2 + y^2 - 2x - 4y - 20 = 0$
(C) $x^2 + y^2 + 2x + 4y - 20 = 0$
(D) $x^2 + y^2 + 2x + 4y - 5 = 0$

Q.9 The length of semi-minor axis of the ellipse is

(A) 1 (B) $2\sqrt{2}$ (C) $\sqrt{17}$ (D) $\sqrt{19}$

Q.10 The equations of directrices of the ellipse are

(A) $x-y+2=0,\ x-y-5=0$ (B) $x+y-\frac{21}{2}=0,\ x+y+\frac{17}{2}=0$

(C) $x-y+\frac{3}{2}=0,\ x-y-\frac{5}{2}=0$ (D) $x+y-\frac{31}{2}=0,\ x+y+\frac{19}{2}=0$

Q.11 The point of contact of the tangent with the ellipse is

(A) $\left(\frac{40}{11},\frac{68}{11}\right)$ (B) $\left(\frac{4}{7},\frac{8}{7}\right)$ (C) $\left(\frac{8}{5},\frac{17}{5}\right)$ (D) $\left(\frac{41}{13},\frac{83}{13}\right)$

Subjective:

Q.12 Find the number of integral values of parameter 'a' for which three chords of the ellipse $\frac{x^2}{2a^2}+\frac{y^2}{a^2}=1$ (other than its diameter) passing through the point $P\left(11a,-\frac{a^2}{4}\right)$ are bisected by the parabola $y^2=4ax$.

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DPP-9

Q.1 Consider the hyperbola $9x^2-16y^2+72x-32y-16=0$. Find the following:

(a) centre **(b)** eccentricity **(c)** focii **(d)** equation of directrix

(e) length of the latus rectum **(f)** equation of auxilary circle **(g)** equation of director circle

Q.2 The area of the quadrilateral with its vertices at the foci of the conics

$9x^2-16y^2-18x+32y-23=0$ and

$25x^2+9y^2-50x-18y+33=0$, is

(A) 5/6 (B) 8/9 (C) 5/3 (D) 16/9

Q.3 Eccentricity of the hyperbola conjugate to the hyperbola $\frac{x^2}{4}-\frac{y^2}{12}=1$ is

(A) $\frac{2}{\sqrt{3}}$ (B) 2 (C) $\sqrt{3}$ (D) $\frac{4}{3}$

Q.4 The locus of the point of intersection of the lines $\sqrt{3}x-y-4\sqrt{3}t=0$ & $\sqrt{3}tx+ty-4\sqrt{3}=0$ (where t is a parameter) is a hyperbola whose eccentricity is

(A) $\sqrt{3}$ (B) 2 (C) $\frac{2}{\sqrt{3}}$ (D) $\frac{4}{3}$

Q.5 If the eccentricity of the hyperbola $x^2-y^2\sec^2\alpha=5$ is $\sqrt{3}$ times the eccentricity of the ellipse $x^2\sec^2\alpha+y^2=25$, then a value of α is :

(A) $\pi/6$ (B) $\pi/4$ (C) $\pi/3$ (D) $\pi/2$

Q.6 The foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. Then the value of b^2 is

(A) 5 (B) 7 (C) 9 (D) 4

More than one are correct:

Q.7 Which of the following equations in parametric form can represent a hyperbola, where 't' is a parameter.

(A) $x = \frac{a}{2}\left(t + \frac{1}{t}\right)$ & $y = \frac{b}{2}\left(t - \frac{1}{t}\right)$ (B) $\frac{tx}{a} - \frac{y}{b} + t = 0$ & $\frac{x}{a} + \frac{ty}{b} - 1 = 0$

(C) $x = e^t + e^{-t}$ & $y = e^t - e^{-t}$ (D) $x^2 - 6 = 2\cos t$ & $y^2 + 2 = 4\cos^2\frac{t}{2}$

Q.8 Let p and q be non-zero real numbers. Then the equation $(px^2 + qy^2 + r)(4x^2 + 4y^2 - 8x - 4) = 0$ represents

(A) two straight lines and a circle, when $r = 0$ and p, q are of the opposite sign.
(B) two circles, when $p = q$ and r is of sign opposite to that of p.
(C) a hyperbola and a circle, when p and q are of opposite sign and $r \neq 0$.
(D) a circle and an ellipse, when p and q are unequal but of same sign and r is of sign opposite to that of p.

Match the column:

Q.9 Match the properties given in **column-I** with the corresponding curves given in the **column-II**.

	Column-I		**Column-II**
(A)	The curve such that product of the distances of any of its tangent from two given points is constant, can be	(P)	Circle
(B)	A curve for which the length of the subnormal at any of its point is equal to 2 and the curve passes through (1, 2), can be	(Q)	Parabola
(C)	A curve passes through (1, 4) and is such that the segment joining any point P on the curve and the point of intersection of the normal at P with the x-axis is bisected by the y-axis. The curve can be	(R)	Ellipse
		(S)	Hyperbola
(D)	A curve passes through (1, 2) is such that the length of the normal at any of its point is equal to 2. The curve can be		

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DPP-10

Q.1 The magnitude of the gradient of the tangent at an extremity of latera recta of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is equal to (where e is the eccentricity of the hyperbola)

(A) be (B) e (C) ab (D) ae

Q.2 The number of possible tangents which can be drawn to the curve $4x^2 - 9y^2 = 36$, which are perpendicular to the straight line $5x + 2y - 10 = 0$ is :

(A) zero (B) 1 (C) 2 (D) 4

Q.3 Locus of the point of intersection of the tangents at the points with eccentric angles ϕ and $\frac{\pi}{2} - \phi$ on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is :

(A) $x = a$ (B) $y = b$ (C) $x = ab$ (D) $y = ab$

Q.4 The equation $\frac{x^2}{29 - p} + \frac{y^2}{4 - p} = 1$ $(p \neq 4, 29)$ represents

(A) an ellipse if p is any constant greater than 4. (B) a hyperbola if p is any constant between 4 and 29
(C) a rectangular hyperbola if p is any constant greater than 29.
(D) no real curve if p is less than 29.

Q.5 If $\frac{x^2}{\cos^2\alpha} - \frac{y^2}{\sin^2\alpha} = 1$ represents family of hyperbolas where 'α' varies then

(A) distance between the foci is constant (B) distance between the two directrices is constant
(C) distance between the vertices is constant
(D) distances between focus and the corresponding directrix is constant

Q.6 Number of common tangent with finite slope to the curves $xy = c^2$ & $y^2 = 4ax$ is :
(A) 0 (B) 1 (C) 2 (D) 4

Q.7 Area of the quadrilateral formed with the foci of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is
(A) $4(a^2 + b^2)$ (B) $2(a^2 + b^2)$ (C) $(a^2 + b^2)$ (D) $\frac{1}{2}(a^2 + b^2)$

Q.8 For each positive integer *n*, consider the point P with abscissa *n* on the curve $y^2 - x^2 = 1$. If d_n represents the shortest distance from the point P to the line $y = x$ then $\lim\limits_{n\to\infty}(n \cdot d_n)$ has the value equal to
(A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{2}$ (C) $\frac{1}{\sqrt{2}}$ (D) 0

Paragraph for question nos. 9 to 11

The graph of the conic $x^2 - (y-1)^2 = 1$ has one tangent line with positive slope that passes through the origin. the point of tangency being (a, b). Then

Q.9 The value of $\sin^{-1}\left(\frac{a}{b}\right)$ is
(A) $\frac{5\pi}{12}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

Q.10 Length of the latus rectum of the conic is
(A) 1 (B) $\sqrt{2}$ (C) 2 (D) none

Q.11 Eccentricity of the conic is
(A) $\frac{4}{3}$ (B) $\sqrt{3}$ (C) 2 (D) none

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DPP-11

Q.1 If $x + iy = \sqrt{\phi + i\psi}$ where $i = \sqrt{-1}$ and ϕ and ψ are non zero real parameters then ϕ = constant and ψ = constant, represents two systems of rectangular hyperbola which intersect at an angle of
(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

Q.2 Locus of the feet of the perpendiculars drawn from either foci on a variable tangent to the hyperbola $16y^2 - 9x^2 = 1$ is
(A) $x^2 + y^2 = 9$ (B) $x^2 + y^2 = 1/9$ (C) $x^2 + y^2 = 7/144$ (D) $x^2 + y^2 = 1/16$

Q.3 PQ is a double ordinate of the ellipse $x^2 + 9y^2 = 9$, the normal at P meets the diameter through Q at R, then the locus of the mid point of PR is
(A) a circle (B) a parabola (C) an ellipse (D) a hyperbola

Q.4 With one focus of the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ as the centre , a circle is drawn which is tangent to the hyperbola with no part of the circle being outside the hyperbola. The radius of the circle is
(A) less than 2 (B) 2 (C) $\frac{11}{3}$ (D) none

Q.5 If the tangent and normal at any point of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, meets the conjugate axis at Q and R, then the circle described on QR as diameter passes through the
(A) vertices
(B) focii
(C) feet of directrices
(D) ends of latera recta

Q.6 Let the major axis of a standard ellipse equals the transverse axis of a standard hyperbola and their director circles have radius equal to 2R and R respectively. If e_1 and e_2 are the eccentricities of the ellipse and hyperbola then the correct relation is
(A) $4e_1^2 - e_2^2 = 6$
(B) $e_1^2 - 4e_2^2 = 2$
(C) $4e_2^2 - e_1^2 = 6$
(D) $2e_1^2 - e_2^2 = 4$

Q.7 If the normal to the rectangular hyperbola $xy = c^2$ at the point 't' meets the curve again at 't_1' then $t^3 t_1$ has the value equal to
(A) 1
(B) – 1
(C) 0
(D) none

Q.8 P is a point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, N is the foot of the perpendicular from P on the transverse axis. The tangent to the hyperbola at P meets the transverse axis at T . If O is the centre of the hyperbola, the OT. ON is equal to :
(A) e^2
(B) a^2
(C) b^2
(D) b^2/a^2

More than one are correct:

Q.9 Solutions of the differential equation $(1 - x^2)\frac{dy}{dx} + xy = ax$ where $a \in R$, is
(A) a conic which is an ellipse or a hyperbola with principal axes parallel to coordinates axes.
(B) centre of the conic is (0, a)
(C) length of one of the principal axes is 1.
(D) length of one of the principal axes is equal to 2.

Q.10 In which of the following cases maximum number of normals can be drawn from a point P lying in the same plane
(A) circle
(B) parabola
(C) ellipse
(D) hyperbola

Q.11 If θ is eliminated from the equations
$a \sec\theta - x \tan\theta = y$ and $b \sec\theta + y \tan\theta = x$ (a and b are constant)
then the eliminant denotes the equation of
(A) the director circle of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$
(B) auxiliary circle of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
(C) Director circle of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
(D) Director circle of the circle $x^2 + y^2 = \frac{a^2 + b^2}{2}$.

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DPP-12

Q.1 If $P(x_1, y_1)$, $Q(x_2, y_2)$, $R(x_3, y_3)$ & $S(x_4, y_4)$ are 4 concyclic points on the rectangular hyperbola $xy = c^2$, the co-ordinates of the orthocentre of the triangle PQR are :
(A) $(x_4, -y_4)$ (B) (x_4, y_4) (C) $(-x_4, -y_4)$ (D) $(-x_4, y_4)$

Q.2 Let F_1, F_2 are the foci of the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$ and F_3, F_4 are the foci of its conjugate hyperbola. If e_H and e_C are their eccentricities respectively then the statement which holds true is
(A) Their equations of the asymptotes are different.
(B) $e_H > e_C$
(C) Area of the quadrilateral formed by their foci is 50 sq. units.
(D) Their auxillary circles will have the same equation.

Q.3 The chord PQ of the rectangular hyperbola $xy = a^2$ meets the axis of x at A ; C is the mid point of PQ & 'O' is the origin. Then the ΔACO is :
(A) equilateral (B) isosceles (C) right angled (D) right isosceles.

Q.4 The asymptote of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ form with any tangent to the hyperbola a triangle whose area is $a^2 \tan\lambda$ in magnitude then its eccentricity is :
(A) $\sec\lambda$ (B) $\operatorname{cosec}\lambda$ (C) $\sec^2\lambda$ (D) $\operatorname{cosec}^2\lambda$

Q.5 Latus rectum of the conic satisfying the differential equation, $x\,dy + y\,dx = 0$ and passing through the point (2, 8) is :
(A) $4\sqrt{2}$ (B) 8 (C) $8\sqrt{2}$ (D) 16

Q.6 AB is a double ordinate of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ such that ΔAOB (where 'O' is the origin) is an equilateral triangle, then the eccentricity e of the hyperbola satisfies
(A) $e > \sqrt{3}$ (B) $1 < e < \frac{2}{\sqrt{3}}$ (C) $e = \frac{2}{\sqrt{3}}$ (D) $e > \frac{2}{\sqrt{3}}$

Q.7 The tangent to the hyperbola $xy = c^2$ at the point P intersects the x-axis at T and the y-axis at T′. The normal to the hyperbola at P intersects the x-axis at N and the y-axis at N′. The areas of the triangles PNT and PN'T' are Δ and Δ' respectively, then $\frac{1}{\Delta} + \frac{1}{\Delta'}$ is
(A) equal to 1 (B) depends on t (C) depends on c (D) equal to 2

Q.8 At the point of intersection of the rectangular hyperbola $xy = c^2$ and the parabola $y^2 = 4ax$ tangents to the rectangular hyperbola and the parabola make an angle θ and ϕ respectively with the axis of X, then
(A) $\theta = \tan^{-1}(-2\tan\phi)$ (B) $\phi = \tan^{-1}(-2\tan\theta)$
(C) $\theta = \frac{1}{2}\tan^{-1}(-\tan\phi)$ (D) $\phi = \frac{1}{2}\tan^{-1}(-\tan\theta)$

Q.9 Locus of the middle points of the parallel chords with gradient m of the rectangular hyperbola $xy = c^2$ is
(A) $y + mx = 0$ (B) $y - mx = 0$ (C) $my - x = 0$ (D) $my + x = 0$

Q.10 The locus of the foot of the perpendicular from the centre of the hyperbola $xy = c^2$ on a variable tangent is
(A) $(x^2 - y^2)^2 = 4c^2xy$ (B) $(x^2 + y^2)^2 = 2c^2xy$
(C) $(x^2 + y^2) = 4x^2xy$ (D) $(x^2 + y^2)^2 = 4c^2xy$

Q.11 The equation to the chord joining two points (x_1, y_1) and (x_2, y_2) on the rectangular hyperbola $xy = c^2$ is

(A) $\frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$ (B) $\frac{x}{x_1 - x_2} + \frac{y}{y_1 - y_2} = 1$

(C) $\frac{x}{y_1 + y_2} + \frac{y}{x_1 + x_2} = 1$ (D) $\frac{x}{y_1 - y_2} + \frac{y}{x_1 - x_2} = 1$

Q.12 A tangent to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ meets its director circle at P and Q. Then the product of the slopes of CP and CQ where 'C' is the origin is

(A) $\frac{9}{4}$ (B) $\frac{-4}{9}$ (C) $\frac{2}{9}$ (D) $-\frac{1}{4}$

Q.13 The foci of a hyperbola coincide with the foci of the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$. Then the equation of the hyperbola with eccentricity 2 is

(A) $\frac{x^2}{12} - \frac{y^2}{4} = 1$ (B) $\frac{x^2}{4} - \frac{y^2}{12} = 1$ (C) $3x^2 - y^2 + 12 = 0$ (D) $9x^2 - 25y^2 - 225 = 0$

Paragraph for question nos. 14 to 16

From a point 'P' three normals are drawn to the parabola $y^2 = 4x$ such that two of them make angles with the abscissa axis, the product of whose tangents is 2. Suppose the locus of the point 'P' is a part of a conic 'C'. Now a circle S = 0 is described on the chord of the conic 'C' as diameter passing through the point (1, 0) and with gradient unity. Suppose (a, b) are the coordinates of the centre of this circle. If L_1 and L_2 are the two asymptotes of the hyperbola with length of its transverse axis 2a and conjugate axis 2b (principal axes of the hyperbola along the coordinate axes) then answer the following questions.

Q.14 Locus of P is a
(A) circle (B) parabola (C) ellipse (D) hyperbola

Q.15 Radius of the circle S = 0 is
(A) 4 (B) 5 (C) $\sqrt{17}$ (D) $\sqrt{23}$

Q.16 The angle $\alpha \in (0, \pi/2)$ between the two asymptotes of the hyperbola lies in the interval
(A) (0, 15°) (B) (30°, 45°) (C) (45°, 60°) (D) (60°, 75°)

Paragraph for question nos. 17 to 19

A conic C passes through the point (2, 4) and is such that the segment of any of its tangents at any point contained between the co-ordinate axes is bisected at the point of tangency. Let S denotes circle described on the foci F_1 and F_2 of the conic C as diameter.

Q.17 Vertex of the conic C is

(A) (2, 2), (–2, – 2) (B) $(2\sqrt{2}, 2\sqrt{2})$, $(-2\sqrt{2}, -2\sqrt{2})$

(C) (4, 4), (–4, – 4) (D) $(\sqrt{2}, \sqrt{2})$, $(-\sqrt{2}, -\sqrt{2})$

Q.18 Director circle of the conic is
(A) $x^2 + y^2 = 4$ (B) $x^2 + y^2 = 8$ (C) $x^2 + y^2 = 2$ (D) None

Q.19 Equation of the circle S is
(A) $x^2 + y^2 = 16$ (B) $x^2 + y^2 = 8$ (C) $x^2 + y^2 = 32$ (D) $x^2 + y^2 = 4$

Assertion and Reason:

Q.20 **Statement-1:** Diagonals of any parallelogram inscribed in an ellipse always intersect at the centre of the ellipse.

Statement-2: Centre of the ellipse is the only point at which two chords can bisect each other and every chord passing through the centre of the ellipse gets bisected at the centre.

(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

Q.21 **Statement-1:** The points of intersection of the tangents at three distinct points A, B, C on the parabola $y^2 = 4x$ can be collinear.

Statement-2: If a line L does not intersect the parabola $y^2 = 4x$, then from every point of the line two tangents can be drawn to the parabola.

(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

Q.22 **Statement-1:** The latus rectum is the shortest focal chord in a parabola of length 4a.

because

Statement-2: As the length of a focal chord of the parabola $y^2 = 4ax$ is $a\left(t+\frac{1}{t}\right)^2$, which is minimum when t = 1.

(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

Q.23 **Statement-1:** If P(2a, 0) be any point on the axis of parabola, then the chord QPR, satisfy $\frac{1}{(PQ)^2}+\frac{1}{(PR)^2}=\frac{1}{4a^2}$.

Statement-2: There exists a point P on the axis of the parabola $y^2 = 4ax$ (other than vertex), such that $\frac{1}{(PQ)^2}+\frac{1}{(PR)^2}$ = constant for all chord QPR of the parabola.

(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

Q.24 **Statement-1:** The quadrilateral formed by the pair of tangents drawn from the point (0, 2) to the parabola $y^2 - 2y + 4x + 5 = 0$ and the normals at the point of contact of tangents in a square.

Statement-2: The angle between tangents drawn from the given point to the parabola is 90°.

(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

More than one are correct:

Q.25 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) $y_1 y_2 y_3 y_4 = c^4$

Q.26 The tangent to the hyperbola, $x^2 - 3y^2 = 3$ at the point $\left(\sqrt{3}, 0\right)$ when associated with two asymptotes constitutes

(A) isosceles triangle (B) an equilateral triangle

(C) a triangles whose area is $\sqrt{3}$ sq. units (D) a right isosceles triangle .

Q.27 The locus of the point of intersection of those normals to the parabola $x^2 = 8y$ which are at right angles to each other, is a parabola. Which of the following hold(s) good in respect of the locus?

(A) Length of the latus rectum is 2. (B) Coordinates of focus are $\left(0, \frac{11}{2}\right)$

(C) Equation of a director circle is $2y - 11 = 0$ (D) Equation of axis of symmetry $y = 0$.

Match the column:

Q.28

	Column-I		Column-II
(A)	If the chord of contact of tangents from a point P to the parabola $y^2 = 4ax$ touches the parabola $x^2 = 4by$, the locus of P is	(P)	Straight line
(B)	A variable circle C has the equation $x^2 + y^2 - 2(t^2 - 3t + 1)x - 2(t^2 + 2t)y + t = 0$, where t is a parameter. The locus of the centre of the circle is	(Q)	Circle
(C)	The locus of point of intersection of tangents to an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at two points the sum of whose eccentric angles is constant is	(R)	Parabola
(D)	An ellipse slides between two perpendicular straight lines. Then the locus of its centre is	(S)	Hyperbola

Q.29

	Column-I		Column-II
(A)	For an ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ with vertices A and A', tangent drawn at the point P in the first quadrant meets the y-axis in Q and the chord A'P meets the y-axis in M. If 'O' is the origin then $OQ^2 - MQ^2$ equals to	(P)	2
(B)	If the product of the perpendicular distances from any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ of eccentricity $e = \sqrt{3}$ from its asymptotes is equal to 6, then the length of the transverse axis of the hyperbola is	(Q)	3
(C)	The locus of the point of intersection of the lines $\sqrt{3}x - y - 4\sqrt{3}t = 0$ and $\sqrt{3}tx + ty - 4\sqrt{3} = 0$ (where t is a parameter) is a hyperbola whose eccentricity is	(R)	4
(D)	If F_1 & F_2 are the feet of the perpendiculars from the foci S_1 & S_2 of an ellipse $\frac{x^2}{5} + \frac{y^2}{3} = 1$ on the tangent at any point P on the ellipse, then $(S_1F_1).(S_2F_2)$ is equal to	(S)	6

ANSWER KEY

DPP -1

Q.1 B Q.2 A Q.3 A Q.4 B Q.5 A Q.6 D Q.7 B Q.8 C Q.9 D
Q.10 C Q.11 B Q.12 A Q.13 B Q.14 B

Q.15 $4\sqrt{3}$ Q.16 $\left(\frac{-b}{2a}, \frac{4ac-b^2}{4a}\right)$; $\left(\frac{-b}{2a}, \frac{1}{4a} + \frac{4ac-b^2}{4a}\right)$; $\frac{1}{a}$, $y = \frac{4ac-b^2}{4a} - \frac{1}{4a}$

DPP -2

Q.1 C Q.2 D Q.3 A Q.4 C Q.5 C Q.6 B Q.7 D
Q.8 A Q.9 D Q.10 B Q.11 A Q.12 A,B

DPP -3

Q.1 B Q.2 B Q.3 B Q.4 C Q.5 B Q.6 D Q.7 C
Q.8 C Q.9 C Q.10 B Q.11 C Q.12 D Q.13 D Q.14 C
Q.15 A,D Q.16 A,B,C

DPP -4

Q.1 C Q.2 A Q.3 B Q.4 C Q.5 C Q.6 B Q.7 A
Q.8 C Q.9 A Q.10 A Q.11 C Q.12 C Q.13 D

DPP -5

Q.1 B Q.2 B Q.3 D Q.4 D Q.5 C Q.6 A Q.7 A
Q.8 B Q.9 C Q.10 C Q.11 B Q.12 A Q.13 A,B,C,D
Q.14 A,B,C Q.15 A,B,C,D Q.16 A,B,D Q.17 (A) Q; (B) R; (C) S; (D) P Q.18 0011

DPP -6

Q.1 D Q.2 B Q.3 A Q.4 C Q.5 C Q.6 A Q.7 B
Q.8 C Q.9 C Q.10 A,B,D Q.11 A,B Q.12 0016

DPP -7

Q.1 A Q.2 A Q.3 B Q.4 A Q.5 D Q.6 A Q.7 A
Q.8 C Q.9 B Q.10 C Q.11 D Q.12 A,C

DPP -8

Q.1 C Q.2 A Q.3 A Q.4 C Q.5 B Q.6 D Q.7 A
Q.8 B Q.9 C Q.10 D Q.11 A Q.12 0002

DPP -9

Q.1 **(a)** $(-4, -1)$; **(b)** 5/4; **(c)** $(1, -1), (-9, -1)$; **(d)** $5x + 4 = 0$, $5x + 36 = 0$, **(e)** 9/2;
(f) $(x + 4)^2 + (y + 1)^2 = 16$; **(g)** $(x + 4)^2 + (y + 1)^2 = 7$
Q.2 B Q.3 A Q.4 B Q.5 B Q.6 B Q.7 A,C,D Q.8 A,B,C,D
Q.9 (A) R, S; (B) Q; (C) R; (D) P

DPP -10

Q.1 B Q.2 A Q.3 B Q.4 B Q.5 A Q.6 B Q.7 B
Q.8 A Q.9 D Q.10 C Q.11 D

DPP -11

Q.1 D Q.2 D Q.3 C Q.4 B Q.5 B Q.6 C Q.7 B
Q.8 B Q.9 A,B,D Q.10 A Q.11 C,D

DPP -12

Q.1 C Q.2 C Q.3 B Q.4 A Q.5 C Q.6 D Q.7 C
Q.8 A Q.9 A Q.10 D Q.11 A Q.12 B Q.13 B Q.14 B
Q.15 A Q.16 D Q.17 B Q.18 D Q.19 C Q.20 A Q.21 D
Q.22 A Q.23 A Q.24 D Q.25 A,B,C,D Q.26 B,C Q.27 A,C
Q.28 (A) S; (B) R; (C) P; (D) Q Q.29 (A) R; (B) S; (C) P; (D) Q