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

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

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) $\frac{4}{3}$

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) $\frac{4}{3}$

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) $\pi/2$

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

7. The focal length of the hyperbola $x^2 - 3y^2 - 4x - 6y - 11 = 0$, is-

(A) 4 (B) 6 (C) 8 (D) 10

8. 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 is p is less than 29.

9. 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

10. 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

11. 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) $y = ab$

12. 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

13. 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

14. 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, then OT.ON is equal to :

(A) e^2 (B) a^2 (C) b^2 (D) b^2/a^2

15. 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) $x^2 + y^2 = 1/16$

16. 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

17. 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

18. 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) $2e_1^2 - e_2^2 = 4$

19. 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

20. 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 $\lim_{n\to\infty} (n.d_n)$ has the value equal to-

(A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{2}$ (C) $\frac{1}{\sqrt{2}}$ (D) 0

21. 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

22. 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 auxiliary circles will have the same equation.

23. 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 Δ ACO is :

(A) equilateral (B) isosceles (C) right angled (D) right isosceles.

24. 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) $\operatorname{cosec}^2\lambda$

25. 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

26. 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) $e > \frac{2}{\sqrt{3}}$

27. 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

28. 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) $\phi = \frac{1}{2}\tan^{-1}(-\tan\theta)$

29. 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) $my + x = 0$

30. 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) $(x^2 + y^2) = 4c^2xy$ (D) $(x^2 + y^2)^2 = 4c^2xy$

31. 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) $\frac{x}{y_1 - y_2} + \frac{y}{x_1 - x_2} = 1$

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

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

33. 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) $9x^2 - 25y^2 - 225 = 0$

34. The graph of the equation $x + y = x^3 + y^3$ is the union of -

(A) line and an ellipse (B) line and a parabola (C) line and hyperbola (D) line and a point