1. Let P_1 be a parabola with vertex $(3,2)$ and focus $(4,4)$ and P_2 be its mirror image with respect to the line $x+2y=6$. Then the directrix of P_2 is $x+2y=$ _____.

2. Let $x=2t, y=\frac{t^2}{3}$ be a conic. Let S be the focus and B be the point on the axis of the conic such that $SA \perp BA$, where A is any point on the conic. If k is the ordinate of the centroid of the ΔSAB, then $\lim\limits_{t \to 1} k$ is equal to

(1) $\frac{17}{18}$
(2) $\frac{19}{18}$
(3) $\frac{11}{18}$
(4) $\frac{13}{18}$

3. Let P be a point on the parabola, $y^2=12x$ and N be the foot of the perpendicular drawn from P , on the axis of the parabola. A line is now drawn through the mid-point M of PN, parallel to its axis which meets the parabola at Q. If the $y-$intercept of the line NQ is $\frac{4}{3}$, then :

(1) $PN=4$
(2) $MQ=\frac{1}{3}$
(3) $MQ=\frac{1}{4}$
(4) $PN=3$

4. Let $P(4,-4)$ and $Q(9,6)$ be two points on the parabola, $y^2=4x$ and let X be any point on the arc POQ of this parabola, where O is the vertex of this parabola, such that the area of ΔPXQ is maximum. Then this maximum area (in sq. units) is :

(1) $\frac{625}{4}$
(2) $\frac{75}{2}$
(3) $\frac{125}{4}$
(4) $\frac{125}{2}$

5. If the x-intercept of a focal chord of the parabola $y^2=8x+4y+4$ is 3, then the length of this chord is equal to _____ .

6. Let PQ be a focal chord of the parabola $y^2=36x$ of length 100, making an acute angle with the positive $x-$axis. Let the ordinate of P be positive and M be the point on the line segment PQ such that $PM:MQ=3:1$. Then which of the following points does NOT lie on the line passing through M and perpendicular to the line PQ?

(1) $(-6,45)$
(2) $(6,29)$
(3) $(3,33)$
(4) $(-3,43)$

7. Let R be the focus of the parabola $y^2=20x$ and the line $y=mx+c$ intersect the parabola at two points P and Q. Let the points $G(10,\ 10)$ be the centroid of the triangle PQR. If $c-m=6$, then PQ^2 is

(1) 296
(2) 325
(3) 317
(4) 346

8. Let the latus rectum of the parabola $y^2=4x$ be the common chord to the circles C_1 and C_2 each of them having radius $2\sqrt{5}$. Then, the distance between the centres of the circles C_1 and C_2 is :

(1) 12
(2) 8
(3) $8\sqrt{5}$
(4) $4\sqrt{5}$

9. Let P be a variable point on the parabola $y=4x^2+1$. Then, the locus of the mid-point of the point P and the foot of the perpendicular drawn from the point P to the line $y=x$ is:

(1) $(3x-y)^2+(x-3y)+2=0$
(2) $2(3x-y)^2+(x-3y)+2=0$
(3) $(3x-y)^2+2(x-3y)+2=0$
(4) $2(x-3y)^2+(3x-y)+2=0$

10. Let a tangent to the curve $y^2=24x$ meet the curve $xy=2$ at the points A and B. Then the mid-points of such line segments AB lie on a parabola with the

(1) directrix $4x=3$
(2) directrix $4x=-3$
(3) Length of latus rectum $\frac{3}{2}$
(4) Length of latus rectum 2

11. Let an ellipse with centre $(1,\ 0)$ and latus rectum of length $\frac{1}{2}$ have its major axis along x-axis. If its minor axis subtends an angle 60° at the foci, then the square of the sum of the lengths of its minor and major axes is equal to _______.

12. Let the eccentricity of an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, a>b$, be $\frac{1}{4}$. If this ellipse passes through the point $\left(-4\sqrt{\frac{2}{5}},3\right)$, then a^2+b^2 is equal to

(1) 29
(2) 31
(3) 32
(4) 34

13. If the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ meets the line $\frac{x}{7}+\frac{y}{2\sqrt{6}}=1$ on the x-axis and the line $\frac{x}{7}-\frac{y}{2\sqrt{6}}=1$ on the y-axis, then the eccentricity of the ellipse is

(1) $\frac{5}{7}$
(2) $\frac{2\sqrt{6}}{7}$
(3) $\frac{3}{7}$
(4) $\frac{2\sqrt{5}}{7}$

14. Let PQ be a focal chord of the parabola $y^2=4x$ such that it subtends an angle of $\frac{\pi}{2}$ at the point $(3,0)$. Let the line segment PQ be also a focal chord of the ellipse $E:\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, a^2>b^2$. If e is the eccentricity of the ellipse E, then the value of $\frac{1}{e^2}$ is equal to

(1) $1+\sqrt{2}$
(2) $3+2\sqrt{2}$
(3) $1+2\sqrt{3}$
(4) $4+5\sqrt{3}$

15. Let the maximum area of the triangle that can be inscribed in the ellipse $\frac{x^2}{a^2}+\frac{y^2}{4}=1, a>2$, having one of its vertices at one end of the major axis of the ellipse and one of its sides parallel to the y-axis, be $6\sqrt{3}$. Then the eccentricity of the ellipse is:

(1) $\frac{\sqrt{3}}{2}$
(2) $\frac{1}{2}$
(3) $\frac{1}{\sqrt{2}}$
(4) $\frac{\sqrt{3}}{4}$

16. Let $P\left(\frac{2\sqrt{3}}{\sqrt{7}}, \frac{6}{\sqrt{7}}\right)$, Q, R and S be four points on the ellipse $9x^2+4y^2=36$. Let PQ and RS be mutually perpendicular and pass through the origin. If $\frac{1}{(PQ)^2}+\frac{1}{(RS)^2}=\frac{p}{q}$, where p and q are coprime, then $p+q$ is equal to

(1) 147 (2) 143
(3) 137 (4) 157

17. A ray of light through $(2,1)$ is reflected at a point P on the $y-$ axis and then passes through the point $(5,3)$. If this reflected ray is the directrix of an ellipse with eccentricity $\frac{1}{3}$ and the distance of the nearer focus from this directrix is $\frac{8}{\sqrt{53}}$, then the equation of the other directrix can be:

(1) $11x+7y+8=0$ or $11x+7y-15=0$ (2) $11x-7y-8=0$ or $11x+7y+15=0$
(3) $2x-7y+29=0$ or $2x-7y-7=0$ (4) $2x-7y-39=0$ or $2x-7y-7=0$

18. Let the ellipse $E: x^2+9y^2=9$ intersect the positive x- and y-axes at the points A and B respectively. Let the major axis of E be a diameter of the circle C. Let the line passing through A and B meet the circle C at the point P. If the area of the triangle with vertices A, P and the origin O is $\frac{m}{n}$, where m and n are coprime, then $m-n$ is equal to

(1) 16 (2) 15
(3) 17 (4) 18

19. Let
$S=\left\{(x,y)\in \mathbb{N}\times\mathbb{N} : 9(x-3)^2+16(y-4)^2 \le 144\right\}$
and $T=\left\{(x,y)\in \mathbb{R}\times\mathbb{R} : (x-7)^2+(y-4)^2 \le 36\right\}$
The $n(S\cap T)$ is equal to ______.

20. The line $y=x+1$ meets the ellipse $\frac{x^2}{4}+\frac{y^2}{2}=1$ at two points P and Q. If r is the radius of the circle with PQ as diameter then $(3r)^2$ is equal to

(1) 20 (2) 12
(3) 11 (4) 8

21. The locus of the mid-point of the line segment joining the point $(4,3)$ and the points on the ellipse $x^2+2y^2=4$ is an ellipse with eccentricity

(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{1}{2\sqrt{2}}$
(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{1}{2}$

22. Let $O(0,0)$ and $A(0,1)$ be two fixed points. Then, the locus of a point P such that the perimeter of ΔAOP is 4 is

(1) $8x^2+9y^2-9y=18$ (2) $9x^2-8y^2+8y=16$
(3) $8x^2-9y^2+9y=18$ (4) $9x^2+8y^2-8y=16$

23. Let the eccentricity of an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is reciprocal to that of the hyperbola $2x^2-2y^2=1$. If the ellipse intersects the hyperbola at right angles, then square of length of the latus-rectum of the ellipse is _____.

24. Let a line $L: 2x+y=k,\ k>0$ be a tangent to the hyperbola $x^2-y^2=3$. If L is also a tangent to the parabola $y^2=\alpha x$, then α is equal to:

(1) 12 (2) -12
(3) 24 (4) -24

25. Let the hyperbola $H: \frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ pass through the point $\left(2\sqrt{2},-2\sqrt{2}\right)$. A parabola is drawn whose focus is same as the focus of H with positive abscissa and the directrix of the parabola passes through the other focus of H. If the length of the latus rectum of the parabola is e times the length of the latus rectum of H, where e is the eccentricity of H, then which of the following points lies on the parabola?

(1) $\left(2\sqrt{3},3\sqrt{2}\right)$ (2) $\left(3\sqrt{3},-6\sqrt{2}\right)$
(3) $\left(\sqrt{3},-\sqrt{6}\right)$ (4) $\left(3\sqrt{6},6\sqrt{2}\right)$

26. Let the hyperbola $H: \frac{x^2}{a^2}-y^2=1$ and the ellipse $E: 3x^2+4y^2=12$ be such that the length of latus rectum of H is equal to the length of latus rectum of E. If e_H and e_E are the eccentricities of H and E respectively, then the value of $12\left(e_H^2+e_E^2\right)$ is equal to _____.

27. Let R be a rectangle given by the lines $x=0,\ x=2,\ y=0$ and $y=5$. Let A$(\alpha,0)$ and B$(0,\beta)$, $\alpha\in[0,2]$ and $\beta\in[0,5]$, be such that the line segment AB divides the area of the rectangle R in the ratio $4:1$. Then, the mid-point of AB lies on a

(1) straight line (2) parabola
(3) hyperbola (4) circle

28. Let $H_n: \frac{x^2}{1+n}-\frac{y^2}{3+n}=1,\ n\in\mathbb{N}$. Let k be the smallest even value of n such that the eccentricity of H_k is a rational number. If l is the length of the latus rectum of H_k, then $21l$ is equal to

29. An ellipse $E: \frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ passes through the vertices of the hyperbola $H: \frac{x^2}{49}-\frac{y^2}{64}=-1$. Let the major and minor axes of the ellipse E coincide with the transverse and conjugate axes of the hyperbola H. Let the product of the eccentricities of E and H be $\frac{1}{2}$. If l is the length of the latus rectum of the ellipse E, then the value of $113l$ is equal to _______.

30. A square $ABCD$ has all its vertices on the curve $x^2y^2=1$. The midpoints of its sides also lie on the same curve. Then, the square of area of $ABCD$ is