PARABOLA

OBJECTIVES

1. **The focus of the parabola $y^2 = 4y - 4x$ is**

   (a) (0, 2) (b) (1, 2) (c) (2, 0) (d) (2, 1)

2. **Vertex of the parabola $x^2 + 4x + 2y - 7 = 0$ is**

   (a)(–2, 11/2) (b) (–2, 2) (c)(–2, 11) (d)(2, 11)

3. **The equations $x = \frac{t}{4}, y = \frac{t^2}{4}$ represents**

   (a) A circle (b) A parabola (c) An ellipse (d) A hyperbola

4. **The equation of parabola whose vertex and focus are (0, 4) and (0, 2) respectively, is**

   (a) $y^2 - 8x = 32$ (b) $y^2 + 8x = 32$ (c) $x^2 + 8y = 32$ (d) $x^2 - 8y = 32$

5. **Curve $16x^2 + 8xy + y^2 - 74x - 78y + 212 = 0$ represents**

   (a) Parabola (b) Hyperbola (c)Ellipse (d) None of these

6. **If the vertex of the parabola $y = x^2 - 8x + c$ lies on *x*-axis, then the value of *c* is**

   (a) –16 (b) –4 (c) 4 (d) 16

7. **Eccentricity of the parabola $x^2 - 4x - 4y + 4 = 0$ is**

   (a) $e = 0$ (b) $e = 1$ (c) $e > 4$ (d) $e = 4$

8. **The axis of the parabola $9y^2 - 16x - 12y - 57 = 0$ is**

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

9. **The focus of the parabola $x^2 = 2x + 2y$ is**

   (a) $\left(\frac{3}{2}, \frac{-1}{2}\right)$ (b) $\left(1, \frac{-1}{2}\right)$ (c) (1, 0) (d) (0, 1)

10. **The focus of the parabola $4y^2 - 6x - 4y = 5$ is**

    (a) (–8/5, 2) (b) (–5/8, 1/2)

    (c) (1/2, 5/8) (d) (5/8, –1/2)

11. **Equation of the parabola whose directrix is $y = 2x - 9$ and focus (–8, –2) is**

    (a) $x^2 + 4y^2 + 4xy + 16x + 2y + 259 = 0$ (b) $x^2 + 4y^2 + 4xy + 116x + 2y + 259 = 0$

    (c) $x^2 + y^2 + 4xy + 116x + 2y + 259 = 0$ (d) None of these

12. **Vertex of the parabola** $9x^2 - 6x + 36y + 9 = 0$ **is**

(a) $(1/3, -2/9)$ (b) $(-1/3, -1/2)$ (c) $(-1/3, 1/2)$ (d) $(1/3, 1/2)$

13. **The equation of the parabola whose vertex is (–1, –2), axis is vertical and which passes through the point (3, 6), is**

(a) $x^2 + 2x - 2y - 3 = 0$ (b) $2x^2 = 3y$ (c) $x^2 - 2x - y + 3 = 0$ (d) None of these

14. **The focus of the parabola** $x^2 = -16y$ **is**

(a) (4, 0) (b) (0, 4) (c) (–4, 0) (d) (0, –4)

15. **The equation of the parabola with focus (3, 0) and the directirx** $x + 3 = 0$ **is**

(a) $y^2 = 3x$ (b) $y^2 = 2x$ (c) $y^2 = 12x$ (d) $y^2 = 6x$

16. **Axis of the parabola** $x^2 - 4x - 3y + 10 = 0$ **is**

(a) $y + 2 = 0$ (b) $x + 2 = 0$

(c) $y - 2 = 0$ (d) $x - 2 = 0$

17. **The equation of the parabola with its vertex at the origin, axis on the *y*-axis and passing through the point (6, –3) is**

(a) $y^2 = 12x + 6$ (b) $x^2 = 12y$ (c) $x^2 = -12y$ (d) $y^2 = -12x + 6$

18. **The latus rectum of the parabola** $y^2 = 5x + 4y + 1$ **is**

(a) $\frac{5}{4}$ (b) 10 (c) 5 (d) $\frac{5}{2}$

19. **Focus and directrix of the parabola** $x^2 = -8ay$ **are**

(a) $(0, -2a)$ and $y = 2a$ (b) $(0, 2a)$ and $y = -2a$ (c) $(2a, 0)$ and $x = -2a$ (d) $(-2a, 0)$ and $x = 2a$

20. **The ends of latus rectum of parabola** $x^2 + 8y = 0$ **are**

(a) (–4, –2) and (4, 2) (b) (4, –2) and (–4, 2)

(c) (–4, –2) and (4, –2) (d) (4, 2) and (–4, 2)

21. **The co-ordinates of the extremities of the latus rectum of the parabola** $5y^2 = 4x$ **are**

(a) $(1/5, 2/5), (-1/5, 2/5)$ (b) $(1/5, 2/5), (1/5, -2/5)$ (c) $(1/5, 4/5), (1/5, -4/5)$ (d) None of these

22. **The points on the parabola** $y^2 = 12x$ **whose focal distance is 4, are**

(a) $(2, \sqrt{3}), (2, -\sqrt{3})$ (b) $(1, 2\sqrt{3}), (1, -2\sqrt{3})$ (c) (1, 2) (d) None of these

23. **The vertex of the parabola** $x^2 + 8x + 12y + 4 = 0$ **is**

(a)(–4, 1) (b) (4, –1) (c) (–4, –1) (d) (4, 1)

24. The equation of axis of the parabola $2x^2 + 5y - 3x + 4 = 0$ is

(a) $x = \frac{3}{4}$ (b) $y = \frac{3}{4}$ (c) $x = -\frac{1}{2}$ (d) $x - 3y = 5$

25. The focus of the parabola $y = 2x^2 + x$ is

(a) (0, 0) (b) $\left(\frac{1}{2}, \frac{1}{4}\right)$ (c) $\left(-\frac{1}{4}, 0\right)$ (d) $\left(-\frac{1}{4}, \frac{1}{8}\right)$

26. The equation of parabola whose focus is (5, 3) and directrix is $3x - 4y + 1 = 0$, is

(a) $(4x + 3y)^2 - 256x - 142y + 849 = 0$ (b) $(4x - 3y)^2 - 256x - 142y + 849 = 0$

(c) $(3x + 4y)^2 - 142x - 256y + 849 = 0$ (d) $(3x - 4y)^2 - 256x - 142y + 849 = 0$

27. The directrix of the parabola $x^2 - 4x - 8y + 12 = 0$ is

(a) $x = 1$ (b) $y = 0$ (c) $x = -1$ (d) $y = -1$

28. The length of the latus rectum of the parabola $x^2 - 4x - 8y + 12 = 0$ is

(a) 4 (b) 6 (c) 8 (d) 10

29. The equation of the parabola whose vertex is at (2, –1) and focus at (2, –3) is

(a) $x^2 + 4x - 8y - 12 = 0$ (b) $x^2 - 4x + 8y + 12 = 0$ (c) $x^2 + 8y = 12$ (d) $x^2 - 4x + 12 = 0$

30. The equation of latus rectum of a parabola is $x + y = 8$ and the equation of the tangent at the vertex is $x + y = 12$, then length of the latus rectum is

(a) $4\sqrt{2}$ (b) $2\sqrt{2}$ (c) 8 (d) $8\sqrt{2}$

31. The point of intersection of the latus rectum and axis of the parabola $y^2 + 4x + 2y - 8 = 0$

(a) (5/4, –1) (b) (9/4, –1) (c) (7/2, 5/2) (d) None of these

32. The equation of the latus rectum of the parabola $x^2 + 4x + 2y = 0$ is

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

33. The equation of the parabola with (–3, 0) as focus and $x + 5 = 0$ as directirx, is

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

34. The point on the parabola $y^2 = 18x$, for which the ordinate is three times the abscissa, is

(a) (6, 2) (b) (–2, –6) (c) (3, 18) (d) (2, 6)

35. Equation of the parabola with its vertex at (1, 1) and focus (3, 1) is

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

36. The point of contact of the tangent $18x - 6y + 1 = 0$ to the parabola $y^2 = 2x$ is

(a) $\left(\frac{-1}{18}, \frac{-1}{3}\right)$ (b) $\left(\frac{-1}{18}, \frac{1}{3}\right)$ (c) $\left(\frac{1}{18}, \frac{-1}{3}\right)$ (d) $\left(\frac{1}{18}, \frac{1}{3}\right)$

37. The equation of a tangent to the parabola $y^2 = 4ax$ making an angle θ with *x*-axis is

(a) $y = x\cot\theta + a\tan\theta$ (b) $x = y\tan\theta + a\cot\theta$ (c) $y = x\tan\theta + a\cot\theta$ (d) None of these

38. The point of the contact of the tangent to the parabola $y^2 = 4ax$ which makes an angle of 60^o with *x*-axis, is

(a) $\left(\frac{a}{3}, \frac{2a}{\sqrt{3}}\right)$ (b) $\left(\frac{2a}{\sqrt{3}}, \frac{a}{3}\right)$ (c) $\left(\frac{a}{\sqrt{3}}, \frac{2a}{3}\right)$ (d) None of these

39. If $x^2 + 6x + 20y - 51 = 0$, then axis of parabola is

(a) $x + 3 = 0$ (b) $x - 3 = 0$ (c) $x = 1$ (d) x+1=0

40. The equation of the directrix of the parabola $x^2 + 8y - 2x = 7$ is

(a) $y = 3$ (b) $y = -3$

(c) $y = 2$ (d) $y = 0$

41. The straight line $y = 2x + \lambda$ does not meet the parabola $y^2 = 2x$, if

(a) $\lambda < \frac{1}{4}$ (b) $\lambda > \frac{1}{4}$ (c) $\lambda = 4$ (d) $\lambda = 1$

42. The angle between the tangents drawn at the end points of the latus rectum of parabola $y^2 = 4ax$, is

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

43. The line $y = 2x + c$ is tangent to the parabola $y^2 = 4x$, then $c =$

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

44. The locus of the point of intersection of the perpendicular tangents to the parabola $x^2 = 4ay$ is

(a) Axis of the parabola (b)Directrix of the parabola

(c) Focal chord of the parabola (d)Tangent at vertex to the parabola

45. If the straight line $x + y = 1$ touches the parabola $y^2 - y + x = 0$, then the co-ordinates of the point of contact are

(a) (1, 1) (b) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (c)(0, 1) (d)(1, 0)

46. The equation of common tangent to the circle $x^2 + y^2 = 2$ and parabola $y^2 = 8x$ is

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

47. The locus of a foot of perpendicular drawn to the tangent of parabola $y^2 = 4ax$ from focus, is

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

48. If y_1, y_2 are the ordinates of two points *P* and *Q* on the parabola and y_3 is the ordinate of the point of intersection of tangents at *P* and *Q*, then

(a) y_1, y_2, y_3 are in A.P. (b) y_1, y_3, y_2 are in A.P.

(c) y_1, y_2, y_3 are in G.P. (d) y_1, y_3, y_2 are in G.P.

49. The line $x \cos\alpha + y \sin\alpha = p$ will touch the parabola $y^2 = 4a(x + a)$, if

(a) $p\cos\alpha + a = 0$ (b) $p\cos\alpha - a = 0$ (c) $a\cos\alpha + p = 0$ (d) $a\cos\alpha - p = 0$

50. If the line $lx + my + n = 0$ is a tangent to the parabola $y^2 = 4ax$, then locus of its point of contact is

(a) A straight line (b) A circle (c) A parabola (d) Two straight lines

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

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

52. 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) $\sqrt{3}y = -(3x + 1)$

53. If The tangent to the parabola $y^2 = ax$ makes an angle of 45^o with *x*-axis, then the point of contact is

(a) $\left(\frac{a}{2}, \frac{a}{2}\right)$ (b) $\left(\frac{a}{4}, \frac{a}{4}\right)$ (c) $\left(\frac{a}{2}, \frac{a}{4}\right)$ (d) $\left(\frac{a}{4}, \frac{a}{2}\right)$

54. Tangents at the extremities of any focal chord of a parabola intersect

(a) At right angles (b) On the directrix (c) On the tangents at vertex (d) None of these

55. The point on the parabola $y^2 = 8x$ at which the normal is parallel to the line $x - 2y + 5 = 0$ is

(a) $(-1/2, 2)$ (b) $(1/2, -2)$ (c) $(2, -1/2)$ (d) $(-2, 1/2)$

56. The point on the parabola $y^2 = 8x$ at which the normal is inclined at 60^o to the *x*-axis has the co-ordinates

(a) $(6, -4\sqrt{3})$ (b) $(6, 4\sqrt{3})$ (c) $(-6, -4\sqrt{3})$ (d) $(-6, 4\sqrt{3})$

57. The locus of the middle points of the chords of the parabola $y^2 = 4ax$ which passes through the origin

(a) $y^2 = ax$ (b) $y^2 = 2ax$ (c) $y^2 = 4ax$ (d) $x^2 = 4ay$

58. The focal chord to $y^2 = 16x$ is tangent to $(x-6)^2 + y^2 = 2$, then the possible value of the slope of this chord, are

(a) $\{-1, 1\}$ (b) {–2, 2} (c) {-2, 1/2} (d) {2, –1/2}

59. If $x = my + c$ is a normal to the parabola $x^2 = 4ay$, then the value of *c* is

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

60. If '*a*' and '*c*' are the segments of a focal chord of a parabola and *b* the semi-latus rectum, then

(a) *a, b, c* are in A.P. (b) *a, b, c* are in G.P. (c) *a, b, c* are in H.P. (d) None of these

61. If a normal drawn to the parabola $y^2 = 4ax$ at the point $(a, 2a)$ meets parabola again on $(at^2, 2at)$, then the value of *t* will be

(a) 1 (b) 3 (c)–1 (d)–3

62. If *PSQ* is the focal chord of the parabola $y^2 = 8x$ such that $SP = 6$. Then the length *SQ* is

(a) 6 (b) 4 (c) 3 (d) None of these

63. If the line $2x + y + k = 0$ is normal to the parabola $y^2 = -8x$, then the value of *k* will be

(a) -16 (b) -8 (c) -24 (d) 24

64. If $x + y = k$ is a normal to the parabola $y^2 = 12x$, then *k* is

(a) 3 (b) 9 (c)–9 (d)–3

65. Tangents drawn at the ends of any focal chord of a parabola $y^2 = 4ax$ intersect in the line

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

66. Equation of diameter of parabola $y^2 = x$ corresponding to the chord $x - y + 1 = 0$ is

(a) $2y = 3$ (b) $2y = 1$ (c) $2y = 5$ (d) $y = 1$

67. An equilateral triangle is inscribed in the parabola $y^2 = 4ax$ whose vertices are at the parabola, then the length of its side is equal to

(a) 8*a* (b) $8a\sqrt{3}$ (c) $a\sqrt{2}$ (d) None of these

68. The equation of a straight line drawn through the focus of the parabola $y^2 = -4x$ at an angle of 120° to the *x*-axis is

(a) $y + \sqrt{3}(x-1) = 0$ (b) $y - \sqrt{3}(x-1) = 0$ (c) $y + \sqrt{3}(x+1) = 0$ (d) $y - \sqrt{3}(x+1) = 0$

69. From the point (–1, 2) tangent lines are drawn to the parabola $y^2 = 4x$, then the equation of chord of contact is

(a) $y = x + 1$ (b) $y = x - 1$ (c) $y + x = 1$ (d) None of these

70. The ordinates of the triangle inscribed in parabola $y^2 = 4ax$ are y_1, y_2, y_3, then the area of triangle is

(a) $\frac{1}{8a}(y_1 + y_2)(y_2 + y_3)(y_3 + y_1)$ (b) $\frac{1}{4a}(y_1 + y_2)(y_2 + y_3)(y_3 + y_1)$

(c) $\frac{1}{8a}(y_1 - y_2)(y_2 - y_3)(y_3 - y_1)$ (d) $\frac{1}{4a}(y_1 - y_2)(y_2 - y_3)(y_3 - y_1)$

71. The point on parabola $2y = x^2$, which is nearest to the point (0, 3) is

(a) (±4, 8) (b) $(\pm 1, 1/2)$ (c) (±2, 2) (d) None of these

72. The normal meet the parabola $y^2 = 4ax$ at that point where the abissiae of the point is equal to the ordinate of the point is

(a) $(6a, -9a)$ (b) $(-9a, 6a)$ (c) $(-6a, 9a)$ (d) $(9a, -6a)$

73. From the point (–1, –60) two tangents are drawn to the parabola $y^2 = 4x$. Then the angle between the two tangents is

(a) 30° (b) 45° (c) 60° (d) 90°

74. Let a circle tangent to the directrix of a parabola $y^2 = 2ax$ has its centre coinciding with the focus of the parabola. Then the point of intersection of the parabola and circle is

(a) $(a, -a)$ (b) $(a/2, a/2)$ (c) $(a/2, \pm a)$ (d) $(\pm a, a/2)$

75. The equation of the lines joining the vertex of the parabola $y^2 = 6x$ to the points on it whose abscissa is 24, is

(a) $y \pm 2x = 0$ (b) $2y \pm x = 0$ (c) $x \pm 2y = 0$ (d) $2x \pm y = 0$

76. *PQ* is a double ordinate of the parabola $y^2 = 4ax$. The locus of the points of trisection of *PQ* is

(a) $9y^2 = 4ax$ (b) $9x^2 = 4ay$ (c) $9y^2 + 4ax = 0$ (d) $9x^2 + 4ay = 0$

PARABOLA

HINTS AND SOLUTIONS

1. (a) $(y-2)^2 = -4x+4 \Rightarrow (y-2)^2 = -4(x-1)$

Vertex is (1,2) and focus = (0,2).

2. (a) $(x+2)^2 = -2y+7+4 \Rightarrow (x+2)^2 = -2\left(y-\frac{11}{2}\right)$

Hence vertex is $\left(-2,\frac{11}{2}\right)$.

3. (b) Eliminating *t*, we get

$16x^2 = 4y \Rightarrow x^2 = \frac{1}{4}y$, which is a parabola.

4. (c) Vertex $(0,4)$; focus $(0,2)$; $\therefore\ a=2$

Hence parabola is $(x-0)^2 = -4.2(y-4)$ *i.e.*, $x^2+8y=32$.

5. (a) $\Delta \neq 0, h^2 = ab$ *i.e.*, parabola.

6. (d) The given equation can be written as $(x-4)^2 = y-(c-16)$. Therefore the vertex of the parabola is $(4, c-16)$. The point lies on $x-$axis.

$\therefore c-16=0 \Rightarrow c=16$.

7. (b) Always eccentricity of parabola is $e=1$.

8. (a) Since $9y^2-16x-12y-57=0$

$\Rightarrow \left(y-\frac{2}{3}\right)^2 = \frac{16}{9}\left(x+\frac{61}{16}\right)$

Put $y-\frac{2}{3}=Y$ and $x+\frac{61}{16}=X \Rightarrow Y^2 = 4\left(\frac{4}{9}\right)X$

Axis of this parabola is $Y=0 \Rightarrow y-\frac{2}{3}=0 \Rightarrow 3y=2$.

9. (c) The parabola is $x^2-2x=2y$

Or $x^2-2x+1=2y+1 \Rightarrow (x-1)^2 = 2\left(y+\frac{1}{2}\right)$

Here $4a=2 \Rightarrow a=\frac{1}{2}$

Now focus is $\left(x-1=0, y+\frac{1}{2}=\frac{1}{2}\right)$ *i.e.*, $(1,0)$.

10. (b) Given equation of parabola written in standard form, we get

$$4\left(y-\frac{1}{2}\right)^2 = 6(x+1) \Rightarrow \left(y-\frac{1}{2}\right)^2 = \frac{3}{2}(x+1) \Rightarrow Y^2 = \frac{3}{2}X$$

Where, $Y = y - \frac{1}{2}$, $X = x+1$

$\therefore y = Y + \frac{1}{2}$, $x = X - 1$ .....(i)

For focus $X = a$, $Y = 0$

$\because 4a = \frac{3}{2} \Rightarrow a = \frac{3}{8} \Rightarrow x = \frac{3}{8} - 1 = -\frac{5}{8}$

$y = 0 + \frac{1}{2} = \frac{1}{2}$, Focus $= \left(-\frac{5}{8}, \frac{1}{2}\right)$.

11. (b) Let any point on it be (*x*, *y*), then from definition of parabola, we get $\frac{\sqrt{(x+8)^2+(y+2)^2}}{\left|\frac{2x-y-9}{\sqrt{5}}\right|} = 1$

Squaring and after simplification, we get

$x^2 + 4y^2 + 4xy + 116x + 2y + 259 = 0$.

12. (a) The equation can be written as $(3x-1)^2 = -4(9y+2)$.

Hence the vertex is $\left(\frac{1}{3}, -\frac{2}{9}\right)$.

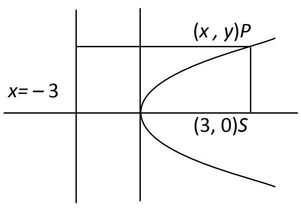
13. (a) $(x+1)^2 = 4a(y+2)$

Passes through (3, 6) $\Rightarrow$ $16 = 4a.8$ $\Rightarrow$ $a = \frac{1}{2}$

$\Rightarrow (x+1)^2 = 2(y+2) \Rightarrow x^2 + 2x - 2y - 3 = 0$.

14. (d) $a = 4$, vertex $= (0,0)$, focus $= (0,-4)$.

15. (c) $\because SP^2 = PM^2$



$\Rightarrow (x-3)^2 + y^2 = \left|\frac{x+3}{\sqrt{1}}\right|^2$

$\Rightarrow x^2 + 9 - 6x + y^2 = x^2 + 9 + 6x$

$\Rightarrow y^2 = 12x$.

16. (d) The parabola is $(x-2)^2 = (3y-6)$. Hence axis is $x - 2 = 0$.

17. (c) Since the axis of parabola is *y*-axis

$\therefore$ Equation of parabola $x^2 = 4ay$

Since it passes through (6, – 3)

$\therefore$ 36 $= -12a \Rightarrow a = -3$

$\therefore$ Equation of parabola is $x^2 = -12y$.

18. (c) $y^2 - 4y + 4 = 5x + 5 \Rightarrow (y-2)^2 = 5(x+1)$

Obviously, latus rectum is 5.

19. (a) Given equation is $x^2 = -8ay$. Here $A = 2a$

Focus of parabola $(0, -A)$ *i.e.* (0, – 2*a*)

Directrix *y* = *A* *i.e.*, *y* = 2*a*.

20. (c) Since the ends of latus rectum lie on parabola, so only points $(-4,-2)$ and $(4,-2)$ satisfy the parabola.

21. (b) $y^2 = 4.\frac{1}{5}x; a = \frac{1}{5}$. Focus is $\left(\frac{1}{5}, 0\right)$ and co-ordinates of latus rectum are $y^2 = \frac{4}{25} \Rightarrow y = \pm\frac{2}{5}$

Or end points of latus rectum are $\left(\frac{1}{5}, \pm\frac{2}{5}\right)$.

22. (b) $a = 3 \Rightarrow$ abscissa is $4 - 3 = 1$ and $y^2 = 12, y = \pm 2\sqrt{3}$.

Hence points are $(1, 2\sqrt{3}), (1, -2\sqrt{3})$.

23. (a) Given parabola is $x^2 + 8x + 12y + 4 = 0$

It can be written as $(x+4)^2 = -12y + 12$

$\Rightarrow (x+4)^2 = -12(y-1)$, $\therefore$ vertex is $(-4, 1)$.

24. (a) Given equation of parabola is $2x^2 + 5y - 3x + 4 = 0$

$\Rightarrow x^2 - \frac{3}{2}x = -\frac{5}{2}y - 2 \Rightarrow \left(x - \frac{3}{4}\right)^2 = -\frac{5}{2}y - \frac{23}{16}$

$\therefore$ Equation of axis is, $x - \frac{3}{4} = 0 \Rightarrow x = \frac{3}{4}$.

25. (c) The given equation of parabola is

$y = 2x^2 + x \Rightarrow x^2 + \frac{x}{2} = \frac{y}{2}$

$\Rightarrow \left(x + \frac{1}{4}\right)^2 = \frac{y}{2} + \frac{1}{16} \Rightarrow \left(x + \frac{1}{4}\right)^2 = \frac{1}{2}\left(y + \frac{1}{8}\right)$

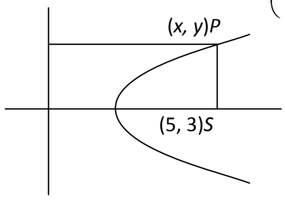
It can be written as, $X^2 = \frac{1}{2}Y$ .....(i)

Here $A = \frac{1}{8}$, focus of (i) is $\left(0, \frac{1}{8}\right)$ *i.e.* $X = 0$, $Y = \frac{1}{8}$

$\Rightarrow x+\frac{1}{4}=0$, $y+\frac{1}{8}=\frac{1}{8} \Rightarrow x=-\frac{1}{4}$, $y=0$

i.e. focus of given parabola is $\left(-\frac{1}{4},0\right)$.

26. (a) $PM^2 = PS^2 \Rightarrow (x-5)^2+(y-3)^2 = \left(\frac{3x-4y+1}{\sqrt{9+16}}\right)^2$



$\Rightarrow 25(x^2+25-10x+y^2+9-6x)$

$=9x^2+16y^2+1-12xy+6x-8y-12xy$

$\Rightarrow 16x^2+9y^2-256x-142y+24xy+849=0$

$\Rightarrow (4x+3y)^2-256x-142y+849=0$.

27. (d) Equation of parabola is $x^2-4x-8y+12=0$

$\Rightarrow x^2-4x+4=8y-8$

$\Rightarrow (x-2)^2=8(y-1) \Rightarrow X^2=8Y$

Comparing with $X^2=4aY$, we get $a=2$

$\therefore$ Directrix is $Y=-a \Rightarrow y-1=-2 \Rightarrow y=-1$.

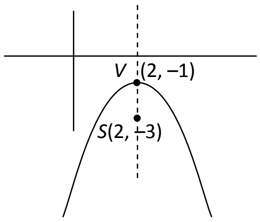
28. (c) The given equation of parabola is $x^2-4x-8y+12=0$

$\Rightarrow x^2-4x=8y-12 \Rightarrow (x-2)^2=8(y-1)$

Hence the length of latus rectum $= 4a=8$.

29. (b) $VS=\sqrt{(2-2)^2+(-3+1)^2}=2$. From $(x-h)^2=-4a(y-k)$

Parabola is,



$(x-2)^2=-4.2(y+1)$

$\Rightarrow (x-2)^2=-8(y+1)$

$\Rightarrow x^2+4-4x=-8y-8$

$\Rightarrow x^2-4x+8y+12=0$.

30. (d) Clearly; $a=\left|\frac{-8}{\sqrt{1+1}}\right|-\left|\frac{-12}{\sqrt{1+1}}\right|=\frac{4}{\sqrt{2}}$

Length of latus rectum = $4a = 4\times\frac{4}{\sqrt{2}}=8\sqrt{2}$.

31. (a) The required point is nothing but the focus of the parabola. Therefore

$(y+1)^2 = -(4x-9) = -4\left(x-\frac{9}{4}\right)$

$S \equiv \left(-1+\frac{9}{4}, -1\right)$ or $\left(\frac{5}{4}, -1\right)$.

32. (c) $(x+2)^2 = -2(y-2)$

Equation of latus rectum is $y-2 = -\frac{1}{2} \Rightarrow y = \frac{3}{2}$.

33. (c) Directrix $= x+5=0$

Focus is (–3, 0) $\Rightarrow$ $2a = (-5+3) = 2 \Rightarrow a = 1$

Vertex is $\left(\frac{-3+(-5)}{2}, 0\right) = (-4, 0)$

Therefore, equation is $(y-0)^2 = 4(x+4)$.

34. (d) Let $y = 3x$, then $(3x)^2 = 18x$

$\Rightarrow 9x^2 = 18x \Rightarrow x = 2$ and $y = 6$.

35. (c) Given, vertex of parabola $(h, k) \equiv (1,1)$ and its focus $(a+h, k) \equiv (3,1)$ or $a+h=3$ or $a = 2$. We know that as the y-coordinates of vertex and focus are same, therefore axis of parabola is parallel to x-axis. Thus equation of the parabola is $(y-k)^2 = 4a(x-h)$ or $(y-1)^2 = 4\times 2(x-1)$ **or** $(y-1)^2 = 8(x-1)$.

36. (d) Let point of contact be (h, k), then tangent at this point is $ky = x+h$.

$x - ky + h = 0 \equiv 18x - 6y + 1 = 0$

Or $\frac{1}{18} = \frac{k}{6} = \frac{h}{1}$ or $k = \frac{1}{3}$, $h = \frac{1}{18}$.

37. (c) $m = \tan\theta$. The tangent to $y^2 = 4ax$ is $y = x\tan\theta + c$

Hence $c = \frac{a}{\tan\theta} = a\cot\theta$

$\therefore$ The equation of tangent is $y = x\tan\theta + a\cot\theta$.

38. (a) $m = \tan\theta = \tan 60^\circ = \sqrt{3}$

The equation of tangent at (h,k) to $y^2 = 4ax$ is $yk = 2a(x+h)$

Comparing, we get $m = \sqrt{3} = \frac{2a}{k}$ or $k = \frac{2a}{\sqrt{3}}$ and $h = \frac{a}{3}$.

39. (a) Given equation of parabola is $x^2 + 6x + 20y - 51 = 0$

$\Rightarrow x^2 + 6x = -20y + 51$

$\Rightarrow (x+3)^2 = -20y + 60 \Rightarrow (x+3)^2 = -20(y-3)$

$\Rightarrow (x+3)^2 = -4.5(y-3)$

$\therefore$ Axis of parabola is $x+3=0$.

40. (a) Given, equation of parabola is $x^2+8y-2x=7 \Rightarrow x^2-2x+8y-7=0$

$\Rightarrow x^2-2x+1+8y-7-1=0 \Rightarrow (x-1)^2+8y=8$

$\Rightarrow (x-1)^2=-8(y-1) \Rightarrow (x-1)^2=-4.2(y-1)$

Here, $a=2$.

$\therefore$ Equation of directrix is $y-1=2$ *i.e.*, $y=3$.

41. (b) $y=2x+\lambda$ does not meet, if $\lambda > \frac{a}{m} = \frac{1}{2.2} = \frac{1}{4} \Rightarrow \lambda > \frac{1}{4}$.

42. (d) End points are $(a, \pm 2a)$.

$\therefore$ Tangents are , $\pm 2ay = 2a(x+a)$ or $m = \pm\frac{2a}{2a} = \pm 1$

Hence angle between them is $\frac{\pi}{2}$.

43. (b) $\because c = \frac{a}{m}, \therefore c = \frac{1}{2}$.

44. (b) It is a fundamental property.

45. (c) *m* of tangent $=-1$.

Also from equation of parabola, we get gradient at (h,k) as the slope of parabola

$= \frac{dy}{dx} = \frac{-1}{2y-1} = \frac{-1}{2k-1}$

Since line and parabola touch at (h,k)

$\Rightarrow \frac{-1}{2k-1} = -1 \Rightarrow -2k+1=-1 \Rightarrow k=1$

Putting this value in $x+y=1$, we have $h=0$, so the point of contact is $(0,1)$.

46. (b) $y^2=8x$, $\therefore 4a=8 \Rightarrow a=2$

Any tangent of parabola is,

$y = mx + \frac{a}{m}$ or $mx - y + \frac{2}{m} = 0$

If it is a tangent to the circle $x^2+y^2=2$, then perpendicular from centre $(0,0)$ is equal to radius $\sqrt{2}$.

$\therefore \frac{2/m}{\sqrt{m^2+1}} = \sqrt{2}$ or $\frac{4}{m^2} = 2(m^2+1)$

$\Rightarrow m^4+m^2-2=0 \Rightarrow (m^2+2)(m^2-1)=0$ or $m=\pm 1$

Hence the common tangent are $y=\pm(x+2)$

$\therefore y = x + 2$.

47. (a) Tangent to parabola is, $y = mx + \frac{a}{m}$ .....(i)

A line perpendicular to tangent and passing from focus $(a, 0)$ is, $y = -\frac{x}{m} + \frac{a}{m}$ .....(ii)

Solving both lines (i) and (ii) $\Rightarrow x = 0$.

48. (b) Let the co-ordinates of P and Q be $(at_1^2, 2at_1)$ and $(at_2^2, 2at_2)$ respectively. Then $y_1 = 2at_1$ and $y_2 = 2at_2$. The co-ordinates of the point of intersection of the tangents at P and Q are $\{at_1t_2, a(t_1 + t_2)\}$

$\therefore y_3 = a(t_1 + t_2)$

$\Rightarrow y_3 = \frac{y_1 + y_2}{2} \Rightarrow y_1, y_3$ and y_2 are in A.P.

49. (a) $x\cos\alpha + y\sin\alpha - p = 0$ .....(i)

$2ax - yy_1 + 2a(x_1 + 2a) = 0$ .....(ii)

From (i) and (ii), $\frac{\cos\alpha}{2a} = \frac{\sin\alpha}{-y} = \frac{-p}{2a(x + 2a)}$

$\Rightarrow y = -2a\tan\alpha$ and $x = -p\sec\alpha - 2a$

$\therefore y^2 = 4a(x + a) \Rightarrow 4a^2\tan^2\alpha = -4a(p\sec\alpha + a)$

$\Rightarrow p\cos\alpha + a = 0$.

50. (c) Standard condition.

51. (c, d) Given that $y^2 = 9x$. Here, $a = \frac{9}{4}$.

Now, equation of tangent to the parabola $y^2 = 9x$ is

$y = mx + \frac{9/4}{m}$

If this tangent goes through the point $(4, 10)$, then $10 = 4m + \frac{9}{4m} \Rightarrow (4m - 9)(4m - 1) = 0 \Rightarrow m = \frac{9}{4}, \frac{1}{4}$

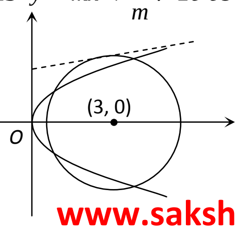
$\therefore$ Equation of tangents are, $4y = x + 36$

and $4y = 9x + 4$

Or $x - 4y + 36 = 0$ and $9x - 4y + 4 = 0$.

52. (c) Any tangent to $y^2 = 4x$ is $y = mx + \frac{1}{m}$. It touches the circle, if $3 = \left|\frac{3m + \frac{1}{m}}{\sqrt{1 + m^2}}\right|$

Or $9(1 + m^2) = \left(3m + \frac{1}{m}\right)^2$



Or $\frac{1}{m^2} = 3$, $\therefore m = \pm\frac{1}{\sqrt{3}}$.

For the common tangent to be above the x-axis, $m = \frac{1}{\sqrt{3}}$

$\therefore$ Common tangent is, $y = \frac{1}{\sqrt{3}}x + \sqrt{3} \Rightarrow \sqrt{3}y = x + 3$.

53. (d) Parabola is $y^2 = ax$ *i.e.*, $y^2 = 4\left(\frac{a}{4}\right)x$ .....(i)

$\because$ Let point of contact is (x_1, y_1)

$\therefore$ Equation of tangent is $y - y_1 = \frac{2\left(\frac{a}{4}\right)}{y_1}(x - x_1)$

$\Rightarrow y = \frac{a}{2y_1}(x) - \frac{ax_1}{2y_1} + y_1$

Here, $m = \frac{a}{2y_1} = \tan 45^o \Rightarrow \frac{a}{2y_1} = 1 \Rightarrow y_1 = \frac{a}{2}$

From (i), $x_1 = \frac{a}{4}$. $\therefore$ Point is $\left(\frac{a}{4}, \frac{a}{2}\right)$.

54. (a,b) It is a fundamental concept

55. (d) It is obvious.

56. (a) Normal at (h, k) to the parabola $y^2 = 8x$ is

$y - k = -\frac{k}{4}(x - h)$

Gradient $= \tan 60^\circ = \sqrt{3} = -\frac{k}{4} \Rightarrow k = -4\sqrt{3}$ and $h = 6$

Hence required point is $(6, -4\sqrt{3})$.

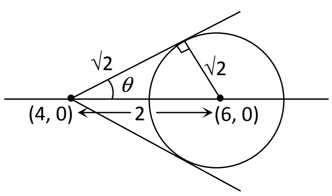
57. (b) Any line through origin (0,0) is $y = mx$. It intersects $y^2 = 4ax$ in $\left(\frac{4a}{m^2}, \frac{4a}{m}\right)$.

Mid point of the chord is $\left(\frac{2a}{m^2}, \frac{2a}{m}\right)$

$x = \frac{2a}{m^2}, y = \frac{2a}{m} \Rightarrow \frac{2a}{x} = \frac{4a^2}{y^2}$ or $y^2 = 2ax$, which is a parabola.

58. (a) From diagram, $\theta = 45^o$

$\Rightarrow$ Slope = ± 1.



59. (a) The equation of the normal to $x^2 = 4ay$ is of the form $x = my - 2am - am^3$. Therefore $c = -2am - am^3$.

60. (c) Semi latus rectum is harmonic mean between segments of focal chords of a parabola.

$\therefore\ b = \frac{2ac}{a+c} \Rightarrow a, b, c$ are in H.P.

61. (d) We know that $t_2 = -t_1 - \frac{2}{t_1}$

Put $t_1 = 1$ and $t_2 = t$. Hence $t = -3$.

62. (c) Since the semi-latus rectum of a parabola is the harmonic mean between the segments of any focal chord of a parabola, therefore SP, 4, SQ are in H.P.

$$\Rightarrow 4 = 2.\frac{SP.SQ}{SP+SQ} \Rightarrow 4 = \frac{2(6)(SQ)}{6+SQ} \Rightarrow SQ = 3.$$

63. (d) $y = -2x - k$ is normal to $y^2 = -8x$

or $-k = -\{-4(-2) - 2(-2)^3\} = -(8+16) \Rightarrow k = 24$.

64. (b) Any normal is $y + tx = 6t + 3t^3$. It is identical with $x + y = k$ if $\frac{t}{1} = \frac{1}{1} = \frac{6t+3t^3}{k}$

$\therefore t = 1$ and $1 = \frac{6+3}{k} \Rightarrow k = 9$.

65. (c) Semi latus rectum is harmonic mean between segments of focal chords of a parabola.

$\therefore\ b = \frac{2ac}{a+c} \Rightarrow a, b, c$ are in H.P.

66. (b) Equation of diameter of parabola is $y = \frac{2a}{m}$

Here $a = \frac{1}{4}$, $m = 1 \Rightarrow y = \frac{2 \times 1/4}{1} \Rightarrow 2y = 1$.

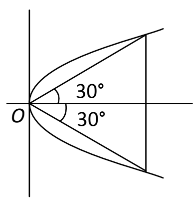
67. (b) $L_1 = \sqrt{3}y - x = 0$, solving L_1

and $S_1 \equiv y^2 - 4ax = 0$

Then $y = 4a\sqrt{3}$ and $x = 12a$

Hence $L = \sqrt{144a^2 + 48a^2}$

$= a\sqrt{192} = 8a\sqrt{3}$.

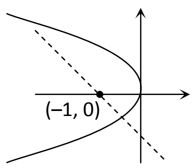


68. (c) $m = \tan(120°) = -\sqrt{3}$

= Slope of the line which passes

through (–1, 0).

Required equation, $y - 0 = -\sqrt{3}(x+1)$



$y+\sqrt{3}(x+1)=0$.

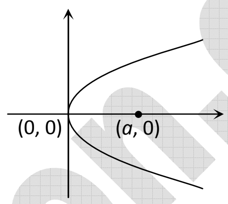
69. (b) Chord of contact of $(-1,2)$ is $yy_1=2a(x+x_1)$ or $y=x-1$.

70. (c) Points $\left(\frac{y_1^2}{4a},y_1\right),\left(\frac{y_2^2}{4a},y_2\right),\left(\frac{y_3^2}{4a},y_3\right)$

Use area formula and get $\Delta=\frac{1}{8a}(y_1-y_2)(y_2-y_3)(y_3-y_1)$.

71. (c) Checking from options point $(\pm 2,2)$ is nearest. Hence option (c) is correct.

72. (d) If normal drawn to point $(at_1^2,2at_1)$ of a parabola $y^2=4ax$ meets at point $(at_2^2,2at_2)$ of same parabola then, $t_2=-t_1-2/t_1$



In question $x=y$ (given)

Because abscissa and ordinate are equal.

$\therefore\ y^2=4ax \Rightarrow y^2=4ay$

[We use relation $x=y$]

$\Rightarrow y^2=4ay=0 \Rightarrow y(y-4a)=0 \Rightarrow y=0$ or $y=4a$

Therefore point $(x=0,y=0)$ and $(x=4a,y=4a)$

$2at_1=4a \Rightarrow t_1=\frac{4a}{2a}=2$; $t_2=-2-\frac{2}{2}=-2-1=-3$

$\therefore\ (at_2^2,2at_2)=[a\times(-3)^2,2a(-3))=(9a,-6a)$.

73. (d) The given point (–1, –60) lies on the directrix $x=-1$ of the parabola $y^2=4x$. Thus the tangents are at right angle.

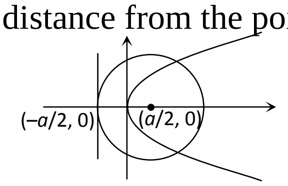
74. (c) Given parabola is $y^2=2ax$

$\therefore$ Focus (a/2, 0) and directrix is given by $x=-a/2$,

As circle touches the directrix.

$\therefore$ Radius of circle = distance from the point (a/2, 0) to the line

$(x=-a/2)=\frac{\left|\frac{a}{2}+\frac{a}{2}\right|}{\sqrt{1}}=a$



$\therefore$ Equation of circle be $\left(x-\frac{a}{2}\right)^2+y^2=a^2$ …..(i)

Also $y^2=2ax$ …..(ii)

Solving (i) and (ii) we get $x=\frac{a}{2},-\frac{3a}{2}$

Putting these values in $y^2=2ax$ we get

$y = \pm a$ and $x = -3a/2$ gives imaginary values of *y*.

$\therefore$ Required points are $(a/2, \pm a)$.

75. (b,c) $y^2 = 6.24 \Rightarrow y = \pm 12$

Therefore, the points are $(24, 12), (24, -12)$

Hence lines are $y = \pm \frac{12}{24} x \Rightarrow 2y = \pm x$.

76. (a) Centre $\left(\frac{hf - bg}{ab - h^2}, \frac{gh - af}{ab - h^2}\right)$.

PARABOLA

PRACTICE EXERCISE

1. **The parabola $(y - 1)^2 = a(x - 2)$ passes through the point (1, -2). The equation of its directrix is**

   1) $4x - 9 = 0$ 2) $4x + 9 = 0$ 3) $x - 9 = 0$ 4) $4x = 17$

2. **The focus is at (2, 3) and the foot of the perpendicular from the focus on the directrix is (4, 5). The equation of the parabola** is

   1) $(x - 2)^2 + (y - 3)^2 = (x + y - 9)^2$ 2) $(x-2)^2 + (y-3)^2 = (x + y + 9)^2$
   3) $(x - 2)^2 + (y - 3)^2 = (x - y - 9)^2$ 4) $2[(x - 2)^2 + (y - 3)^2] = (x + y - 9)^2$

3. **The equation of the parabola whose axis is parallel to x-axis and passing through (1,2), (4,-1), (2,3) is**

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

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

4. **If the ordinate of a point on the parabola $y^2=4x$ is twice the latusrectum, then the point is**

   1) (16,8) 2) (16,-8) 3) (-16,8) 4) (-16,-8)

5. **The length of the latusrectum of the parabola whose focus is (3,3) and directrix is $3x-4y-2=0$ is**

   1) 2 2) 1 3) 4 4) 3

6. The focal distance of a point on $y^2 = 8x$ is 10, then its coordinates are

   1) $(2, \pm 2)$ 2) $(3, \pm 3)$ 3) $(5, \pm 5)$ 4) $(8, \pm 8)$

7. **The latusrectum of a parabola whose focal chord is PSQ such that SP = 3 and SQ = 2 is given by**

   1) 24/5 2) 12/5 3) 6/5 4) 5/24

8. **A tangent to the parabola $y^2 = 4ax$ makes an angle 45^0 with the x-axis. Then its point of contact is**

1) (a, 2a) 2) (-a, -2a) 3) (a, -2a) 4) (-a, 2a)

9. **The equation of the tangent to $y^2 = 7x$ which is perpendicular to x - 4y - 7 = 0 is**

1) 4x + y + 7 = 0 2) 8x + 2y + 7 = 0

3) 64x + 16y + 7 = 0 4) 16x + 64y + 7 = 0

10. **If x+y+k = 0 is a tangent to the parabola $x^2 = 4y$, then k =**

1) 1 2) 2 3) -1 4) 4

11. **The equation of the common tangent to $x^2 + y^2 = 8$ and $y^2 = 16x$ is**

1) y = ±(x+2) 2) y = ±(x+4) 3) 2x+3y+36 = 0 4) 3x+2y+24 = 0

12. **The slopes of two tangents drawn from (1, 4) to the parabola $y^2 = 12x$ are**

1) 1, 4 2) 1, 3 3) 1, 2 4) 2, 3

13. **Two tangents are drawn from (-2, -1) to the parabola $y^2 = 4x$. If 'α' is the angle between them, then tanα =**

1) 3 2) 1/3 3) 2 4) 1/2

14. **The product of slopes of the tangents to the parabola $y^2 = x$ drawn from the point (1, -2) is**

1) -2 2) 1/4 3) -1/2 4) 1

15. **The locus of the point of intersection of perpendicular tangents to the parabola $y^2 = 8x$ is**

1) x - 2 = 0 2) y - 2 = 0 3) x + 2 = 0 4) y + 2 = 0

16. **The length of the chord 4y = 3x+8 intercepted by $y^2 = 8x$ is**

1) 80/9 2) 40/9 3) 20/9 4) 70/9

17. **The normal at (16,16) to the parabola $y^2 = 16x$ again meets at**

1) (36,-24) 2) (36,24) 3) (-36,24) 4) (18,24)

18. **The feet of the normals to $y^2 = 4ax$ drawn from (6a,0) are**

1) (0,0) (4a, 4a) (4a,-4a) 2) (0,0) (a,2a) (a, -2a)

3) (0,0) (6a, 9a) (6a, -9a) 4) (0, 0) (a, a) (-a, a)

19. **If t_1,t_2,t_3 are the feet of the normals drawn from (x_1, y_1) to the parabola $y^2=4ax$, then** $t_1t_2 + t_2t_3 + t_3t_1 =$

1) 0 2) y_1 / a 3) $(2a- x_1) / a$ 4) $(x_1 - 2a) / a$

20. If a normal chord of $y^2 = 4x$ makes an angle of 45^o with the axis of parabola, then its length is

1) 8 2) $8\sqrt{2}$ 3) 4 4) $4\sqrt{2}$

21. The normals at $(x_1, y_1), (x_2, y_2)$ on the parabola $y^2 = 12x$, meet again on the parabola, then $x_1x_2 + y_1y_2 =$

1) 147 2) 108 3) 27 4) -27

22. The length of the chord of the parabola $y^2 = 4ax$ which is a normal at one end of a latusrectum is

1) $a\sqrt{2}$ 2) $4a\sqrt{2}$ 3) $8a\sqrt{2}$ 4) 8a

23. The midpoint of the chord $2x - y - 2 = 0$ of the parabola $y^2 = 8x$ is

1) (1,0) 2) (2,2) 3) (3,4) 4) (0,-2)

24. An equilateral triangle is inscribed in the parabola $y^2 = 4ax$ with one vertex at the origin. The radius of the circum circle of that triangle is

1) 2a 2) 4a 3) 6a 4) 8a

25. I : The length of the latus rectum of the parabola $y^2 + 8x - 2y + 17 = 0$ is 8.

II : The focal distance of the point (9, 6) on the parabola $y^2 = 4x$ is 12.

1) Only I is true 2) Only II is true

3) Both I and II are true 4) Neither I nor II true

26. If the chord of contact of (3, -2) with respect to the parabola $y^2 = x$ is $ax + by + c = 0$, then the ascending order of a, b, c is

1) a, b, c 2) a, c, b 3) c, a, b 4) b, a, c

27. If $(x_1, y_1), (x_2, y_2)$ are the ends of the focal chord of the parabola $y^2 = 4ax$, then match the following.

I) $x_1, x_2 =$	a) a^2
II) $y_1 y_2 =$	b) $5a^2$
III) $x_1 x_2 + y_1 y_2 =$	c) $-3a^2$
IV) $x_1 x_2 - y_1 y_2 =$	d) $-4a^2$

1) a, b, c, d 2) b, c, a, d

3) a, d, c, b 4) b, d, a, c

28. Match the following:

P $\left(at_1^2, 2at_1\right), Q\left(at_2^2, 2at_2\right)$ are two points on the parabola $y^2 = 4ax$

List - I	**List - II**
A) PQ is a focal chord	1) $t_1 t_2 = 1$
B) PQ subtends a right angle at the vertex	2) $t_1 t_2 = 4$
C) The normals at P and Q meet on the parabola	3) $t_1 t_2 = -1$
D) The tangents at P and Q meet on the latusrectum	4) $t_1 t_2 = -4$
	5) $t_1 t_2 = 2$

Correct match from List- I to List - II

	A	B	C	D
1)	2	3	4	5
2)	5	4	3	2
3)	3	1	5	4
4)	3	4	5	1

29. I : The focus and directrix of a parabola are (3, -4) and x + y + 7 = 0. Then its latusrectum is equal to $4\sqrt{2}$.

II : The focus and vertex of a parabola are (4, 5) and (3, 6) respectively. Then the equation of the directrix is 2x - 2y + 10 = 0.

Which of the statement is correct?

1) Only I is true
2) Only II is true
3) Both I and II are true
4) Neither I nor II true

30. Assertion (A): The tangents drawn to the parabola $y^2 = 4ax$ at the ends of any focal chord intersect on the directrix

Reason (R): The point of intersection of the tangents at drawn at $P(t_1)$ and $Q(t_2)$ on the parabola $y^2 = 4ax$ is $\left[at_1t_2, a(t_1 + t_2)\right]$

1) Both A and R are true and R is correct explanation of A
2) Both A and R are true but R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true.

31. Assertion (A): The centroid of the triangle formed by the conormal points on a parabola lies on its axis.

Reason (R): $A(t_1)$, $B(t_2)$, $C(t_3)$ are the feet of the normals drawn from a point P to the parabola $y^2 = 4ax$. Then $t_1 + t_2 + t_3 = 0$

1) Both A and R are true and R is correct explanation of A

2) Both A and R are true but R is not the correct explanation of A

3) A is true but R is false

4) A is false but R is true

32. I: The length of the focal chord of $y^2 = 4ax$ and which makes an angle θ with x-axis is $4a\,\text{cosec}^2\theta$.

II: The normals at two points on a parabola $y^2 = 4ax$ intersect on the curve.

Then the product of their ordinates is $4a^2$.

Which of the statements is correct?

1) Only I is true 2) Only II is true

3) Both I and II are true 4) Neither I nor II true

33. The equation of the common tangent to the parabolas $y^2 = 32x$ and $x^2 = 108y$ is

1) $2x + 3y + 36 = 0$ 2) $3x + 2y + 108 = 0$

3) $3x + 2y - 36 = 0$ 4) $2x + 3y - 108 = 0$

34. The locus of the point of intersection of two tangents to the parabola $y^2 = 4ax$ which make an angle 45^0 with one another is

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

3) $y^2 - 4ax = (x+a)^2$ 4) $y^2 - 4ax = 2(x+a)^2$

35. The tangents at P, Q, R on the parabola $y^2 = 4ax$ make angles 30^0, 45^0, 60^0 with the x-axis. Then their ordinates form a

1) A.P. 2) G.P. 3) H.P. 4) A.G.P

36. If y_1, y_2 are the ordinates of two points P and Q on the parabola and y_3 is the ordinate of the point of intersection of tangents at P and Q, then

1) y_1, y_2, y_3 are in AP 2) y_1, y_3, y_2 are in AP

3) y_1, y_2, y_3 are in GP 4) y_1, y_3, y_2 are in GP

37. The area of the triangle formed by the tangents from (1,3) to the parabola $y^2 = 4x$ and their chord of contact is

1) 15/2 2) $3\sqrt{5}/2$ 3) $5\sqrt{5}/2$ 4) $7\sqrt{5}/2$

PRACTICE EXERCISE KEY

1	2	3	4	5	6	7	8	9	10
4	4	4	1	1	4	1	1	3	1
11	12	13	14	15	16	17	18	19	20
2	2	1	2	3	1	1	1	3	2
21	22	23	24	25	26	27	28	29	30
2	3	2	4	1	2	3	4	3	1
31	32	33	34	35	36	37			
1	1	1	3	2	2	3			