



# MATHS

## BOOKS - VIKAS GUPTA MATHS (HINGLISH)

### PARABOLA

#### Exercise 1 Single Choice Problems

1. Let PQ be the latus rectum of the parabola  $y^2 = 4x$  with vertex A. Minimum length of the

projection of PQ on a tangent drawn in  
portion of Parabola PAQ is

A. 2

B. 4

C.  $2\sqrt{3}$

D.  $2\sqrt{2}$

**Answer: D**



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2. A normal is drawn to the parabola  $y^2 = 9x$  at the point  $P(4, 6)$ . A circle is described on  $SP$  as diameter, where  $S$  is the focus. The length of the intercept made by the circle on the normal at point  $P$  is :

A.  $\frac{17}{4}$

B.  $\frac{15}{4}$

C. 4

D. 5

**Answer: B**



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3. A trapezium is inscribed in the parabola  $y^2 = 4x$ , such that its diagonal pass through the point  $(1, 0)$  and each has length  $\frac{25}{4}$ . If the area of the trapezium be  $P$ , then  $4P$  is equal to :

A. 70

B. 71

C. 80

D. 75

**Answer: D**



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4. The length of normal chord of parabola  $y^2 = 4x$ , which subtends an angle of  $90^\circ$  at the vertex is :

A.  $6\sqrt{3}$

B.  $7\sqrt{2}$

C.  $8\sqrt{2}$

D.  $9\sqrt{2}$

**Answer: A**



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5. If  $b$  and  $c$  are lengths of the segments of any focal chord of the parabola  $y^2 = 4ax$ , then write the length of its latus rectum.

A.  $\frac{bc}{b+c}$

B.  $\frac{2bc}{b+c}$

C.  $\frac{b+c}{2}$

D.  $\sqrt{bc}$

**Answer: B**



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**6.** The length of the shortest path that begins at the point  $(-1, 1)$ , touches the  $x$ -axis and then ends at a point on the parabola

$(x - y)^2 = 2(x + y - 4)$ , is :

A.  $3\sqrt{2}$

B. 5

C.  $4\sqrt{10}$

D. 13

**Answer: A**



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7. If the normals at P, Q, R of the parabola

$y^2 = 4ax$  meet in O and S be its focus, then

$. SP. SQ. SR =$



A.  $2^3$

B.  $a^2(SO')$

C.  $a(SO')^2$

D. None of these

**Answer: C**



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**8.** A and B are two points on the parabola  $y^2 = 4ax$  with vertex O. if OA is perpendicular

to OB and they have lengths  $r_1$  and  $r_2$

respectively, then the value of  $\frac{r_1^{4/3} r_2^{4/3}}{r_1^{2/3} + r_2^{2/3}}$  is

A.  $16a^2$

B.  $a^2$

C.  $4a$

D. None of these

**Answer: A**



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9. Length of the shortest chord of the parabola  $y^2 = 4x + 8$ , which belongs to the family of lines  $(1 + \lambda)y + (\lambda - 1)x + 2(1 - \lambda) = 0$  is

A. 6

B. 5

C. 8

D. 2

**Answer: C**



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10. If locus of mid point of any normal chord of the parabola :

$$y^2 = 4x \text{ is } x - a = \frac{b}{y^2} + \frac{y^2}{c},$$

where  $a, b, c \in N$ , then  $(a + b + c)$  equals to :

A. 5

B. 8

C. 10

D. None of these

**Answer: B**



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**11.** Let tangents at P and Q to curve  $y^2 - 4x - 2y + 5 = 0$  intersect at T. If S(2, 1) is a point such that  $(SP)(SQ) = 16$ , then the length ST is equal to :

A. 3

B. 4

C. 5

D. None of these

**Answer: B**



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**12.** Abscissa of two points P and Q on parabola  $y^2 = 8x$  are roots of equation  $x^2 - 17x + 11 = 0$ . Let Tangents at P and Q meet at point T, then distance of T from the focus of parabola is :

A. 7

B. 6

C. 5

D. 4

**Answer: A**



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**13.** If  $Ax + By = 1$  is a normal to the curve

$ay = x^2$ , then :

A.  $4A^2(1 - aB) = aB^3$

$$\text{B. } 4A^2(2 + aB) = aB^3$$

$$\text{C. } 4A^2(1 + aB) + aB^3 = 0$$

$$\text{D. } 2A^2(2 - aB) = aB^3$$

**Answer: D**



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**14.** The equation of a curve which passes through the point (3, 1), such the segment of any tangent between the point of tangency



and the x-axis is bisected at its point of intersection with y-axis, is :

A.  $x = 3y^2$

B.  $x^2 = 9y$

C.  $x = y^2 + 2$

D.  $2x = 3y^2 + 3$

**Answer: A**



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15. The parabola  $y = 4 - x^2$  has vertex P. It intersects x-axis at A and B. If the parabola is translated from its initial position to a new position by moving its vertex along the line  $y = x + 4$ , so that it intersects x-axis at B and C, then abscissa of C will be :

A. 3

B. 4

C. 5

D. 8

**Answer: D**



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**16.** A focal chord for parabola  $y^2 = 8(x + 2)$  is inclined at an angle of  $60^\circ$  with positive x-axis and intersects the parabola at P and Q. Let perpendicular bisector of the chord PQ intersects the x-axis at R, then the distance of R from focus is :

A.  $\frac{8}{3}$

B.  $\frac{16\sqrt{3}}{3}$

C.  $\frac{16}{3}$

D.  $8\sqrt{3}$

**Answer: C**



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**17. v34**

A. 10

B. 11

C. 12

D. None of these

**Answer: C**



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**18.** The chord of contact of a point  $A(x_A, y_A)$  of  $y^2 = 4x$  passes through  $(3, 1)$  and point A lies on  $x^2 + y^2 = 5^2$ . Then :

A.  $5x_A^2 + 24x_A + 11 = 0$

B.  $13x_A^2 + 8x_A - 21 = 0$

C.  $5x_A^2 + 24x_A + 61 = 0$

D.  $13x_A^2 + 21x_A - 31 = 0$

**Answer: A**



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**Exercise 2 One Or More Than One Answer Is Are Correct**

1. PQ is a double ordinate of the parabola  $y^2 = 4ax$ . If the normal at P intersect the line passing through Q and parallel to axis of x at G, then locus of G is a parabola with -

A. vertex at  $(4a, 0)$

B. focus at  $(5a, 0)$

C. directrix as the line  $x - 3a = 0$

D. length of latus rectum equal to  $4a$

**Answer: A::B::C::D**



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## Exercise 3 Comprehension Type Problems

1. Consider the following lines :

$$L_1: x - y - 1 = 0$$

$$L_2: x + y - 5 = 0$$

$$L_3: y - 4 = 0$$

Let  $L_1$  is axis to a parabola,  $L_2$  is tangent at the vertex to this parabola and  $L_3$  is another tangent to this parabola at some point P.

Let 'C' be the circle circumscribing the triangle



formed by tangent and normal at point P and axis of parabola. The tangent and normals at normals at the extremities of latus rectum of this parabola forms a quadrilateral ABCD.

Q. The equation of the circle 'C' is :

A.  $x^2 + y^2 - 2x - 31 = 0$

B.  $x^2 + y^2 - 2y - 31 = 0$

C.  $x^2 + y^2 - 2x - 2y - 31 = 0$

D.  $x^2 + y^2 + 2x + 2y = 31$

**Answer: A**



2. Consider the following lines :

$$L_1: x - y - 1 = 0$$

$$L_2: x + y - 5 = 0$$

$$L_3: y - 4 = 0$$

Let  $L_1$  is axis to a parabola,  $L_2$  is tangent at the vertex to this parabola and  $L_3$  is another tangent to this parabola at some point P.

Let 'C' be the circle circumscribing the triangle formed by tangent and normal at point P and axis of parabola. The tangent and normals at

normals at the extremities of latus rectum of this parabola forms a quadrilateral ABCD.

Q. The given parabola is equal to which of the following parabola ?

A.  $y^2 = 16\sqrt{2}x$

B.  $x^2 = -4\sqrt{2}y$

C.  $y^2 = -\sqrt{2}x$

D.  $y^2 = 8\sqrt{2}x$

**Answer: D**



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**3.** Consider the following lines :

$$L_1: x - y - 1 = 0$$

$$L_2: x + y - 5 = 0$$

$$L_3: y - 4 = 0$$

Let  $L_1$  is axis to a parabola,  $L_2$  is tangent at the vertex to this parabola and  $L_3$  is another tangent to this parabola at some point P.

Let 'C' be the circle circumscribing the triangle formed by tangent and normal at point P and axis of parabola. The tangent and normals at normals at the extremities of latus rectum of

this parabola forms a quadrilateral ABCD.

Q. The area of the quadrilateral ABCD is :

A. 16

B. 8

C. 64

D. 32

**Answer: C**



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1. Points  $A$  and  $B$  lie on the parabola  $y = 2x^2 + 4x - 2$ , such that origin is the mid-point of the line segment  $AB$ . If  $l$  be the length of the line segment  $AB$ , then find the unit digit of  $l^2$ .



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2. For the parabola  $y = -x^2$ , let  $a < 0$  and  $b > 0$ ,  $P(a, -a^2)$  and  $Q(b, -b^2)$ . Let  $M$  be the mid-point of  $PQ$  and  $R$  be the

point of intersection of the vertical line through  $M$ , with the parabola. If the ratio of the area of the region bounded by the parabola and the line segment  $PQ$  to the area of the triangle  $PQR$  be  $\frac{\lambda}{\mu}$ , where  $\lambda$  and  $\mu$  are relatively prime positive integers, then find the value of  $(\lambda + \mu)$ :



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**3.** The chord  $AC$  of the parabola  $y^2 = 4ax$  subtends an angle of  $90^\circ$  at points  $B$  and  $D$  on

the parabola. If points A, B, C and D are represented by  $(at_i^2, 2at_i)$ ,  $i = 1, 2, 3, 4$  respectively, then find the value of  $\left| \frac{t_2 + t_4}{t_1 + t_3} \right|$ .



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