1. A variable line L = 0 is drawn through O(0,0) to meet the lines L_1 : x + 2y – 3 = 0 and L_2: x+2y+4= 0 at points M and N respectively. A point P is taken on L = 0 such that $\frac{1}{OP^2}=\frac{1}{OM^2}+\frac{1}{ON^2}$. Locus of P is-

(A) $x^2 + 4y^2 = \frac{144}{25}$ (B) $(x+2y)^2 = \frac{144}{25}$ (C) $4x^2 + y^2 = \frac{144}{25}$ (D) $(x-2y)^2 = \frac{144}{25}$

2. The area of the triangular region in the first quadrant bounded on the left by the y-axis, bounded above by the line 7x + 4y = 168 and bounded below by the line 5x + 3y = 121, is-

(A) $\frac{50}{3}$ (B) $\frac{52}{3}$ (C) $\frac{53}{3}$ (D) 17

3. Let A(5,12), B(–13 cos θ, 13 sinθ) and C(13 sinθ – 13 cosθ) are angular points of ΔABC where θ ∈ R. The locus of orthocentre of ΔABC is -

(A) x – y + 7 = 0 (B) x – y – 7 = 0 (C) x + y – 7 = 0 (D) x + y + 7 = 0

4. Let PQR be a right angled isosceles triangle, right angled at P(2,1). If the equation of the line QR is 2x + y = 3, then the equation representing the pair of lines PQ and PR is -

(A) $3x^2 - 3y^2 + 8xy + 20x + 10y + 25 = 0$ (B) $3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$

(C) $3x^2 - 3y^2 + 8xy + 10x + 15y + 20 = 0$ (D) $3x^2 - 3y^2 - 8xy - 10x - 15y - 20 = 0$

5. If the straight lines joining the origin and the points of intersection of the curve $5x^2 + 12xy - 6y^2 + 4x - 2y + 3 = 0$ and x + ky – 1 = 0 are equally inclined to the co-ordinate axes then the value of k is

(A) 1 (B) –1 (C) 2 (D) does not exist

6. If the line y = mx bisects the angle between the lines $ax^2 + 2h\,xy + by^2 = 0$ then m is a root of the quadratic equation

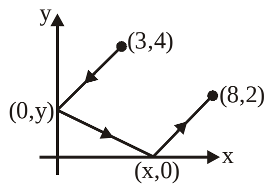
(A) $hx^2 + (a - b)x - h = 0$ (B) $x^2 + h(a - b)x - 1 = 0$

(C) $(a - b)x^2 + hx - (a - b) = 0$ (D) $(a - b)x^2 - hx - (a - b) = 0$

7. If the equation $ax^2 - 6xy + y^2 + 2gx + 2fy + c = 0$ represents a pair of lines whose slopes are m and m^2, then sum of all possible values of a is

(A) 17 (B) –19 (C) 19 (D) –17

8. Suppose that a ray of light leaves the point (3,4), reflects off the y-axis towards the x-axis, reflects off the x-axis, and finally arrives at the point (8,2). The value of x, is-



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

9. Through a point A on the x-axis a straight line is drawn parallel to y-axis so as to meet the pair of straight lines $ax^2 + 2hxy + by^2 = 0$ in B and C. If AB = BC then

(A) $h^2 = 4ab$ (B) $8h^2 = 9ab$ (C) $9h^2 = 8ab$ (D) $4h^2 = ab$

10. Let $S = \{(x,y) | x^2 + 2xy + y^2 - 3x - 3y + 2 = 0\}$, then S -

(A) consists of two coincident lines. (B) consists of two non-coincident parallel lines

(C) consists of two intersecting lines. (D) is a parabola.

11. P(x,y) moves such that the area of the triangle formed by P,Q(a,2a) and R(–a,–2a) is equal to the area of the triangle formed by P,S(a,2a) and T(2a,3a). The locus of 'P' is a straight line given by -

(A) 3x – y = a (B) 5x – 3y + a = 0 (C) 5x – 5y + a = 0 (D) 2y = ax

[MULTIPLE CHOICE]

12. If $a^2 + 9b^2 - 4c^2 = 6ab$ then the family of lines $ax + by + c = 0$ are concurrent at :

(A) (1/2, 3/2) (B) (–1/2, –3/2) (C) (–1/2, 3/2) (D) (1/2, –3/2)

13. The x-coordinates of the vertices of a square of unit area are the roots of the equation $x^2 - 3|x| + 2 = 0$ and the y-coordinates of the vertices are the roots of the equation $y^2 - 3y + 2 = 0$ then the possible vertices of the square is/are-

(A) (1,1), (2,1), (2,2), (1,2) (B) (–1,1), (–2,1), (–2,2), (–1,2)

(C) (2,1), (1,–1),(1,2),(2,2) (D) (–2,1), (–1,–1),(–1,2), (–2,2)

14. The lines L_1 and L_2 denoted by $3x^2 + 10xy + 8y^2 + 14x + 22y + 15 = 0$ intersect at the point P and have gradients m_1 and m_2 respectively. The acute angles between them is θ. Which of the following relations hold good ?

(A) $m_1 + m_2 = 5/4$ (B) $m_1m_2 = 3/8$

(C) acute angle between L_1 and L_2 is $\sin^{-1}\left(\frac{2}{5\sqrt{5}}\right)$ (D) sum of the abscissa and ordinate of the point P is –1

[SUBJECTIVE]

15. The equation $9x^3 + 9x^2y - 45x^2 = 4y^3 + 4xy^2 - 20y^2$ represents 3 straight lines, two of which pass through the origin. Find the area of the triangle formed by these lines (in sq. units).

16. Find the value of K for which the equation $2x^2 - xy + Ky^2 + 8x + 7y - 10 = 0$ may represent a pair of lines. For this value of K show that this equation can be transformed into a homogeneous equation of second degree by translating the origin to a properly chosen point. Also find the acute angle between the line pair represented by the given general equation.

17. If the straight line joining the origin to the points of intersection of $3x^2 - xy + 3y^2 + 2x - 3y + 4 = 0$ and $2x + 3y = k$ are at right angles, then find the value of $5k - 6k^2$.

18. Find the sum of the abscissas of all the points on the line $x + y = 4$ that lie at a unit distance from the line $4x + 3y - 10 = 0$.

[MATRIX TYPE]

19.

Column-I	Column-II
(A) The four lines $3x - 4y + 11 = 0$; $3x - 4y - 9 = 0$; $4x + 3y + 3 = 0$ and $4x + 3y - 17 = 0$ enclose a figure which is nor a kite.	(P) a quadrilateral which is neither a parallelogram nor a trapezium
(B) The lines $2x + y = 1$, $x + 2y = 1$, $2x + y = 3$ and $x + 2y = 3$ form a figure which is	(Q) a parallelogram which is neither a rectangle nor a rhombus
(C) If 'O' is the origin, P is the intersection of the lines $2x^2 - 7xy + 3y^2 + 5x + 10y - 25 = 0$, A and B are the points in which these lines are cut by the line $x + 2y - 5 = 0$, then the points O,A,P,B (in some order) are the vertices of	(R) a rhombus which is not a square
	(S) a square

20. Consider the 3 linear equations $ax + by + c = 0$, $bx + cy + a = 0$, $cx + ay + b = 0$ where $a,b,c \in R$.

Column-I	Column-II
(A) If $a + b + c = 0$ and $a^2 + b^2 + c^2 \neq ab + bc + ca$ then	(P) entire xy plane
(B) If $a + b + c = 0$ and $a^2 + b^2 + c^2 = ab + bc + ca$ then	(Q) the lines are concurrent
(C) If $a + b + c \neq 0$ and $a^2 + b^2 + c^2 \neq ab + bc + ca$ then	(R) lines are coincident
(D) If $a + b + c \neq 0$ and $a^2 + b^2 + c^2 = ab + bc + ca$ then	(S) lines are neither coincident nor concurrent

Answers

RACE # 48

1. (B) **2.** (A) **3.** (A) **4.** (B) **5.** (B) **6.** (A) **7.** (B) **8.** (B) **9.** (B) **10.** (B)

11. (AB) **12.** (CD) **13.** (AB) **14.** (BCD) **15.** 30 **16.** $k = -1,\ \theta = \tan^{-1}(3)$ **17.** 52

18. –4 **19.** A-S ; B-R ; C-Q **20.** A-Q ; B-P ; C-S ; D-R