Straight Lines

Date Planned : __ / __ / __	CBSE PATTERN
Actual Date of Attempt : __ / __ / __	Level - 0

1. Find the equation of the straight line which passes through the point $(1-2)$ and cuts off equal intercepts from axes.

2. Find the equation of the line passing through the point (5, 2) and perpendicular to the line joining the points (2, 3) and (3, –1).

3. Find the angle between the lines $y=\left(2-\sqrt{3}\right)\left(x+5\right)$ and $y=\left(2+\sqrt{3}\right)\left(x-7\right)$.

4. Find the equation of the lines which passes through the point (3, 4) and cuts off intercepts from the coordinate axes such that their sum is 14.

5. Find the points on the line $x+y=4$ which lie at a unit distance from the line $4x+3y=10$.

6. Show that the tangent of an angle between the lines $\frac{x}{a}+\frac{y}{b}=1$ and $\frac{x}{a}-\frac{y}{b}=1$ is $\frac{2ab}{a^2-b^2}$.

7. Find the equation of lines passing through (1, 2) and making angle 30° with Y-axis.

8. Find the equation of the line passing through the point of intersection of $2x+y=5$ and $x+3y+8=0$ and parallel to the line $3x+4y=7$.

9. For what values of a and b the intercept cut off on the coordinate axes by the line $ax+by+8=0$ are equal in length but opposite in signs to those cut off by the line $2x-3y+6=0$ on the axes?

10. If the intercept of a line between the coordinate axes is divided by the point (–5, 4) in the ratio 1 : 2, then find the equation of the line.

11. Find the equation of a straight line on which length of perpendicular from the origin is four units and the line makes an angle of 120° with the positive direction of X-axis.

12. Find the equation of one of the sides of an isosceles right-angled triangle whose hypotenuse is given by $3x+4y=4$ and the opposite vertex of the hypotenuse is (2, 2).

13. If the equation of the base of an equilateral triangle is $x+y=2$ and the vertex is (2, –1), then find the length of the side of the triangle.

14. A variable line passes through a fixed-point P. The algebraic sum of the perpendiculars drawn from the points (2, 0), (0, 2) and (1, 1) on the line is zero. Find the coordinates of the point P.

15. Find the equation of the line which passes through the point (–4, 3) and the portion of the line intercepted between the axes is divided internally in the ratio 5 : 3 by this point.

16. Find the equations of the lines through the point of intersection of the lines $x-y+1=0$ and $2x-3y+5=0$ and whose distance from the point (3, 2) is $\frac{7}{5}$.

17. If p is the length of perpendicular from the origin on the line $\frac{x}{a}+\frac{y}{b}=1$ and a^2, p^2 and b^2 are in A.P., the show that $a^4+b^4=0$.

18. A line cutting off intercept –3 from the Y-axis and the tangent at angle to the X-axis is $\frac{3}{5}$, its equation is:

(A) $5y-3x+15=0$ **(B)** $3y-5x+15=0$

(C) $5y-3x-15=0$ **(D)** None of these

19. Slope of a line which cuts off intercepts of equal lengths on the axes is:

(A) -1 **(B)** 0 **(C)** 2 **(D)** 3

20. The equation of the straight line passing through the point (3, 2) and perpendicular to the line $y=x$ is:

(A) $x-y=5$ **(B)** $x+y=5$ **(C)** $x+y=1$ **(D)** $x-y=1$

21. The equation of the line passing through the point (1, 2) and perpendicular to the line $x+y+1=0$ is:

(A) $y-x+1=0$ **(B)** $y-x-1=0$ **(C)** $y-x+2=0$ **(D)** $y-x-2=0$

22. The tangent of angle between the lines whose intercepts on the axes are $a, -b$ and $b, -a$ respectively, is:

(A) $\frac{a^2-b^2}{ab}$ **(B)** $\frac{b^2-a^2}{2}$ **(C)** $\frac{b^2-a^2}{2ab}$ **(D)** None of these

23. If the line $\frac{x}{a}+\frac{y}{b}=1$ passes through the points (2, –3) and (4, –5), then (a, b) is:

(A) (1, 1) **(B)** (–1, 1) **(C)** (1, –1) **(D)** (–1, –1)

24. The distance of the point of intersection of the lines $2x-3y+5=0$ and $3x+4y=0$ from the line $5x-2y=0$ is:

(A) $\frac{130}{17\sqrt{29}}$ **(B)** $\frac{13}{7\sqrt{29}}$ **(C)** $\frac{130}{7}$ **(D)** None of these

25. The equation of the lines which pass through the point (3, –2) and are inclined at 60° to the line $\sqrt{3}x+y=1$ is:

(A) $y+2=0, \sqrt{3}x-y-2-3\sqrt{3}=0$ **(B)** $x-2=0, \sqrt{3}x-y+2+3\sqrt{3}=0$

(C) $\sqrt{3}x-y-2-3\sqrt{3}=0$ **(D)** None of these

26. The equations of the lines pass through the point (1, 0) and at a distance $\frac{\sqrt{3}}{2}$ from the origin, are:

(A) $\sqrt{3}x+y-\sqrt{3}=0, \sqrt{3}x-y-\sqrt{3}=0$ **(B)** $\sqrt{3}x+y+\sqrt{3}=0, \sqrt{3}x-y+\sqrt{3}=0$

(C) $x+\sqrt{3}y-\sqrt{3}=0, x-\sqrt{3}y-\sqrt{3}=0$ **(D)** None of these

27. The distance between the lines $y = mx + c_1$ and $y = mx + c_2$ is:

(A) $\frac{c_1 - c_2}{\sqrt{m^2+1}}$ **(B)** $\frac{|c_1 - c_2|}{\sqrt{1+m^2}}$ **(C)** $\frac{c_2 - c_1}{\sqrt{1+m^2}}$ **(D)** 0

28. The coordinates of the foot of the perpendiculars from the point (2, 3) on the line $y = 3x + 4$ is given by:

(A) $\left(\frac{37}{10}, \frac{-1}{10}\right)$ **(B)** $\left(-\frac{1}{10}, \frac{37}{10}\right)$ **(C)** $\left(\frac{10}{37}, -10\right)$ **(D)** $\left(\frac{2}{3}, -\frac{1}{3}\right)$

29. If the coordinates of the middle point of the portion of a line intercepted between the coordinate axes is (3, 2), then the equation of the line will be:

(A) $2x + 3y = 12$ **(B)** $3x + 2y = 12$ **(C)** $4x - 3y = 16$ **(D)** $5x - 2y = 10$

30. Equation of the line passing through (1, 2) and parallel to the line $y = 3x - 1$ is:

(A) $y + 2 = x + 1$ **(B)** $y + 2 = 3(x + 1)$ **(C)** $y - 2 = 3(x - 1)$ **(D)** $y - 2 = x - 1$

31. Equations of diagonals of the square formed by the lines $x = 0, y = 0, x = 1$ and $y = 1$ are:

(A) $y = x, y + x = 1$ **(B)** $y = x, x + y = 2$

(C) $2y = x, y + x = \frac{1}{3}$ **(D)** $y = 2x, y + 2x = 1$

32. For specifying a straight line, how many geometrical parameters should be known?

(A) 1 **(B)** 2 **(C)** 4 **(D)** 3

33. The point (4, 1) undergoes the following two successive transformations:

I. Reflection about the line $y = x$

II. Translation through a distance 2 units along the positive X-axis.

Then, the final coordinates of the point are:

(A) (4, 3) **(B)** (3, 4) **(C)** (1, 4) **(D)** $\left(\frac{7}{2}, \frac{7}{2}\right)$

34. A point equidistant from the lines $4x + 3y + 10 = 0, 5x - 12y + 26 = 0$ and $7x + 24y - 50 = 0$ is:

(A) (1, –1) **(B)** (1, 1) **(C)** (0, 0) **(D)** (0, 1)

35. A line passes through (2, 2) and is perpendicular to the line $3x + y = 3$. Its y-intercept is:

(A) $\frac{1}{3}$ **(B)** $\frac{2}{3}$ **(C)** 1 **(D)** $\frac{4}{3}$

36. The ratio in which the line $3x + 4y + 2 = 0$ divides the distance between the line $3x + 4y + 5 = 0$ and $3x + 4y - 5 = 0$ is:

(A) 1 : 2 **(B)** 3 : 7 **(C)** 2 : 3 **(D)** 2 : 5

37. One vertex of the equilateral triangle with centroid at the origin and one side as $x + y - 2 = 0$ is:

(A) (–1, 1) **(B)** (2, 2) **(C)** (–2, –2) **(D)** (2, –2)

Fill in the Blanks

38. If a, b and c are in AP, then the straight lines $ax + by + c = 0$ will always pass through_______.

39. The line which cuts off equal-intercept from the axes and pass through the point (1, –2) is _______.

40. Equation of the line through the point (3, 2) and making an angle of 45° with the line $x - 2y = 3$ are ___.

41. The point (3, 4) and (2, –6) are situated on the _______ of the line $3x - 4y - 8 = 0$.

42. A point moves so that square of its distance from the point (3, –2) is numerically equal to its distance from the line $5x - 12y = 3$. The equation of its locus is _______.

43. Locus of the mid-points of the portion of the line $x \sin\theta + y \cos\theta = p$ intercepted between the axes is ____.

44. The point $A(-2, 1)$, $B(0, 5)$ and $C(-1, 2)$ are collinear.

True or False

45. Equation of the line passing through the point $\left(a \cos^3\theta, a \sin^3\theta\right)$ and perpendicular to the line $x \sec\theta + y \operatorname{cosec}\theta = a$ is $x \cos\theta - y \sin\theta = a \sin 2\theta$.

46. The straight line $5x + 4y = 0$ passes through the point of intersection of the straight lines $x + 2y - 10 = 0$ and $2x + y + 5 = 0$.

47. The vertex of an equilateral triangle is (2, 3) and the equation of the opposite side is $x + y = 2$. Then, the other two sides are $y - 3 = \left(2 \pm \sqrt{3}\right)(x - 2)$.

48. The equation of the line joining the point (3, 5) to the point of intersection of the lines $4x + y - 1 = 0$ and $7x - 3y - 35 = 0$ is equidistant from the points (0, 0) and (8, 34).

49. The line $\frac{x}{a} + \frac{y}{b} = 1$ moves in such a way that $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$, where c is a constant. The locus of the foot of the perpendicular from the origin on the given line is $x^2 + y^2 = c^2$.

50. The lines $ax + 2y + 1 = 0$, $bx + 3y + 1 = 0$ and $cx + 4y + 1 = 0$ are concurrent, if a, b and c are in G.P.

51. Line joining the points (3, –4) and (–2, 6) is perpendicular to the line joining the points (–3, 6) and (9, –18).

Straight Lines

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Note (A) : Questions having asterisk marked against them may have more than one correct answer.

(B) : Questions having ▶ (Symbol) marked against them have a video solution.

1. One of the vertices of a triangle whose midpoint of edges are $(3, 1), (5, 6), (-3, 2)$ is:

(A) $(-5, -3)$ **(B)** $(1, 7)$ **(C)** $(-11, 5)$ **(D)** None of these

2. If the point (x, y) be equidistant from the points $(a+b, b-a)$ and $(a-b, a+b)$, then:

(A) $bx + ay = 0$ **(B)** $bx - ay = 0$ **(C)** $ax - by = 0$ **(D)** None of these

3. If P, Q are two points whose coordinates are $(at^2, 2at)$ and $\left(\frac{a}{t^2}, -\frac{2a}{t}\right)$ respectively and S is the point $(a, 0)$, then $\frac{1}{SP} + \frac{1}{SQ}$ is:

(A) $3/a$ **(B)** $2/a$ **(C)** independent of t **(D)** $4/a$

4. If four points $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ and (x_4, y_4) taken in order in a parallelogram, then:

(A) $x_1 - x_2 + x_3 - x_4 = 0$ **(B)** $y_1 - y_2 + y_3 + y_4 = 0$

(C) $x_1 + x_2 - x_3 - x_4 = 0$ **(D)** $y_1 + y_2 - y_3 - y_4 = 0$

5. Select the correct alternative for the following questions:

(i) In what ratio is the line joining the points $(4, 5)$ and $(1, 2)$ is divided by X-axis.

(A) 2 : 5 externally **(B)** 2 : 5 internally

(C) 3 : 4 externally **(D)** 3 : 4 internally

(ii) In what ratio is the line joining the points $(4, 5)$ and $(1, 2)$ is divided by Y-axis.

(A) 1 : 4 externally **(B)** 3 : 4 internally

(C) 3 : 4 externally **(D)** 1 : 4 internally

(iii) The coordinates of the point case (i) are:

(A) $(-1, 0)$ **(B)** $(0, 1)$ **(C)** $(0, -1)$ **(D)** $(1, 0)$

(iv) The coordinates of the point case (ii) are:

(A) $(-1, 0)$ **(B)** $(0, 1)$ **(C)** $(0, -1)$ **(D)** $(1, 0)$

6. Three vertices of a parallelogram $(a+b, a-b), (2a+b, 2a-b)$ and $(a-b, a+b)$ taken in a order. The forth vertex is:

(A) (b, b) **(B)** $(b, -b)$ **(C)** $(-b, b)$ **(D)** $(-b, -b)$

7. Two vertices of a triangle are $(-4, 3)$ and $(2, 6)$. If the centroid is at origin, then the third vertex is:

(A) $(2, 9)$ **(B)** $(2, -9)$ **(C)** $(-2, 9)$ **(D)** $(-2, -9)$

For Questions 8 - 9

(A) Statement-1 is True, Statement-2 is True and Statement-2 is a correct explanation for Statement-1
(B) Statement-1 is True, Statement-2 is True and Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

8. **Statement 1:** The vertices of a triangle are (1, 2), (2, 1) and $\left\{\frac{1}{2}\left(3+\sqrt{3}\right), \frac{1}{3}\left(3+\sqrt{3}\right)\right\}$. Its distance between its orthocentre and circumcentre is zero.

Statement 2: In an equilateral triangle, orthocentre and circumcentre coincide.

9. **Statement 1:** The equations to the sides of a triangle are $x-3y=0, 4x+3y=5$ and $3x+y=0$. The line $3x-3y=0$ passes through the orthocentre of triangle.

Statement 2: If two lines of slopes m_1 and m_2 are perpendicular then $m_1 m_2 = -1$.

10. The coordinates of ABC are (6, 3), (–3, 5) and (4, –2) respectively P is a point (x, y). If $\frac{\Delta PBC}{\Delta ABC} = \frac{|x+y-2|}{k}$, then value of k is:

(A) 7 **(B)** -2 **(C)** 1 **(D)** 3

11. The equation straight line such that the portion of it intercepted between the coordinate axes is bisected at the point (h, k) is:

(A) $\frac{x}{h}+\frac{y}{k}=-1$ **(B)** $\frac{x}{h}+\frac{y}{k}=2$ **(C)** $\frac{x}{h}+\frac{y}{k}=1$ **(D)** $\frac{x}{h}+\frac{y}{k}=-1$

12. The equation straight line such that it passes through point $(-2, 6)$ and the portion of the line intercepted between the axes is divided at this point in the ratio 3 : 2 is :

(A) $2x-y=10$ **(B)** $2x-y+10=0$ **(C)** $x-2y=10$ **(D)** $x+2y=10$

13. The equation of straight line such that it passes through point $(12, -1)$ and the sum of the intercepted made on the axes is equal to 7 is:

(A) $2x-y+14=0$ **(B)** $x-2y+14=0$ **(C)** $x-2y=14$ **(D)** $x+6y+6=0$

14. The equation of the sides of a triangle, the coordinates of whose angular points are: $(3, 5), (1, 2)$ and $(-7, 4)$.

(A) $3x-2y+1=0$ **(B)** $x-10y+47=0$ **(C)** $x+4y-9=0$ **(D)** All of these

15. If the points $A\left(at_1^2, 2at_1\right), B\left(at_2^2, 2at_2\right)$ and $C(a, 0)$ are collinear, then $t_1 t_2$ equals:

(A) 2 **(B)** -1 **(C)** 1 **(D)** None of these

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16. The mid-points of the sides of a triangles are $(2, 1), (-5, 7)$ and $(-5, -5)$. The equation of the sides are:

(A) $x-2=0$ **(B)** $6x+7y+65=0$ **(C)** $6x-7y+79=0$ **(D)** All of these

17. The intercept made by a line on Y-axis is double to the intercept made by it on X-axis and it passes through (1, 2), then its equation is:

(A) $2x+y=4$ **(B)** $2x+y+4=0$ **(C)** $2x-y=4$ **(D)** $2x-y+4=0$

18. The equation of the line which passes through the point (3, 4) and the sum of its intercepts on the axes is 14, is:

(A) $x+y=7$ and $4x+3y=24$ **(B)** $x+y=24$ and $4x+3y=7$

(C) $x-y=7$ and $4x-3y=24$ **(D)** None of the above

19. The distance of the point (2, 3) from the line $2x-3y+9=0$ measured along a line $x-y+1=0$ is:

(A) $4\sqrt{2}$ **(B)** $2\sqrt{2}$ **(C)** $\sqrt{2}$ **(D)** $\frac{1}{\sqrt{2}}$

20. The equation of the line is passing through P (4, 5) and making $30°$ angle with x-axis. Then coordinates of point which is at distance 4 units on either side of P, is:

(A) $\left(4-2\sqrt{3}, 7\right)$ **(B)** $\left(4 \pm 2\sqrt{3}, 7\right)$

(C) $\left(4+2\sqrt{3}, 7\right), \left(4-2\sqrt{3}, 3\right)$ **(D)** $\left(4-2\sqrt{3}, 7\right), \left(4-2\sqrt{3}, 7\right)$

21. The equation of a line in parametric form is given by:

(A) $\left(x-x_1\right) r \cos\theta = \left(y-y_1\right) \sin\theta$ **(B)** $\frac{\left(x-x_1\right)}{\cos\theta} = \frac{\left(y-y_1\right)}{\sin\theta} = r$

(C) $\left(x_1-x_1\right)\cos\theta = \left(y-y_1\right)\sin\theta = r$ **(D)** None of these

22. The line joining two points A (2, 0), B (3, 1) is rotated about A in anticlockwise direction through an angle of 15°. Then the equation of the line in the new position if B goes to C in the new position, is:

(A) $\frac{x+2}{1/2} = \frac{y}{\sqrt{3}/2}$ **(B)** $\frac{x-2}{1/2} = \frac{y}{\sqrt{3}/2}$ **(C)** $\frac{x}{1/2} = \frac{y}{\sqrt{3}/2}$ **(D)** None of these

23. An equation of a line through the point (1, 2) whose distance from the point (3, 1) has the greatest value is:

(A) $y = 2x$ **(B)** $y = x+1$ **(C)** $x+2y=5$ **(D)** $y=3x+1$

24. **Statement 1:** Lines $3x+4y+6=0$, $\sqrt{2}x+\sqrt{3}y+2\sqrt{2}=0$ and $4x+7y+8=0$ are concurrent.

Statement 2: If three lines are concurrent then determinant of coefficients should be non-zero.

(A) Statement-1 is True, Statement-2 is True and Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statement-2 is True and Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

25. The equations of the two straight lines through (7, 9) and making an angle of 60° with the line $x-\sqrt{3}y-2\sqrt{3}=0$, are:

(A) $x = 7$ and $x+\sqrt{3}y = 7+9\sqrt{3}$ **(B)** $x=-7$ and $x+\sqrt{3}y=7+9\sqrt{3}$

(C) $x = 7$ *and* $x-\sqrt{3}y=7+9\sqrt{3}$ **(D)** $x = 7$ *and* $x+\sqrt{3}y = 7+\sqrt{3}$

26. If (1, 1) and (–3,5) are vertices of a diagonal of a square, then the equations of its sides through (1, 1) are:

(A) $2x-y=1, y-1=0$ **(B)** $3x+y=4, x-1=0$

(C) $x=1, y=1$ **(D)** None of these

27. The diagonals of a parallelogram PQRS are the along $x+3y=4$ & $6x-2y=7$. Then PQRS must be a:

(A) Rectangle **(B)** Square

(C) Cyclic quadrilateral **(D)** Rhombus

28. If the family of lines $x(a+2b)+y(a+3b)=a+b$ passes through the point for all values of a and b, then the coordinates of the point are:

(A) $(2, 1)$ **(B)** $(2, -1)$ **(C)** $(-2, 1)$ **(D)** None of these

29. The equation of the straight line through the intersection of line $2x+y=1$ and $3x+2y=5$ and passing through the origin, is:

(A) $7x+3y=0$ **(B)** $7x-y=0$ **(C)** $3x+2y=0$ **(D)** $x+y=0$

30. The equation of the straight line which passes the point of intersection of the straight line $x+2y=5$ and $3x+7y=17$ and is perpendicular to the straight line $3x+4y=10$, is:

(A) $4x+3y+2=0$ **(B)** $4x-3y+2=0$

(C) $4x-3y-2=0$ **(D)** $4x+3y-2=0$

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31. The equations of the bisectors of the angles between the straight line $3x-4y+7=0$ and $12x-5y-8=0$, are:

(A) $21x+27y+131=0$ **(B)** $x+27y-131=0$

(C) $21x-27y+131=0$ **(D)** $21x+27y-131=0$

32. **Statement 1:** The points $(k+1,\ k+2)$, $(k,\ k+1)$, $(k+1,\ k)$ are collinear for any value of k.

Statement 2: If three points are collinear area of the triangle formed by them is zero.

(A) Statement-1 is True, Statement-2 is True and Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statement-2 is True and Statement-2 is NOT a correct explanation for Statement-1

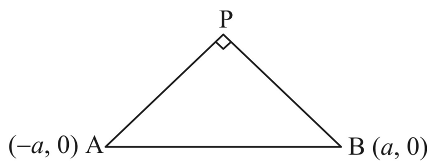
(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

33. x-coordinates of two points B and C are the roots of equation $x^2+4x+3=0$ and their y-coordinates are the roots of equation $x^2-x-6=0$. If x-coordinates of B is less than x-coordinates of C and y-coordinates of B is greater than the y-coordinate of C and coordinates of a third point A be $(3,-5)$, then the length of the bisector of the interior angle at A is:

(A) $\frac{7\sqrt{2}}{3}$ **(B)** $\frac{14\sqrt{2}}{3}$ **(C)** $\frac{5\sqrt{2}}{3}$ **(D)** None of these

34. A and B are two fixed points. The locus of a point P such that $\angle APB$ is a right angle, is:



(A) $x^2+y^2=a^2$ **(B)** $x^2-y^2=a^2$

(C) $2x^2+y^2=a^2$ **(D)** None of these

35. The equation of the straight line through the origin making angle ϕ with the line $y=mx+b$ is:

(A) $\frac{y}{x}=\frac{m-\tan\phi}{1-m\tan\phi}$ **(B)** $\frac{x}{y}=\frac{m+\tan\phi}{1-m\tan\phi}$ **(C)** $\frac{y}{x}=\frac{m\pm\tan\phi}{1\mp m\tan\phi}$ **(D)** $\frac{y}{x}=\frac{m+\tan\phi}{1+m\tan\phi}$

36. If $P(1,0)$, $Q(-1,0)$ and $R(2,0)$ are three given points, then locus of the points satisfying the relation $SQ^2+SR^2=2SP^2$ is:

(A) A straight line parallel to X-axis **(B)** A circle passing through origin

(C) A straight line parallel to Y-axis **(D)** None of these

37. The image of the point $(1, 3)$ in the line $x + y - 6 = 0$ is:

(A) $(3, 5)$ **(B)** $(5, 3)$ **(C)** $(1, -3)$ **(D)** $(-1, 3)$

38. A and B are two fixed points. The vertex C of a ΔABC moves such that $\cot A + \cot B =$ constant. Locus of C is a straight line:

(A) $\perp$ to AB **(B)** parallel to AB
(C) Inclined at an angle 30° to AB **(D)** None of these

39. The number of integer values of m, for which the x-co-ordinate of the point of intersection of the lines $3x + 4y = 9$ and $y = mx + 1$ also an integer, is:

(A) 2 **(B)** 0 **(C)** 4 **(D)** 1

40. If the quadrilateral formed by the lines
$ax + by + c = 0,\ a'x + b'y + c = 0$
$ax + by + c' = 0,\ a'x + b'y + c' = 0$
have perpendicular diagonals, then:

(A) $b^2 + c^2 = b'^2 + c'^2$ **(B)** $c^2 + a^2 = c'^2 + a'^2$
(C) $a^2 + b^2 = a'^2 + b'^2$ **(D)** None of these

41. For a variable line $\frac{x}{a} + \frac{y}{b} = 1$ where $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$, the locus of the foot of perpendicular drawn from origin to it is:

(A) $x^2 + y^2 = \frac{c^2}{2}$ **(B)** $x^2 + y^2 = c^2$ **(C)** $x^2 + y^2 = 2c$ **(D)** None of these

42. Consider the family of line $(x + y - 1) + \lambda(2x + 3y - 5) = 0$ and $(3x + 2y - 4) + \mu(x + 2y - 6) = 0$. Equation of a straight line that belongs to both the families is:

(A) $x - 2y - 8 = 0$ **(B)** $x - 2y + 8 = 0$ **(C)** $2x - y - 8 = 0$ **(D)** None of these

43. The set of values of b for which the origin and the point $(1, 1)$ lie on the same side of the straight line $a^2x + aby + 1 = 0,\ \forall\ a \in R,\ b > 0$ are:

(A) $b \in (2, 4)$ **(B)** $b \in (0, 2)$ **(C)** $b \in [0, 2]$ **(D)** None of these

44. If the point $(a, 2)$ lies between the lines $x - y - 1 = 0$ and $2(x - y) + 5 = 0$, then the set of values of a is:

(A) $(-\infty, 3) \cup \left(\frac{9}{2}, \infty\right)$ **(B)** $\left(3, \frac{9}{2}\right)$ **(C)** $(-\infty, 3)$ **(D)** None of these

45. The number of real values of k for which the lines $x - 2y + 3 = 0$, $kx + 3y + 1 = 0$ and $4x - ky + 2 = 0$ are concurrent is:

(A) 0 **(B)** 1 **(C)** 2 **(D)** infinite

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46. The parametric equation of a line is given by $x = -2 + \frac{r}{\sqrt{10}}$ and $y = 1 + 3\frac{r}{\sqrt{10}}$:

(A) intercept on the X-axis $= \frac{7}{3}$ **(B)** intercept on the Y-axis = –7

(C) slope of the line = 3 **(D)** None of these

47. The length of the perpendicular from the origin to a line is 7 and the makes on angle of 150° with the positive direction of Y-axis. Then the equation of the line is:

(A) $\sqrt{3}x + y = 14$ **(B)** $\sqrt{3}x - y = 14$ **(C)** $3x - y = 14$ **(D)** None of these

48. The area of the triangle by the lines $y = ax$, $x + y - a = 0$ and the Y-axis is equal to:

(A) $\frac{1}{2|1+a|}$ **(B)** $\frac{a^2}{|1+a|}$ **(C)** $\frac{1}{2}\left|\frac{1}{1+a}\right|$ **(D)** $\frac{a^2}{2|1+a|}$

49. If m_1 and m_2 are the root of the equation $x^2 + (\sqrt{3}+2)x + (\sqrt{3}-1) = 0$, then the area of the triangle formed by the lines $y = m_1x$, $y = m_2x$ and $y = 2$ is:

(A) $\sqrt{33} - \sqrt{11}$ **(B)** $\sqrt{33} + \sqrt{11}$ **(C)** $\sqrt{33} + \sqrt{7}$ **(D)** None of these

50. Let PS be the median of the triangle with vertices $P(2, 2)$, $Q(6, -1)$ and $R(7, 3)$. The equation of the line passing through $(1, -1)$ and parallel to PS is:

(A) $2x - 9y - 7 = 0$ **(B)** $2x - 9y - 11 = 0$ **(C)** $2x + 9y - 11 = 0$ **(D)** $2x + 9y + 7 = 0$

51. The incentre of the triangle whose vertices are (–36, 7), (20, 7) and (0, – 8) is:

(A) $(0, -1)$ **(B)** $(-1, 0)$ **(C)** $\left(\frac{1}{2}, 1\right)$ **(D)** None of these

52. The locus of the mid-point of the portion intercepted between the axes by the line $x\cos\alpha + y\sin\alpha = p$, where p is a constant is:

(A) $x^2 + y^2 = 4p^2$ **(B)** $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$ **(C)** $x^2 + y^2 = \frac{4}{p^2}$ **(D)** $\frac{1}{x^2} + \frac{1}{y^2} = \frac{2}{p^2}$

53. The nearest point on the line $3x - 4y = 25$ from the origin is:

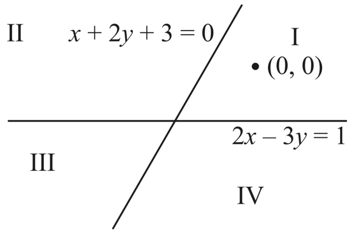
(A) $(-4, 5)$ **(B)** $(3, -4)$ **(C)** $(3, 4)$ **(D)** $(3, 5)$

54. Points (1, 2) and (2, 1) are:

(A) On the same side of the line $4x + 2y = 1$ **(B)** On the line $4x + 2y = 1$

(C) On the opposite sides of $4x + 2y = 1$ **(D)** None of these

55. Two lines $2x - 3y = 1$ and $x + 2y + 3 = 0$ divide the x-y plane in four compartments which are named as shown in the figure. Consider the locations of the points $(2, -1)$, $(3, 2)$ and $(-1, -2)$. The correct option is:



(A) $(2, -1) \in \text{IV}$ **(B)** $(3, 2) \in \text{III}$ **(C)** $(-1, -2) \in \text{II}$ **(D)** None of these

56. If O be the origin and if $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ two points, then $OP_1 \cdot OP_2 \cos(\angle P_1OP_2)$ is equal to:

(A) $x_1y_2 + x_2y_1$ **(B)** $(x_1^2 + y_1^2)(x_2^2 + y_2^2)$

(C) $(x_1 + x_2)^2 + (y_1 + y_2)^2$ **(D)** $x_1x_2 + y_1y_2$

57. The locus of the point of intersection of lines $x\cos\alpha + y\sin\alpha = a$ and $x\sin\alpha - y\cos\alpha = b$ is: (α is a variable)

(A) $2(x^2 + y^2) = a^2 + b^2$ **(B)** $x^2 - y^2 = a^2 - b^2$

(C) $x^2 + y^2 = a^2 + b^2$ **(D)** None of these

58. If the equation of the locus of a point equidistant from the points (a_1, b_1) and (a_2, b_2) is $(a_1 - a_2)x + (b_1 + b_2)y + c = 0$, then the value of c is:

(A) $a_1^2 - a_2^2 + b_1^2 - b_2^2$ **(B)** $\sqrt{a_1^2 + b_1^2 - a_2^2 - b_2^2}$

(C) $\dfrac{(a_1^2 + a_2^2 + b_1^2 + b_2^2)}{2}$ **(D)** $\dfrac{(a_1^2 + b_2^2 - a_1^2 - b_1^2)}{2}$

59. Let O be the origin, and let A (1, 0), B (0, 1) be two points. If P (x, y) is a point such that $xy > 0$ and $x + y < 1$, then:

(A) P lies either inside ΔOAB or in third quadrant **(B)** P cannot be inside ΔOAB

(C) P lies inside the ΔOAB **(D)** None of these

60. The equation of a line which passes through $(a\cos^3\theta, a\sin^3\theta)$ and perpendicular to the line $x\sec\theta + y\,\text{cosec}\,\theta = a$ is:

(A) $x\cos\theta + y\sin\theta = 2a\cos\theta$ **(B)** $x\sin\theta - y\cos\theta = 2a\sin\theta$

(C) $x\sin\theta + y\cos\theta = 2a\cos\theta$ **(D)** None of these

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61. The equation(s) of the bisector(s) of that angle between the lines $x+2y-11=0, 3x-6y-5=0$ which contains the point $(1,-3)$ is:

(A) $3x=19$ **(B)** $3y=7$

(C) $3x=19$ and $3y=7$ **(D)** None of these

62. The vertices of a triangle are $A(-1,-7), B(5,1)$ and $C(1,4)$. The equation of the internal bisector of the angle $\angle ABC$ is:

(A) $3x-7y-8=0$ **(B)** $x-7y+2=0$ **(C)** $3x-3y-7=0$ **(D)** None of these

63. If the co-ordinates of points A, B, C, D are (6, 3), (–3, 5), (4, –2) and (x, $3x$) respectively and if $\dfrac{\Delta DBC}{\Delta ABC}=\dfrac{1}{2}$, then x is:

(A) $\dfrac{8}{11}$ **(B)** $\dfrac{11}{8}$ **(C)** $\dfrac{7}{9}$ **(D)** 0

64. If $(x_1-x_2)^2+(y_1-y_2)^2=a^2, (x_2-x_3)^2+(y_2-x_3)^2=b^2, (x_3-x_1)^2+(y_3-y_1)^2=c^2$, and

$2s=a+b+c$ then $\dfrac{1}{4}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2$ is equal to:

(A) $s(s-a)^2$ **(B)** $(s-b)(s-c)^2$

(C) $s(s-a)(s-b)(s-c)$ **(D)** None of these

65. The points $P(a,b)$ and $Q(b,a)$ lie on the lines $3x+2y-13=0$ and $4x-y-5=0$. Then equation of line PQ is:

(A) $x-y=5$ **(B)** $x+y=5$ **(C)** $x-y=-5$ **(D)** $x+y=-5$

66. If the lines $x(\sin\alpha+\sin\beta)-y\sin(\alpha-\beta)=3$ and $x(\cos\alpha+\cos\beta)+y\cos(\alpha-\beta)=5$ are perpendicular then $\sin 2\alpha+\sin 2\beta$ is equal to:

(A) $\sin(\alpha-\beta)-2\sin(\alpha+\beta)$ **(B)** $\sin 2(\alpha-\beta)-2\sin(\alpha+\beta)$

(C) $2\sin(\alpha-\beta)-\sin(\alpha+\beta)$ **(D)** $\sin 2(\alpha-\beta)-\sin(\alpha+\beta)$

67. The vertex C of a triangle ABC moves on the line $L\equiv 3x+4y+5=0$. The co-ordinates of the points A and B are $(2,7)$ and $(5,8)$. The locus of centroid of ΔABC is a line parallel to:

(A) AB **(B)** BC **(C)** CA **(D)** L

68. The line L has intercepts a and b on the coordinate axes. When keeping the origin fixed, the coordinate axes are rotated through a fixed angle, then the same line has intercepts p and q on the rotated axes. Then:

(A) $a^2+b^2=p^2+q^2$ **(B)** $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{p^2}+\frac{1}{q^2}$

(C) $a^2+p^2=b^2+q^2$ **(D)** $\frac{1}{a^2}+\frac{1}{p^2}=\frac{1}{b^2}+\frac{1}{q^2}$

69. The point $(\lambda^2+2\lambda+5, \lambda^2+1)$ lies on the line $x+y=10$ for:

(A) All real value of λ **(B)** Some real value of λ

(C) $\lambda=-1$ **(D)** $\lambda=2$

70. The straight line passing through the point of intersection of the straight lines $x-3y+1=0$ and $2x+5y-9=0$ and having infinite slope and at a distance 2 units from the origin has the equation:

(A) $x=2$ **(B)** $3x+y-1=0$ **(C)** $y=1$ **(D)** None of these

71. The base BC of a triangle ABC is bisected at the point (a, b) and equation to the sides AB and AC are respectively $ax+by=1$ and $bx+ay=1$. Equation of the median through A is:

(A) $ax-by=ab$

(B) $(2b-1)(ax+by)=ab$

(C) $(2ab-1)(ax+by-1)=(a^2+b^2-1)(bx+ay-1)$

(D) $bx-ay=1$

72. The image of the point A (1, 2) by the line mirror $y = x$ is the point B and the image of B by the line mirror $y = 0$ is the point (α, β), then:

(A) $\alpha=1, \beta=-2$ **(B)** $\alpha=0, \beta=0$ **(C)** $\alpha=2, \beta=-1$ **(D)** None of these

73. A point equidistant from the lines $4x+3y+10=0$, $5x-12y+26=0$ and $7x+24y-50=0$ is:

(A) $(1,-1)$ **(B)** $(1, 1)$ **(C)** $(0, 0)$ **(D)** $(0, 1)$

74. The bisector of the acute angle formed between the lines $4x-3y+7=0$ and $3x-4y+14=0$ has the equation:

(A) $x+y-7=0$ **(B)** $x-y+3=0$ **(C)** $2x+y-11=0$ **(D)** $x+2y-12=0$

75. A line is drawn from $P(x_1, y_1)$ in the direction θ with the X-axis, to meet $ax+by+c=0$ at Q. Then length PQ is equal to:

(A) $\left|\frac{ax_1+by_1+c}{\sqrt{(a^2+b^2)}}\right|$ **(B)** $\left|\frac{ax_1+by_1+c}{a\cos\theta+b\sin\theta}\right|$ **(C)** $\frac{ax_1+by_1+c}{a\cos\theta-b\sin\theta}$ **(D)** $-\frac{ax_1+by_1+c}{a\sin\theta+b\cos\theta}$

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76. The equation of the line through (2, 3) so that the segment of the line intercepted between the axes is bisected at this point, is:

(A) $3x-2y=12$ **(B)** $3x+2y=12$ **(C)** $x-2y=12$ **(D)** $3x-y=12$

77. A straight line through the point (2, 2) intersects the lines $\sqrt{3}x+y=0$ *and* $\sqrt{3}x-y=0$ at the points *A* and *B*. The equation of the line *AB* so that $\Delta\, OAB$ is equilateral, is:

(A) $x-2=0$ **(B)** $y-2=0$ **(C)** $x+y-4=0$ **(D)** None of these

78. Consider the equation $y-y_1=m(x-x_1)$. In this equation, if m and x_1 are fixed and different lines are drawn for different values of y_1, then:

(A) The lines will pass through a single point
(B) There will be one possible line only
(C) There will be a set of parallel lines
(D) None of these

79. The equations of the line on which the perpendicular from the origin make 30° angle with *X*-axis and which form a triangle of area $\frac{50}{\sqrt{3}}$ with axes, are:

(A) $x+\sqrt{3}y\pm 10=0$ **(B)** $\sqrt{3}x+y-10=0$ **(C)** $x\pm\sqrt{3}y-10=0$ **(D)** None of these

80. If the point *A* is symmetric to the point $B(4,-1)$ with respect to the bisector of the first quadrant, then the length of *AB* is:

(A) 5 **(B)** $5\sqrt{2}$ **(C)** $3\sqrt{2}$ **(D)** 3

81. The straight line $x+2y-9=0$, $3x+5y-5=0$ *and* $ax+by-1=0$ are concurrent if the straight line $35x-22y+1=0$ passes through the point:

(A) (a, b) **(B)** (b, a) **(C)** $(a, -b)$ **(D)** $(-a, b)$

82. If the algebraic sum of the perpendicular distances from the points $(2, 0)$, $(0, 2)$ *and* $(1, 1)$ to a variable straight line be zero, then the line passes through the point:

(A) $(-1, 1)$ **(B)** $(1, 1)$ **(C)** $(1, -1)$ **(D)** $(-1, -1)$

83. If $u=a_1x+b_1y+c_1=0$ and $\upsilon=a_2x+b_2y+c_2=0$ and $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}=\frac{c_1}{c_2}$, then $u+k\upsilon=0$ represents:

(A) $u=0$ **(B)** A family of concurrent lines
(C) A family of parallel line **(D)** None of the above

84. The straight lines represented by $(y-mx)^2=a^2(1+m^2)$ and $(y-nx)^2=a^2(1+n^2)$, is:

(A) Square **(B)** Rhombus **(C)** Rectangle **(D)** None of these

85. In an isosceles ΔABC, the coordinates of the points B and C on the base BC are respectively $(2, 1)$ and $(1, 2)$. If the equation of the line AB is $y = \frac{1}{2}x$, then the equation of the line AC is:

(A) $2y = x + 3$ **(B)** $y = 2x$ **(C)** $y = \frac{1}{2}(x-1)$ **(D)** $y = x - 1$

86. If two vertices of an equilateral triangle have integral coordinates, then the third vertex will have:

(A) Integral coordinates **(B)** Coordinates which are not rational
(C) Coordinates which are rational **(D)** Nothing can be said

87. The point (4, 1) undergoes the following three transformation successively.

I. Reflection about the line $y = x$

II. Transformation through a distance 2 unit along the positive direction of X-axis.

III. Rotation through an angle of $\pi/4$ about the origin in the anti-clockwise direction.

The final position of the point is given by the coordinates.

(A) $\left(\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ **(B)** $(-2, 7\sqrt{2})$ **(C)** $\left(-\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ **(D)** $(\sqrt{2}, 7\sqrt{2})$

88. If $A\left(\sin\alpha, \frac{1}{\sqrt{2}}\right)$ and $B\left(\frac{1}{\sqrt{2}}, \cos\alpha\right)$, $-\pi \le \alpha \le \pi$, are two points on the same side of the line $x - y = 0$, then α belongs to the interval:

(A) $\left(-\frac{\pi}{4}, \frac{\pi}{4}\right) \cup \left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$ **(B)** $\left(-\frac{\pi}{4}, \frac{\pi}{4}\right)$
(C) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$ **(D)** None of these

89. Family of the lines $x\sec^2\theta + y\tan^2\theta - 2 = 0$, for different real θ, is:

(A) Not concurrent **(B)** Concurrent at $(1, 1)$
(C) Concurrent at $(2, -2)$ **(D)** Concurrent at $(-2, 2)$

90. The number of points on the line $x + y = 4$ which are unit distance apart from the line $2x + 2y = 5$ is:

(A) 0 **(B)** 1 **(C)** 2 **(D)** ∞

Straight Lines

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91. The incentre of the triangle formed by axes and the line $\frac{x}{a}+\frac{y}{b}=1$ is:

(A) $\left(\frac{a}{2}, \frac{b}{2}\right)$ **(B)** $\left(\frac{a}{3}, \frac{b}{3}\right)$

(C) $\left[\frac{ab}{a+b+\sqrt{a^2+b^2}}, \frac{ab}{a+b+\sqrt{a^2+b^2}}\right]$ **(D)** $\left[\frac{ab}{a+b+\sqrt{ab}}, \frac{ab}{a+b+\sqrt{ab}}\right]$

92. The equation of a straight line which cut off an intercept of 5 units on negative direction Y-axis and make an angle of $120°$ with positive direction of X-axis, is:

(A) $x+\sqrt{3}y-5=0$ **(B)** $y+\sqrt{3}x+5=0$

(C) $y-\sqrt{3}x+5=0$ **(D)** $y-\sqrt{3}x-5=0$

93. A line is such that its segments between the straight lines $5x - y = 4$ *and* $3x + 4y - 4 = 0$ is bisected at the points (1, 5). Its equation is:

(A) $23x - 7y + 6 = 0$ **(B)** $7x + 4y + 3 = 0$

(C) $83x - 35y + 92 = 0$ **(D)** None of these

94. The sides of a quadrilateral are given by $xy(x-2)(y-3)=0$. The equation of the line parallel to $x-4y=0$, which divides the quadrilateral into two equal regions, is:

(A) $x-4y-1=0$ **(B)** $x-4y+5=0$ **(C)** $x-4y+1=0$ **(D)** $x-4y+3=0$

95. The algebraic sum of the perpendicular distances from $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ to a variable line is zero, then the line passes through:

(A) the orthocentre of ΔABC **(B)** the centroid ΔABC

(C) the circumcentre ΔABC **(D)** None of these

96. If $A(\cos\alpha, \sin\alpha)$, $B(\sin\alpha, -\cos\alpha)$, $C(1, 2)$ are the vertices of a ΔABC, then as α varies the locus of its centroid is:

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

(C) $2(x^2+y^2)-2x-4y+1=0$ **(D)** None of these

97. The line joining $A(b\cos\alpha, b\sin\alpha)$ and $B(a\cos\beta, a\sin\beta)$ is produced to point $M(x, y)$ so that $AM : MB = b : a$, then the value of $x\cos\frac{\alpha+\beta}{2}+y\sin\frac{\alpha+\beta}{2}$ is:

(A) a^2+b^2 **(B)** 0 **(C)** 1 **(D)** -1

98. The set of all numbers of 'a' such that $a^2+2a, 2a+3$ and a^2+3a+8 are the sides of a triangle is:

(A) $a>5$ **(B)** $a<-5$ **(C)** $a>\frac{-11}{3}$ **(D)** $a \in R$

99. $P(3,1), Q(6,5)$ and $R(x,y)$ are three points such that the angle PRQ is a right angle and the area of $\Delta RQP=7,$ then the number of such points R is:

(A) 0 **(B)** 1 **(C)** 2 **(D)** 4

100. Let $A=(1,2), B(3,4)$ and let $C=(x,y)$ be points such that $(x-1)(x-3)+(y-2)(y-4)=0.$ If $ar(\Delta ABC)=1$ then maximum number of positions of C in the XY plane is:

(A) 2 **(B)** 4 **(C)** 8 **(D)** None of these

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101. If a variable line passes through the point of intersection of the line $x+2y-1=0$ and $2x-y-1=0$ and meets the coordinate axes in A and B, then the locus of the mid-point of AB is:

(A) $x+3y=0$ **(B)** $x+3y=10$ **(C)** $x+3y=10xy$ **(D)** None of these

102. If the vertices of a triangle have integral coordinates, then the triangle cannot be:

(A) equilateral **(B)** isosceles **(C)** scalene **(D)** None of these

103. If $25p^2+9q^2-r^2-30pq=0$, then a point on the line $px+qy+r=0$ is:

(A) $(5,-3)$ **(B)** $(1,2)$ **(C)** $(0,0)$ **(D)** $(5,3)$

104. The side AB of an isosceles triangle is along the axis of x with vertices A $(-1, 0)$ and $AB = AC$. The equation of the side BC when $\angle A = 120°$ and $BC = 4\sqrt{3}$ is:

(A) $\sqrt{3}x+y=3$ **(B)** $x+y=\sqrt{3}$ **(C)** $x+\sqrt{3}y=3$ **(D)** None of these

105. The line $ax+by+c=0$ intersects the line $x\cos\alpha+y\sin\alpha=c$ at the point P and angle between them is $\pi/4$. If the line $x\sin\alpha-y\cos\alpha=0$ also passes through the point P, then:

(A) $a^2+b^2=c^2$ **(B)** $a^2+b^2=2c^2$ **(C)** $a^2+b^2=2$ **(D)** $a^2+b^2=4$

106. The circumcentre of the triangle formed by the lines $xy+2x+2y+4=0$ and $x+y+2=0$ is:

(A) $(0, 0)$ **(B)** $(-1,-1)$ **(C)** $(-1,-2)$ **(D)** $(-2,-2)$

107. The equation $(1+2k)x+(1-k)y+k=0$, k being parameter represents a family of lines. The line which belongs to this family and is at a maximum distance from the point (1, 4) is:

(A) $33x+12y+7=0$ **(B)** $12x+33y-7=0$

(C) $4x-y+7=0$ **(D)** $12x-33y+7=0$

108. The diagonal of the rectangle formed by the lines $x^2-7x+6=0$ and $y^2-14y+40=0$ is:

(A) $5x+6y=0$ **(B)** $5x-6y=0$ **(C)** $6x-5y+14=0$ **(D)** $6x-5y-14=0$

109. The image of the pair of lines represented by $ax^2+2hxy+by^2=0$ by the line mirror $y=0$ is:

(A) $ax^2-2hxy-by^2=0$ **(B)** $bx^2-2hxy+ay^2=0$

(C) $bx^2+2hxy+ay^2=0$ **(D)** $ax^2-2hxy+by^2=0$

110. A line is drawn through the point (1, 2) to meet the coordinate axes at P and Q such that it forms a ΔOPQ, where O is the origin, if the area of the ΔOPQ is least, then the slope of the line PQ is:

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

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111. If the pair of lines $ax^2 + 2(a+b)xy + by^2 = 0$ lie along diameters of a circle and divide into four sectors such that area of one sector is thrice the area of another sector, then:

(A) $3a^2 + 2ab + 3b^2 = 0$ **(B)** $3a^2 + 10ab + 3b^2 = 0$

(C) $3a^2 - 2ab + 3b^2 = 0$ **(D)** $3a^2 - 10ab + 3b^2 = 0$

112. Locus of centroid of the triangle whose vertices are $(a\cos t, a\sin t)$, $(b\sin t, -b\cos t)$ and (1, 0), where t is a parameter, is:

(A) $(3x-1)^2 + (3y)^2 = a^2 - b^2$ **(B)** $(3x-1)^2 + (3y)^2 = a^2 + b^2$

(C) $(3x+1)^2 + (3y)^2 = a^2 + b^2$ **(D)** $(3x-1)^2 + (3y)^2 = a^2 - b^2$

113. Two sides of a rhombus are along the lines, $x - y + 1 = 0$ and $7x - y - 5 = 0$. If its diagonals intersect at $(-1, -2)$, then which one of the following is a vertex of this rhombus ?

(A) $(-3, -8)$ **(B)** $\left(\frac{1}{3}, -\frac{8}{3}\right)$ **(C)** $\left(-\frac{10}{3}, -\frac{7}{3}\right)$ **(D)** $(-3, -9)$

114. The larger of the two angles made with *X*-axis of a straight line drawn through (1, 2) so that it intersects $x + y = 4$ at a distance $\frac{\sqrt{6}}{3}$ from (1, 2) is:

(A) 105° **(B)** 75° **(C)** 60° **(D)** 15°

115. Through the point $P(\alpha, \beta)$, where $\alpha\beta > 0$ the straight line $\frac{x}{a} + \frac{y}{b} = 1$ is drawn so as to form with coordinate axes a triangle of area *S*. If $ab > 0$, then the least value of *S* is:

(A) $\alpha\beta$ **(B)** $2\alpha\beta$ **(C)** $4\alpha\beta$ **(D)** None of these

116. If the equal sides *AB* and *AC* (each equal to *a*) of a right angled isosceles ΔABC be produced to *P* and *Q* so that $BP.CQ = AB^2$, then the line *PQ* always passes through the fixed point:

(A) $(a, 0)$ **(B)** $(0, a)$ **(C)** (a, a) **(D)** None of these

117. A variable line is drawn through the origin *O*. Two points *A* and *B* same side of *O* are taken on the line such that $OA = 1\, and\, OB = 2\, unit$. Through points *A* and *B* two lines are drawn making equal angle α with the line *AB*. Then the locus of the point of intersection of the lines, is:

(A) $x^2 + y^2 = \frac{9 + \tan^2\alpha}{4}$ **(B)** $x^2 + y^2 = \frac{9 - \tan^2\alpha}{4}$

(C) $x^2 + y^2 = \frac{9 + \tan^2\alpha}{2}$ **(D)** $x^2 + y^2 = \frac{9 + 2\tan^2\alpha}{4}$

118. If the line $y = \tan\theta x$ cuts the curve $x^3 + xy^2 + 2x^2 + 2y^2 + 3x + 1 = 0$ at the points A, B and C. If OA, OB, OC are in $H.P.$, then $\tan\theta$ is equal to:

(A) ± 1 **(B)** 0 **(C)** 2 **(D)** -2

119. If the distance of any point (x, y) from origin is defined as $d(x, y) = \max\{|x|, |y|\}$, then the locus of the point $(x, y), where\, d(x, y) = 1$ is:

(A) A circle **(B)** A square **(C)** A triangle **(D)** None of these

120. Let $A = (a, b)$ and $B = (c, d)$ where $c > a > 0$ and $d > b > 0$. Then, point C on the X-axis such that AC + BC is the minimum, is:

(A) $\frac{bc - ad}{b - d}$ **(B)** $\frac{ac + bd}{b + d}$ **(C)** $\frac{ac - bd}{b - a}$ **(D)** $\frac{ad + bc}{b + d}$

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121. A straight-line L with negative slope passes through the point $(8, 2)$ and cuts the positive coordinate axes at points P and Q. As L varies, the absolute minimum value of $OP + OQ$ is (O is origin):

(A) 10 **(B)** 18 **(C)** 16 **(D)** 12

122. If $f(x+y) = f(x) f(y) \forall x, y \in R$ and $f(1) = 2$ then area enclosed by $3|x| + 2|y| \le 8$ is:

(A) $f(4)$ square units **(B)** $\frac{1}{2} f(6)$ square units

(C) $\frac{1}{3} f(6)$ square units **(D)** $\frac{1}{3} f(5)$ square units

123. The equation of image of pair of lines $y = |x-1|$ in Y-axis is:

(A) $y = |x+1|$ **(B)** $y = |x-1| + 3$

(C) $x^2 + y^2 + 2x + 1 = 0$ **(D)** $x^2 - y^2 + 2x - 1 = 0$

124. $ABCD$ is square whose vertices A, B, C and D are (0, 0), (2, 0), (2, 2) and (0, 2) respectively. This square is rotated in the xy plane with an angle of $30°$ in anticlockwise direction about an axis passing through the vertex A, then the equation of the diagonal BD of this rotated square is:

(A) $\sqrt{3x} + (1-\sqrt{3})y = \sqrt{3}$ **(B)** $(1+\sqrt{3})x - (1-\sqrt{2})y = 2$

(C) $(2-\sqrt{3})x + y = 2(\sqrt{3}-1)$ **(D)** None of these

125. The Cartesian co-ordinates (x, y) of a point on a curve are given by $x : y : 1 = t^3 : t^2 - 3 : t - 1$ where t is a parameter, then the points given by $t = a, b, c$ are collinear, if :

(A) $abc + 3(a+b+c) = ab + bc + ca$ **(B)** $3abc + 2(a+b+c) = ab + bc + ca$

(C) $abc + 2(a+b+c) = 3(ab + bc + ca)$ **(D)** None of these

126. The points $(\alpha, \beta), (\gamma, \delta), (\alpha, \delta)$ and (γ, β) where $\alpha, \beta, \gamma, \delta$ are different real numbers are:

(A) Collinear **(B)** Vertices of a square

(C) Vertices of a rhombus **(D)** Concyclic

127. If $A\left(\frac{\sin\alpha}{3} - 1, \frac{\cos\alpha}{2} - 1\right)$ and $B(1, 1)$, $\alpha \in [-\pi, \pi]$ are two points on the same side of the line $3x - 2y + 1 = 0$, then α belongs to the interval :

(A) $\left[-\pi, -\frac{3\pi}{4}\right) \cup \left(\frac{\pi}{4}, \pi\right]$ **(B)** $[-\pi, \pi]$

(C) ϕ **(D)** None of these

128. If p_1, p_2, p_3 be the length of perpendiculars from the points $(m^2, 2m)$, $(mm', m+m')$ and $(m'^2, 2m')$ respectively on the line $x\cos\alpha + y\sin\alpha + \dfrac{\sin^2\alpha}{\cos\alpha} = 0$, then p_1, p_2, p_3 are in:

(A) *A.P.* **(B)** *G.P.* **(C)** *H.P.* **(D)** None of these

129. The vertices of a triangle are $A\ (x_1,\ x_1 \tan\alpha)$, $B\ (x_2,\ x_2 \tan\beta)$ and $C\ (x_3,\ x_3 \tan\gamma)$. If the circumcentre of ΔABC coincides with the origin and $H\ (a,\ b)$ be its orthocentre, then a/b is equal to:

(A) $\dfrac{\cos\alpha + \cos\beta + \cos\gamma}{\cos\alpha\cos\beta\cos\gamma}$ **(B)** $\dfrac{\sin\alpha + \sin\beta + \sin\gamma}{\sin\alpha\sin\beta\sin\gamma}$

(C) $\dfrac{\tan\alpha + \tan\beta + \tan\gamma}{\tan\alpha\tan\beta\tan\gamma}$ **(D)** $\dfrac{\cos\alpha + \cos\beta + \cos\gamma}{\sin\alpha + \sin\beta + \sin\gamma}$

130. Let n be the number of points having rational coordinates equidistant from the point $\left(0, \sqrt{3}\right)$, then:

(A) $n \le 1$ **(B)** $n = 1$ **(C)** $n \le 2$ **(D)** $n > 2$

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131. Let ABC be a given right isosceles triangle with AB = AC. Sides AB and AC are extended up to E and F, respectively, such that $BE \times CF = AB^2$. Prove that the line EF always passes through a fixed point.

132. Let $L_1 = 0$ and $L_2 = 0$ be two fixed lines. A variable line is drawn through the origin to cut the two lines at R and S. P is a point on the line RS such that $(m+n)/OP = m/OR + n/OS$. Show that the locus of P is a straight line passing through the point of intersection of the given lines (R, S, P are on the same side of O).

133. A variable line cuts n given concurrent straight lines at $A_1, A_2, \ldots\ldots\ldots A_n$ such that $\sum_{i=1}^{n} \frac{1}{OA_i}$ is a constant. Show that it always passes through a fixed point, O being the point of intersection of the lines.

134. Consider two lines L_1 and L_2 given by $x - y = 0$ and $x + y = 0$, respectively, and a moving point $P(x, y)$. Let $d(P, L_i),\ i = 1, 2$, represents the distance of point P from the line L_i. If point P moves in a certain region R in such a way that $2 \le d(P, L_1) + d(P, L_2) \le 4$, find the area of region R.

135. A right-angled triangle ABC having C as right angle is of given magnitude and the angular points A and B slide along two given perpendicular axes. Show that the locus of C is the pair of straight lines whose equations are $y = \pm (b/a)x$.

Passage for Q. 136 -138

A variable line L is drawn through O (0, 0) to meet the lines L_1 and L_2 given by $y - x - 10 = 0$ and $y - x - 20 = 0$ at points A and B, respectively.

136. A point P is taken on L such that 2/OP = 1/OA +1/ OB. Then the locus of P is:

(A) $3x + 3y = 40$ **(B)** $3x + 3y + 40 = 0$ **(C)** $3x - 3y = 40$ **(D)** $3y - 3x = 40$

137. Locus of P, if $OP^2 = OA \times OB$, is:

(A) $(y - x)^2 = 100$ **(B)** $(y + x)^2 = 50$ **(C)** $(y - x)^2 = 200$ **(D)** None of these

138. Locus of P, if $1/(OP^2) = 1/(OB^2) + (1/OA^2)$, is:

(A) $(y - x)^2 = 80$ **(B)** $(y - x)^2 = 100$ **(C)** $(y - x)^2 = 64$ **(D)** None of these

Passage for Q. 139 - 140

Let ABCD be a parallelogram whose equations for the diagonals AC and BD are $x + 2y = 3$ and $2x + y = 3$, respectively.

139. If length of diagonal AC is 4 units and the area of parallelogram ABCD is 8 sq. units, then the length of other diagonal BD is:

(A) 10/3 **(B)** 2 **(C)** 20/3 **(D)** None of these

140. The length of side AB is equal to:

(A) $\frac{2\sqrt{58}}{3}$ **(B)** $\frac{4\sqrt{58}}{9}$ **(C)** $\frac{3\sqrt{58}}{9}$ **(D)** $\frac{4\sqrt{58}}{9}$

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141. If lines $x-2y-6=0, 3x-y-4=0$ and $\lambda x+4y+\lambda^2=0$ are concurrent, then the value of λ, where $\lambda>0$.

142. If the line $y-x-1+\lambda=0$ is equidistant from the points $(1,-2)$ and $(3,4)$, then the value of $|\lambda|$ is:

143. If the line $x+y-1-\frac{\lambda}{2}=0$ passing through the intersection of $x-y+1=0$ and $3x+y-5=0$ is perpendicular to one of them, then the value of λ is:

144. Two mutually perpendicular lines are drawn from origin forming an isosceles triangle together with the straight line $2x+y=5$, then area of triangle is:

145. A ray of light coming from the point (1, 2) is reflected at a point '*A*' on the X-axis and then passes through the point (5, 3). Then the *x*-coordinate of the point *A* is $\frac{13}{K}$. Find *K*.

146. The line $x+y=a$ meets the axes of *x* and *y* at *A* and *B* respectively. A triangle *AMN* is inscribed in the triangle *OAB*, *O* being the origin, with right angle at *N*, *M* and *N* lie respectively on *OB* and *AB*. If the area of the triangle *AMN* is $\frac{3}{8}$ of the area of the triangle *OAB*, then $\frac{AN}{BN}$ is equal to:

147. The line $x = c$ cuts the triangle with corners $(0,0); (1,1)$ and $(9,1)$ into two regions. For the area of the two regions to be the same, then *c* must be equal to:

148. Consider the family of lines
$5x+3y-2+\lambda(3x-y-4)=0$ and $x-y+1+\mu(2x-y-2)=0$. Equation of straight line that belong to both families is $ax+by-7=0$, then $a+b$ is:

149. The number of possible straight lines passing through (2, 3) and forming a triangle with the coordinate axes, whose area is 12 *sq* units, is:

150. The portion of the line $ax+3y-1=0$, intercepted between the line $ax+y+1=0$ and $x+3y=0$ subtend a right angle at origin, then the value of $|a|$ is:

151. Let *ABC* be a triangle and $A\equiv(1,2), y=x$ be the perpendicular bisector of *AB* and $x-2y+1=0$ be the angle bisector of $\angle C$. If the equation of *BC* is given by $ax+by-5=0$ then the value of $a-2b$ is:

152. A lattice point in a plane is a point for which both coordinates are integers. If *n* be the number of lattice points inside the triangle whose sides are $x=0$, $y=0$ and $9x+223y=2007$ then tens place digit in *n* is:

153. The number of triangles that the four lines $y=x+3, y=2x+3, y=3x+2$ and $y+x=3$ form is

154. If $(\lambda, \lambda+1)$ is an interior point of ΔABC, where $A\equiv(0,3), B\equiv(-2,0)$ and $C\equiv(6,1)$ then the number of integral values of λ is:

155. If from point $(4,4)$ perpendiculars to the straight lines $3x+4y+5=0$ and $y=mx+7$ meet at *Q* and *R* and area of triangle *PQR* is maximum, then the value of $3m$ is:

Straight Lines

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1. Let a, b, c and d be non-zero numbers. If the point of intersection of the lines $4ax+2ay+c=0$ and $5bx+2by+d=0$ lies in the fourth quadrant and is equidistant from the two axes, then: **[2014]**

(A) $2bc-3ad=0$ **(B)** $2bc+3ad=0$ **(C)** $2ad-3bc=0$ **(D)** $3bc+2ad=0$

2. If PS is the median of the triangle with vertices P(2, 2), Q(6, –1) and R(7, 3), then equation of the line passing through (1, –1) and parallel to PS is: **[2014]**

(A) $4x-7y-11=0$ **(B)** $2x+9y+7=0$ **(C)** $4x+7y+3=0$ **(D)** $2x-9y-11=0$

3. The x-coordinate of the incentre of the triangle that has the coordinates of mid-points of its sides as (0, 1), (1, 1) and (1, 0) is: **[2013]**

(A) $2+\sqrt{2}$ **(B)** $2-\sqrt{2}$ **(C)** $1+\sqrt{2}$ **(D)** $1-\sqrt{2}$

4. A straight-line L through the point (3, –2) is inclined at an angle $60°$ to the line $\sqrt{3}x+y=1$. If L also intersects the X-axis, then the equation of L is: **[2011]**

(A) $y+\sqrt{3}x+2-3\sqrt{3}=0$ **(B)** $y-\sqrt{3}x+2+3\sqrt{3}=0$

(C) $\sqrt{3}y-x+3+2\sqrt{3}=0$ **(D)** $\sqrt{3}y+x-3+2\sqrt{3}=0$

5. Orthocentre of triangle with vertices (0, 0), (3, 4) and (4, 0) is: **[2003]**

(A) $\left(3, \frac{5}{4}\right)$ **(B)** (3, 12) **(C)** $\left(3, \frac{3}{4}\right)$ **(D)** (3, 9)

6. The number of integer values of m, for which the x-coordinate of the point of intersection of the lines $3x+4y=9$ and $y=mx+1$ is also an integer, is: **[2001]**

(A) 2 **(B)** 0 **(C)** 4 **(D)** 1

7. A straight line through the origin O meets the parallel lines $4x+2y=9$ and $2x+y+6=0$ at points P and Q respectively. Then, the point O divides the segments PQ in the ratio: **[2000]**

(A) 1 : 2 **(B)** 3 : 4 **(C)** 2 : 1 **(D)** 4 : 3

8. The incentre of the triangle with vertices $\left(1, \sqrt{3}\right)$, $\left(0, 0\right)$ and (2, 0) is: **[2000]**

(A) $\left(1, \frac{\sqrt{3}}{2}\right)$ **(B)** $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$ **(C)** $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$ **(D)** $\left(1, \frac{1}{\sqrt{3}}\right)$

9. If A_0, A_1, A_2, A_3, A_4, and A_5 be a regular hexagon inscribed in a circle of unit radius. Then, the product of the lengths of the line segments A_0A_1, A_0A_2 and A_0A_4 is: **[1998]**

(A) $\frac{3}{4}$ **(B)** $3\sqrt{3}$ **(C)** 3 **(D)** $\frac{3\sqrt{3}}{2}$

10. If P (1, 2), Q(4, 6), R(5, 7) and S(a, b) are the vertices of a parallelogram PQRS, then: **[1998]**

(A) $a = 2, b = 4$ **(B)** $a = 3, b = 4$ **(C)** $a = 2, b = 3$ **(D)** $a = 3, b = 5$

11. The diagonals of a parallelogram PQRS are along the lines $x + 3y = 4$ and $6x - 2y = 7$. Then, PQRS must be a: **[1998]**

(A) rectangle **(B)** square

(C) cyclic quadrilateral **(D)** rhombus

12. The orthocentre of the triangle formed by the lines $xy = 0$ and $x + y = 1$, is: **[1995]**

(A) $\left(\frac{1}{2}, \frac{1}{2}\right)$ **(B)** $\left(\frac{1}{3}, \frac{1}{3}\right)$ **(C)** (0, 0) **(D)** $\left(\frac{1}{4}, \frac{1}{4}\right)$

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13. If P(1, 0), Q = (–1, 0) and R = (2, 0) are three given points, then locus of the points satisfying the relation $SQ^2 + SR^2 = 2SP^2$, is: **[1988]**

(A) a straight line parallel to X-axis **(B)** a circle passing through the origin

(C) a circle with the centre at the origin **(D)** a straight line parallel to Y-axis

14. The points $(-a,-b),(0,0)(a,b)$ and (a^2,ab) are: **[1979]**

(A) collinear **(B)** vertices of a rectangle

(C) vertices of a parallelogram **(D)** None of these

15. $y=10^x$ is the reflection of $y=log_{10}x$ in the line whose equation is_____. **[1984]**

State true or false: Q. 16 to 18

16. The lines $2x+3y+19=0$ and $9x+6y-17=0$ cut the coordinate axes in concyclic points. **[1988]**

17. No tangent can be drawn from the point (5/2,1) to the circumcircle of the triangle with vertices $(1,\sqrt{3}),(1,-\sqrt{3})$ and $(3,\sqrt{3})$. **[1985]**

18. The straight line $5x+4y=0$ passes through the point of intersection of the straight lines $x+2y-10=0$ and $2x+y+5=0$. **[1983]**

19. Area of the parallelogram formed by the lines $y=mx, y=mx+1, y=nx$ and $y=nx+1$ equals: **[2001]**

(A) $\dfrac{|m+n|}{(m-n)^2}$ **(B)** $\dfrac{2}{|m+n|}$ **(C)** $\dfrac{1}{|m+n|}$ **(D)** $\dfrac{1}{|m-n|}$

20. The points $\left(0,\frac{8}{3}\right),(1,3)$ and (82, 30) are vertices of : **[1986]**

(A) an obtuse angled triangle **(B)** an acute angled triangle

(C) a right-angled triangle **(D)** None of these

21. The straight lines $x+y=0,\ 3x+y-4=0,\ x+3y-4=0$ form a triangle which is: **[1983]**

(A) isosceles **(B)** equilateral **(C)** right angled **(D)** None of the above

22. Given the four lines with the equations $x+2y-3=0, 3x+4y-7=0$, $2x+3y-4=0, 4x+5y-6=0$, then: **[1980]**

(A) they are all concurrent **(B)** they are all sides of a quadrilateral

(C) only three lines are concurrent **(D)** None of the above

23. The set of lines $ax+by+c=0$, where $3a+2b+4c=0$ is concurrent at the point______. **[1982]**

24. Let the orthocentre and centroid of a triangle be $A(-3,5)$ & $B(3,3)$ respectively. If C is the circumcentre of this triangle, then the radius of the circle having line segment AC as diameter, is: **(2018)**

(A) $\dfrac{3\sqrt{5}}{2}$ **(B)** $\sqrt{10}$ **(C)** $2\sqrt{10}$ **(D)** $3\sqrt{\dfrac{5}{2}}$

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25. A straight line through a fixed point (2,3) intersects the coordinate axes at distinct points P and Q. If O is the origin and the rectangle OPRQ is completed, then the locus of R is: **(2018)**

(A) $3x+2y=6xy$ **(B)** $3x+2y=6$ **(C)** $2x+3y=xy$ **(D)** $3x+2y=xy$

26. In a triangle ABC, coordinate of A are (1,2) and the equations of the medians through B and C are respectively, $x+y=5$ & $x=4$. Then area of ΔABC (in sq. units) is: **(Online 2018)**

(A) 12 **(B)** 9 **(C)** 4 **(D)** 5

27. The sides of a rhombus ABCD are parallel to the lines, $x-y+2=0$ & $7x-y+3=0$. If the diagonals of the rhombus intersect at P(1,2) and the vertex A (different from the origin) is on the y-axis then the ordinate of 8 is: **(Online 2018)**

(A) 2 **(B)** $\frac{5}{2}$ **(C)** $\frac{7}{4}$ **(D)** $\frac{7}{2}$

28. The foot of the perpendicular drawn from the origin on the line, $3x+y=\lambda(\lambda \neq 0)$ is P. If the line meets x-axis at A and y-axis at B, then the ratio BP : PA is:

(A) 9 : 1 **(B)** 1 : 3 **(C)** 3 : 1 **(D)** 1 : 9

29. Let k be an integer such that triangle with vertices $(k,-3k), (5,k)$ & $(-k,2)$ has area 28 sq. units. Then the orthocenter of this triangle is at the point. **(2017)**

(A) $\left(1,\frac{3}{4}\right)$ **(B)** $\left(1,-\frac{3}{4}\right)$ **(C)** $\left(2,\frac{1}{2}\right)$ **(D)** $\left(2,-\frac{1}{2}\right)$

30. A square of each side 2, lies above the x-axis and has one vertex at the origin. If one of the sides passing through the origin makes an angle 30° with the positive direction of the x-axis, then the sum of the x-coordinates of the vertices of the square is: **(Online 2017)**

(A) $\sqrt{3}-2$ **(B)** $2\sqrt{3}-1$ **(C)** $\sqrt{3}-1$ **(D)** $2\sqrt{3}-2$

31. Two sides of a rhombus are along the lines, $x-y+1=0$ & $7x-y-5=0$. If its diagonals intersect at (-1, -2), then which one of the following is a vertex of this rhombus? **(2016)**

(A) $(-3,-9)$ **(B)** $(-3,-8)$ **(C)** $\left(\frac{1}{3},-\frac{8}{3}\right)$ **(D)** $\left(-\frac{10}{3},-\frac{7}{3}\right)$

32. If a variable line drawn through the intersection of the line $\frac{x}{3}+\frac{y}{4}=1$ & $\frac{x}{4}+\frac{y}{3}=1$, meets the coordinate axes at A and B, $(A \neq B)$, then the locus of the midpoint of AB is: **(Online 2016)**

(A) $7xy=6(x+y)$ **(B)** $4(x+y)^2-28(x+y)+49=0$

(C) $6xy=7(x+y)$ **(D)** $14(x+y)^2-97(x+y)+168=0$

33. The point $(2,1)$ is translated parallel to the line $L: x-y=4$ by $2\sqrt{3}$ units. If the new point Q lies in the third quadrant, then the equation of the line passing through Q and perpendicular to L is: **(Online 2016)**

(A) $x+y=2-\sqrt{6}$ **(B)** $2x+2y=1-\sqrt{6}$

(C) $x+y=3-3\sqrt{6}$ **(D)** $x+y=3-2\sqrt{6}$

34. A straight line through origin O meets the lines $3y=10-4x$ & $8x+6y+5=0$ at points A and B respectively. Then O divides the segment AB in the ratio: **(Online 2016)**

(A) 2 : 3 **(B)** 1 : 2 **(C)** 4 : 1 **(D)** 3 : 4

35. A ray of light is incident along a line which meets another line, $7x-y+1=0$, at the point $(0,1)$. The ray is then reflected from this point along the line, $y+2x=1$. Then the equation of the line of incidence of the ray of light is: **(Online 2016)**

(A) $41x-25y+25=0$ **(B)** $41x+25y-25=0$

(C) $41x-38y+38=0$ **(D)** $41x+38y-38=0$

Straight Lines

Date Planned : __ / __ / __	Daily Tutorial Sheet - 1	Expected Duration : 90 Min
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1. The locus of the orthocentre of the triangle formed by the lines $(1+p)x - py + p(1+p) = 0$, $(1+q)x - qy + q(1+q) = 0$ and $y = 0$, where $p \neq q$, is: **[2009]**

(A) a hyperbola **(B)** a parabola **(C)** an ellipse **(D)** a straight line

2. The O(0, 0), P(3, 4) and Q(6, 0) be the vertices of a ΔOPQ. The point R inside the ΔOPQ is such that the triangles OPR, PQR and OQR are of equal area. The coordinates of R are: **[2007]**

(A) $\left(\frac{4}{3}, 3\right)$ **(B)** $\left(3, \frac{2}{3}\right)$ **(C)** $\left(3, \frac{4}{3}\right)$ **(D)** $\left(\frac{4}{3}, \frac{2}{3}\right)$

***3.** If the vertices P, Q, R of a ΔPQR are rational points, which of the following points of the ΔPQR is/are always rational point(s): **[1998]**

(A) Centroid **(B)** incentre **(C)** circumcentre **(D)** orthocentre

4. The graph of the function $\cos x \cos(x+2) - \cos^2(x+1)$ is: **[1997]**

(A) a straight line passing through $\left(0, -\sin^2 1\right)$ with slope 2

(B) a straight line passing through (0, 0)

(C) a parabola with vertex $\left(1, -\sin^2 1\right)$

(D) a straight line passing through the point $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and parallel to the X-axis

5. If the sum of the distances of a point from two perpendicular lines in a plane is 1, then its locus is: [1992]

(A) square **(B)** circle **(C)** straight line **(D)** two intersecting lines

6. Line L has intercepts a and b on the coordinate axes. When, the axes are rotated through a given angle, keeping the origin fixed, the same line L has intercepts p and q, then: **[1990]**

(A) $a^2 + b^2 = p^2 + q^2$ **(B)** $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2} + \frac{1}{q^2}$

(C) $a^2 + p^2 = b^2 + q^2$ **(D)** $\frac{1}{a^2} + \frac{1}{p^2} = \frac{1}{b^2} + \frac{1}{q^2}$

7. The point (4, 1) undergoes the following three transformations successively: **[1980]**

I. Reflection about the line $y = x$

II. Translation through a distance 2 units along the positive direction of X-axis.

III. Rotation through an angle $\pi/4$ about the origin in the counterclockwise direction. Then, the final position of the point is given by the coordinates

(A) $\left(\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ **(B)** $\left(-\sqrt{2}, 7\sqrt{2}\right)$ **(C)** $\left(-\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ **(D)** $\left(\sqrt{2}, 7\sqrt{2}\right)$

***8.** For $a > b > c > 0$, the distance between (1, 1) and the point of intersection of the lines $ax + by + c = 0$ and $bx + ay + c = 0$ is less than $2\sqrt{2}$. Then: **[2014]**

(A) $a + b - c > 0$ **(B)** $a - b + c < 0$ **(C)** $a - b + c > 0$ **(D)** $a + b - c < 0$

***9.** All points lying inside the triangle formed by the points (1, 3), (5, 0) and (–1, 2) satisfy: **[1986]**

(A) $3x + 2y \geq 0$ **(B)** $2x + y - 13 \geq 0$ **(C)** $2x - 3y - 12 \leq 0$ **(D)** $-2x + y \geq 0$

10. Let the algebraic sum of the perpendicular distances from the points (2, 0), (0, 2) and (1, 1) to a variable straight line be zero, then the line passes through a fixed point whose coordinates are_______. **[1991]**

11. The orthocentre of the triangle formed by the lines $x + y = 1, 2x + 3y = 6$ and $4x - y + 4 = 0$ lies in quadrant number_______. **[1985]**

12. If a, b and c are in AP, then the straight line $ax + by + c = 0$ will always pass through a fixed point whose coordinates are_______. **[1984]**

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13. A straight-line L through the origin meets the lines $x+y=1$ and $x+y=3$ at P and Q respectively. Through P and Q two straight lines L_1 and L_2 are drawn, parallel to $2x-y=5$ and $3x+y=5$, respectively. Lines L_1 and L_2 intersect at R, show that the locus of R as L varies, is a straight line. **[2002]**

14. A straight-line L with negative slope passes through the point (8, 2) and cuts the positive coordinate axes at points P and Q. Find the absolute minimum value of OP + OQ, as L varies, where O is the origin. **[2002]**

15. For points $P=(x_1, y_1)$ and $Q=(x_2, y_2)$ of the coordinate plane, a new distance $d(P, Q)$ is defined by $d(P,Q)=|x_1-x_2|+|y_1-y_2|$. Let O = (0, 0) and A = (3, 2). Prove that the set of points in the first quadrant which are equidistant (with respect to the new distance) from O and A consists of the union of a line segment of finite length and an infinite ray. Sketch this set in a labelled diagram. **[2000]**

16. A rectangle PQRS has its side PQ parallel to the line $y = mx$ and vertices P, Q and S on the lines $y=a$, $x=b$ and $x=-b$, respectively. Find the locus of the vertex R. **[1996]**

17. A line through A(–5, –4) meets the line $x + 3y + 2 = 0$, $2x + y + 4 = 0$ and $x-y-5=0$ at the points B, C and D respectively. If $(15/AB)^2 + (10/AC)^2 = (6/AD)^2$, find the equation of the line. **[1993]**

18. Determine all values of α for which the point (α, α^2) lies inside the triangles formed by the lines $2x+3y-1=0, x+2y-3=0, 5x-6y-1=0$ **[1992]**

19. Find the equations of the line passing through the point (2, 3) and making intercept of lengths 3 unit between the lines $y+2x=2$ and $y+2x=5$. **[1991]**

20. Straight lines $3x+4y=5$ and $4x-3y=15$ intersect at the point A. Points B and C are chosen on these two lines such that AB = AC. Determine the possible equations of the line BC passing through the point (1, 2). **[1990]**

21. A line cuts the X-axis at A(7, 0) and the Y-axis at B(0,–5). A variable line PQ is drawn perpendicular to AB cutting the X-axis in P and the Y-axis in Q. IF AQ and BP intersect at R, find the locus of R. **[1990]**

22. Let ABC be a triangle with AB = AC. If D is midpoint of BC, the foot of the perpendicular drawn from D to AC is E and F the mid-point of DE. Prove that AF is perpendicular to BE. **[1989]**

23. The equations of the perpendicular bisectors of the sides AB and AC of a ΔABC are $x-y+5=0$ and $x+2y=0$, respectively. If the point A is (1, –2), find the equation of the line BC. **[1986]**

24. One of the diameters of the circle circumscribing the rectangle ABCD $4y=x+7$. If A and B are the points (–3, 4) and (5, 4) respectively, then find the area of rectangle. **[1985]**

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25. Two sides of a rhombus ABCD are parallel to the lines $y = x + 2$ and $y = 7x + 3$. If the diagonals of the rhombus intersect at the point (1, 2) and the vertex A is on the Y-axis, find possible coordinates of A. **[1985]**

26. Two equal sides of an isosceles triangle are given by the equations $7x - y + 3 = 0$ and $x + y - 3 = 0$ and its third side passes through the point (1, –10). Determine the equation of the third side. **[1984]**

27. The vertices of a triangle are $\left[at_1t_2, a\left(t_1+t_2\right)\right], \left[at_2t_3, a\left(t_2+t_3\right)\right], \left[at_3t_1, a\left(t_3+t_1\right)\right]$. Find the orthocentre of the triangle. **[1983]**

28. The ends A and B of a straight-line segment of constant length c slide upon the fixed rectangular axes OX, OY respectively. If the rectangle OAPB be completed, then show that the locus of the foot of the perpendicular drawn from P to AB is $x^{2/3} + y^{2/3} = c^{2/3}$ **[1983]**

29. The points (1, 3) and (5, 1) are two opposite vertices of a rectangle. The other two vertices lie on the line $y = 2x + c$. Find c and the remaining vertices. **[1981]**

30. Two vertices of a triangle are (5, –1) and (–2, 3). If the orthocentre of the triangle is the origin, find the coordinates of the third vertex. **[1978]**

31. One side of a rectangle lies along the line $4x + 7y + 5 = 0$. Two of its vertices are $(-3, 1)$ and $(1, 1)$. Find the equations of the other three sides. **[1978]**

32. For a point P in the plane, let $d_1(P)$ and $d_2(P)$ be the distances of the point P from the lines $x - y = 0$ and $x + y = 0$, respectively. The area of the region R consisting of all points P lying in the first quadrant of the plane and satisfying $2 \le d_1(P) + d_2(P) \le 4$, is $\square\square$. **[2014]**

33. A ray of light along $x + \sqrt{3}y = \sqrt{3}$ gets reflected upon reaching X-axis, the equation of the reflected ray is:

(A) $y = x + \sqrt{3}$ **(B)** $\sqrt{3}y = x - \sqrt{3}$ **(C)** $y = \sqrt{3x} - \sqrt{3}$ **(D)** $\sqrt{3}y = x - 1$ **[2013]**

34. Consider three points $P = \{-\sin(\beta - \alpha), -\cos\beta\}, Q = \{\cos(\beta - \alpha), \sin\beta\}$ and $R = \{\cos(\beta - \alpha + \theta), \sin(\beta - \theta)\}$, where $0 < \alpha, \beta, \theta < \frac{\pi}{4}$. Then: **[2008]**

(A) P lies on the line segment RQ **(B)** Q lies on the line segment PR

(C) R lies on the line segment QP **(D)** P, Q, R are non-collinear

35. Let P = (–1, 0), Q(0, 0) and $R = \left(3, 3\sqrt{3}\right)$ be three points. Then, the equation of the bisector of the angle PQR is: **[2001]**

(A) $\frac{\sqrt{3}}{2}x + y = 0$ **(B)** $x + \sqrt{3}y = 0$ **(C)** $\sqrt{3}x + y = 0$ **(D)** $x + \frac{\sqrt{3}}{2}y = 0$

36. The vertices of a triangle are $A(-1, -7)$, $B(5, 1)$ and C(1, 4). The equation of the bisector of the angle ABC is_____. **[1993]**

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Analytical and Descriptive Questions:

37. The area of the triangle formed by the intersection of the line parallel to X-axis and passing through (*h*, *k*) with the lines $y = x$ and $x + y = 2$ is $4h^2$. Find the locus of point P. **[2005]**

38. Find the equation of the line which bisects the obtuse angle between the lines $x - 2y + 4 = 0$ and $4x - 3y + 2 = 0$. **[1993]**

39. Lines $L_1 \equiv ax + by + c = 0$ and $L_2 \equiv lx + my + n = 0$ intersect at the point P and makes an angle θ with each other. Find the equation of a line L different from L_2 which passes through P and makes the same angle θ with L_1. **[1988]**

***40.** Three lines $px + qy + r = 0, qx + ry + p = 0$ and $rx + py + q = 0$ are concurrent, if: **[1985]**

(A) $p + q + r = 0$ **(B)** $p^2 + q^2 + r^2 = pq + qr + rp$

(C) $p^3 + q^3 + r^3 = 3pqr$ **(D)** None of these

Match the column:

41. Consider the lines given by **[2016]**

$L_1 : x + 3y - 5 = 0$, $L_2 : 3x - ky - 1 = 0$ $L_3 : 5x + 2y - 12 = 0$

	Column-I		Column-II
(A)	L_1, L_2, L_3 are concurrent, if	**(p)**	$k = -9$
(B)	One of L_1, L_2, L_3 is parallel to at least one of the other two, if	**(q)**	$k = -\frac{6}{5}$
(C)	L_1, L_2, L_3 form a triangle, if	**(r)**	$k = \frac{5}{6}$
(D)	L_1, L_2, L_3 do not form a triangle, if	**(s)**	$k = 5$

State true or false: Q. 42

42. If $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \begin{vmatrix} a_1 & b_1 & 1 \\ a_2 & b_2 & 1 \\ a_3 & b_3 & 1 \end{vmatrix}$, then the two triangles with vertices $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ and $(a_1, b_1), (a_2, b_2)$ (a_3, b_3) must be congruent. **[1985]**

43. Coordinates of A, B, C are (6, 3), $(-3, 5), (4, -2)$ respectively and P is any point (*x*, *y*). Show that the ratio of the areas of the triangles ΔPBC *and* ΔABC is $\left|\frac{x + y - 2}{7}\right|$ **[1983]**

***44.** A straight-line L is perpendicular to the line in $5x - y = 1$. The area of the triangle formed by the line L and the coordinate axes is 5. The equation of the line L is: **[1980]**

(A) $x + 5y = 5\sqrt{2}$ **(B)** $x - 5y = 5\sqrt{2}$ **(C)** $x - 5y = -5\sqrt{2}$ **(D)** $x + 5y = -5\sqrt{2}$

45. Let a and b be non-zero and real numbers. Then, the equation $\left(ax^2+by^2+c\right)\left(x^2-5xy+6y^2\right)=0$ represents. **[2008]**

(A) four straight lines, when $c = 0$, a and b are of the same sign

(B) two straight lines and a circle, when $a = b$ and c is of sign opposite to that of a

(C) two straight lines and a hyperbola, when a and b are of the same sign and c is of sign opposite to that of a

(D) a circle and an ellipse, when a and b are of the same sign and c is of sign opposite to that of a

46. 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 find the equation representing the pair of lines PQ and PR is. **[1999]**

47. Area of triangle formed by the lines $x+y=3$ and angle bisectors of the pair of straight lines $x^2-y^2+2y=1$ is: **[2004]**

(A) 2 sq units **(B)** 4 sq units **(C)** 6 sq units **(D)** 8 sq units

48. Show that all chords of curve $3x^2-y^2-2x+4y=0$, which subtend a right angle at the origin pass through a fixed point. Find the coordinates of the point. **[1991]**