

## SL

### LEVEL-I

1. If  $a^2 + b^2 - c^2 + 2ab = 0$ , then family of straight lines  $ax + by + c = 0$  is concurrent at the points.  
(A)  $(-1, 1)$  (B)  $(1, -1)$  (C)  $(1, -2)$  (D)  $(-1, -1), (1, 1)$
2. The pair of straight lines perpendicular to the pair of lines  $ax^2 + 2hxy + by^2 = 0$  has the equation.  
(A)  $ax^2 - 2hxy + by^2 = 0$  (B)  $ay^2 + 2hxy + bx^2 = 0$   
(C)  $bx^2 + 2hxy + ay^2 = 0$  (D)  $bx^2 - 2hxy + ay^2 = 0$
3. If  $x_1, x_2, x_3$  as well as  $y_1, y_2, y_3$  are in G.P with same common ratio ( $\neq 1$ ) then the points  $(x_1, y_1), (x_2, y_2)$  and  $(x_3, y_3)$ .  
(A) lie on a straight line (B) lie on an ellipse  
(C) lie on a circle (D) are the vertices of a triangle
4. If  $a, c, b$  are in A.P the family of line  $ax + by + c = 0$  passes through the point.  
(A)  $\left(\frac{1}{2}, \frac{1}{2}\right)$  (B)  $(1, -2)$  (C)  $(1, 2)$  (D)  $\left(\frac{-1}{2}, \frac{-1}{2}\right)$
5. The image of the point  $(3, -8)$  in the line  $x + y = 0$  is  
(A)  $(-8, 3)$  (B)  $(-3, 8)$  (C)  $(8, -3)$  (D)  $(3, 8)$
6. The nearest point on the line  $2x + 3y = 5$  from the origin is.  
(A)  $(3, -1/3)$  (B)  $\left(\frac{10}{13}, \frac{15}{13}\right)$  (C)  $(0, 5/3)$  (D)  $(1, 1)$
7. A straight line through  $A(2, 1)$  is such that its intercept between the axis is bisected at A. its equation is.  
(A)  $2x + y - 4 = 0$  (B)  $x + 2y - 4 = 0$  (C)  $x + 2y - 4 = 0$  (D)  $x + 2y - 2 = 0$
8. The incentre of the triangle with vertices  $(1, \sqrt{3}), (0, 0)$  and  $(2, 0)$  is.  
(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. It is desired to construct a right angled triangle ABC ( $\angle C = \pi/2$ ) in xy plane so that its sides are parallel to coordinates axis and the medians through A and B lie on the lines  $y = 3x+1$  and  $y = mx + 2$  respectively. The values of 'm' for which such a triangle is possible is /are ,  
(A) 12 (B)  $3/4$  (C)  $4/3$  (D)  $1/12$
10. The equation of the line bisecting the obtuse angle between  $y - x = 2$  and  $\sqrt{3}y + x = 5$  is  
(A)  $\frac{y - x - 2}{\sqrt{2}} = \frac{\sqrt{3}y + x - 5}{2}$  (B)  $\frac{y + x - 2}{\sqrt{2}} = \frac{\sqrt{3}y + x - 5}{2}$   
(C)  $\frac{-y + x + 2}{\sqrt{2}} = \frac{\sqrt{3}y - x - 5}{2}$  (D) none of these
11. If the intercept made on the line  $y = mx$  by the lines  $x = 2$  and  $x = 5$  is less than 5, then the range of m is

- (A)  $(-4/3, 4/3)$  (B)  $(-\infty, -4/3) \cup (4/3, \infty)$  (C)  $[-4/3, 4/3]$  (D) none of these.
12. The equations of three sides of a triangle are  $x = 5$ ,  $y - 2 = 0$  and  $x + y = 9$ . The coordinates of the circumcentre of the triangle are  
 (A)  $(6, 3)$  (B)  $(6, -3)$   
 (C)  $(-6, 3)$  (D) none of these.
13. The equation of a straight line passing through the point  $(-2, 3)$  and making intercepts of equal length on the axes is  
 (A)  $2x + y + 1 = 0$  (B)  $x - y = 5$   
 (C)  $x - y + 5 = 0$  (D) none of these
14. If the intercept made on the line  $y = mx$  by the lines  $y = 2$  and  $y = 6$  is less than 5 then the range of values of  $m$  is  
 (A)  $\left(-\infty, -\frac{4}{3}\right) \cup \left(\frac{4}{3}, \infty\right)$  (B)  $\left(-\frac{4}{3}, \frac{4}{3}\right)$   
 (C)  $\left(-\frac{3}{4}, \frac{3}{4}\right)$  (D) none of these
15. If  $a, c, b$  are in G.P then the line  $ax + by + c = 0$   
 (A) has a fixed direction  
 (B) always passes through a fixed point  
 (C) forms a triangle with axes whose area is constant  
 (D) none of these
16. If a ray travelling along the line  $x = 1$  gets reflected from the line  $x + y = 1$ , then the equation of the line along which the reflected ray travels is  
 (A)  $y = 0$  (B)  $x - y = 1$   
 (C)  $x = 0$  (D) none of these
17. The equations of the lines representing the sides of a triangle are  $3x - 4y = 0$ ,  $x + y = 0$  and  $2x - 3y = 7$ . The line  $3x + 2y = 0$  always passes through the  
 (A) incentre (B) centroid  
 (C) circumcentre (D) orthocentre
18. If the lines  $x = a + m$ ,  $y = -2$  and  $y = mx$  are concurrent, the least value of  $|a|$  is  
 (A) 0 (B)  $\sqrt{2}$   
 (C)  $2\sqrt{2}$  (D) None of these
19. Equation of a line passing through the intersection of the lines  $2x + y = 3$  and  $x + y = 1$  and perpendicular to the line  $y = 2x + k$  is  
 (A)  $x - 2y = 0$  (B)  $x + 2y = 0$   
 (C)  $y - x = 0$  (D)  $y + x = 0$
20. If the sum of the reciprocals of the intercepts made by a line on the coordinate axes is  $1/5$ , then the line always passes through  
 (A)  $(5, -5)$  (B)  $(-5, 5)$   
 (C)  $(-5, -5)$  (D)  $(5, 5)$
21. If  $4a^2 + 9b^2 - c^2 + 12ab = 0$ ,  $a, b, c \in \mathbb{R}^+$ , then the family of straight lines  $ax + by + c = 0$  is concurrent at  
 (A)  $(2, 3)$  (B)  $(-2, -3)$   
 (C)  $(2, -3)$  (D)  $(-3, 2)$

22. Point P (2, 4) is translated parallel to the line  $y - x - 1 = 0$ , through a distance  $3\sqrt{2}$  so that its ordinate is decreased and it reaches at Q. If R is the mirror image of Q in the line  $y - x - 1 = 0$ , its coordinate are  
 (A) (-1, 1) (B) (0, 0)  
 (C) (6, 6) (D) none of these
23. If the line  $y = \sqrt{3}x$  cuts the curve  $x^3 + y^2 + 3x^2 + 9 = 0$  at the points A, B, C, then OA.OB.OC (O being origin) equals  
 (A) 36 (B) 72  
 (C) 108 (D) none of these
24. 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 the  $\triangle OAB$  or in the third quadrant  
 (B) P cannot be inside the  $\triangle OAB$   
 (C) P lies inside the  $\triangle OAB$   
 (D) none of these
25. Let ABC be a triangle with equation of sides AB, BC, CA respectively  $x - 2 = 0$ ,  $y - 5 = 0$  and  $5x + 2y - 10 = 0$ , then the orthocentre of triangle lies on the line  
 (A)  $x - y = 0$  (B)  $3x + y = 1$   
 (C)  $4x + y = 13$  (D)  $x - 2y = 1$
26. The foot of the perpendicular on the line  $3x + y = \lambda$  drawn from the origin is C if the line cuts the x-axis and y-axis at A and B respectively then BC : CA is  
 (A) 1 : 3 (B) 3 : 1  
 (C) 1 : 9 (D) 9 : 1
27. A straight line is drawn through the centre of the circle  $x^2 + y^2 - 2ax = 0$ , parallel to the straight line  $x + 2y = 0$  and intersecting the circle at A and B. Then the area of  $\triangle AOB$  is  
 (A)  $\frac{a^2}{\sqrt{5}}$  (B)  $\frac{a^3}{\sqrt{5}}$  (C)  $\frac{a^2}{\sqrt{3}}$  (D)  $\frac{a^3}{\sqrt{3}}$
28. In what ratio does the point (3, -2) divide the line segment joining the points (1, 4) and (-3, 16)?  
 (A) 1 : 3 (externally) (B) 3 : 1 (externally) (C) 1 : 3 (internally) (D) 3 : 1 (internally)
29. For what value of x will the points (x, -1), (2, 1) and (4, 5) lie on a line?  
 (A) 1 (B) 0 (C) 2 (D) none of these
30. The angle between straight lines  $x^2 - y^2 - 2y - 1 = 0$  is  
 (A)  $90^\circ$  (B)  $60^\circ$  (C)  $75^\circ$  (D)  $36^\circ$
31. The distance between the lines  $4x + 3y = 11$  and  $8x + 6y = 15$  is  
 (A)  $7/2$  (B)  $7/10$  (C) 4 (D) none of these
32. Find the length of the perpendicular from origin to the straight line  $3x - y + 2 = 0$   
 (A) 2 (B)  $-2/\sqrt{10}$  (C)  $2/\sqrt{10}$  (D) none of these
33. If the sum of the slopes of the lines given by  $4x^2 + 2kxy - 7y^2 = 0$  is equal to the product of the slopes then k =  
 (A) -4 (B) 4 (C) -2 (D) 2
34. Find the value of k, so that the equation  $-2x^2 + xy + y^2 - 5x + y + k = 0$  may represent a pair of straight lines

- (A) -2                      (B) 2                      (C) 0                      (D) none of these
35. 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)
36. The lines joining the origin to the points of intersection of  $2x^2 + 3xy - 4x + 1 = 0$  and  $3x + y = 1$  given by  
 (A)  $x^2 - y^2 - 5xy = 0$                       (B)  $x^2 - y^2 + 5xy = 0$                       (C)  $x^2 + y^2 - 5xy = 0$                       (D)  $x^2 + y^2 + 5xy = 0$
37. The distance between the lines  $3x + 4y = 9$  and  $6x + 8y + 15 = 0$   
 (A)  $3/10$     (B)  $33/10$   
 (C)  $33/5$     (D) None of these
38. The equations of the three sides of a triangle are  $x = 2$ ,  $y + 1 = 0$  and  $x + 2y = 4$ . The coordinates of the circumcentre of the triangle are  
 (A) (4, 0)    (B) (2, -1)  
 (C) (0, 4)    (D) None of these
39. If the lines  $y - x = 5$ ,  $3x + 4y = 1$  and  $y = mx + 3$  are concurrent then the value of m is  
 (A)  $19/5$     (B) 1  
 (C)  $5/19$     (D) None of these
40. A line passing through the origin and making an angle  $\pi/4$  with the line  $y - 3x = 5$  has the equation  
 (A)  $x + 2y = 0$     (B)  $2x = y$   
 (C)  $x = 2y$     (D)  $y - 2x = 0$
41. The points (-1, 1) and (1, -1) are symmetrical about the line  
 (A)  $y + x = 0$     (B)  $y = x$   
 (C)  $x + y = 1$     (D) None of these
42. The member of the family of lines  $(p + q)x + (2p + q)y = p + 2q$ , where  $p \neq 0$ ,  $q \neq 0$ , pass through the point  
 (A) (3, -1)    (B) (-3, 1)  
 (C) (1, 1)    (D) None of these
43. The equation of straight line which passes through the point (1, 2) and makes an angle  $\cos^{-1}\left(-\frac{1}{3}\right)$  with the x-axis is  
 (A)  $2\sqrt{2}x + y - 2(\sqrt{2} + 1) = 0$                       (B)  $2x + \sqrt{2}y - \sqrt{2} = 0$   
 (C)  $x + 2\sqrt{2}y - 2\sqrt{2}(\sqrt{2} - 1) = 0$                       (D) none of these
44. The equation of the line joining the points (-1, 3) and (4, -2) is  
 (A)  $x + y - 1 = 0$     (B)  $x + y + 1 = 0$   
 (C)  $x + y + 2 = 0$     (D)  $x + y - 2 = 0$
45. The equation of the line through (3, 4) and parallel to the line  $y = 3x + 5$  is  
 (A)  $3x - y - 5 = 0$     (B)  $3x + y - 5 = 0$   
 (C)  $3x + y + 5 = 0$     (D)  $3x - y + 5 = 0$
46. Locus of the point of intersection of lines  $x \cos \alpha + y \sin \alpha = a$  and  $x \sin \alpha - y \cos \alpha = a$  ( $\alpha \in \mathbb{R}$ ) is  
 (A)  $x^2 + y^2 = a^2$     (B)  $x^2 + y^2 = 2a^2$   
 (C)  $x^2 + y^2 + 2x + 2y = a^2$                       (D) none of these

47. The quadratic equation whose roots are the x and y intercepts of the line passing through (1, 1) and making a triangle of area A with axes is  
 (A)  $x^2 + Ax + 2A = 0$  (B)  $x^2 - 2Ax + 2A = 0$   
 (C)  $x^2 - Ax + 2A = 0$  (D) None of these
48. The area of the quadrilateral formed by  $y = 1 - x$ ,  $y = 2 - x$  and the coordinate axes is  
 (A) 1 (B) 2  
 (C)  $3/2$  (D) None of these
49. The incentre of the triangle formed by the lines  $y = |x|$  and  $y = 1$  is  
 (A)  $(0, 2 - \sqrt{2})$  (B)  $(2 - \sqrt{2}, 0)$   
 (C)  $(2 + \sqrt{2}, 0)$  (D)  $(0, 2 + \sqrt{2})$
50. If one vertex of an equilateral triangle is at (1, -2) and the base is  $x + y + 2 = 0$ , then the length of each side is  
 (A)  $\sqrt{\frac{3}{2}}$  (B)  $\sqrt{\frac{2}{3}}$  (C)  $\frac{2}{3}$  (D)  $\frac{3}{2}$
51. Points on the line  $x + y = 4$  that lie at a unit distance from the line  $4x + 3y - 10 = 0$  are  
 (A) (3, 1) and (-7, 11) (B) (-3, 7) and (2, 2)  
 (C) (-3, 7) and (-7, 11) (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 straight lines of the family  $x(a+b) + y(a-b) = 2a$  (a and b being parameters) are  
 (A) not concurrent (B) Concurrent at (1, -1)  
 (C) Concurrent at (1, 1) (D) None of these
54. If the sum of the distances of a point from two perpendicular lines in a plane is 1, then its locus is  
 (A) square (B) a circle  
 (C) straight line (D) two intersecting lines
55. If the line  $y = mx$  meets the lines  $x + 2y - 1 = 0$  and  $2x - y + 3 = 0$  at the same point, then m is equal to  
 (A) 1 (B) -1  
 (C) 2 (D) -2
56. The area inclosed by  $3|x| + 4|y| \leq 12$  is  
 (A) 6 square units (B) 12 sq. units  
 (C) 24 square units (D) 36 square units
57. If a, b, c are in A.P. then line  $2ax + 3by + 3c = 0$  always passes through fixed point  
 (A) (2, -2) (B)  $(3/2, 2)$   
 (C)  $(3/2, -2)$  (D) none of these

58. Equation  $(3a - 2b)x^2 + (c - 2a)y^2 + 2hxy = 0$  represents pair of straight lines which are perpendicular to each other then  $(a - b)$  is equal to  
 (A)  $b + c$  (B)  $b - c$   
 (C)  $c - b$  (D)  $2c$
59.  $ax + by + c = 0$  represents a line parallel to x-axis if  
 (A)  $a = 0, b = 0$  (B)  $a = 0, b \neq 0$   
 (C)  $a \neq 0, b = 0$  (D)  $c = 0$
60. If the angle between the two straight lines represented by  $2x^2 + 5xy + 3y^2 + 7y + 4 = 0$  is  $\tan^{-1}m$  then  $m$  equals to  
 (A)  $1/5$  (B)  $1$   
 (C)  $7/5$  (D)  $7$
61. The diagonals of a parallelogram PQRS are along the straight lines  $ax + 2by = 50$  and  $4bx - 2ay = 100$ . Then PQRS must be a  
 (A) rhombus (B) rectangle  
 (C) square (D) none of these
62. The area enclosed by  $|x| + |y| = 1$  is  
 (A) 1 (B) 2  
 (C) 3 (D) 4
63. If the line  $6x - y + 2 + k(2x + 3y + 13) = 0$  is parallel to x-axis, then the value of  $k$  is  
 (A)  $-\frac{1}{3}$  (B)  $\frac{1}{3}$  (C)  $-3$  (D)  $3$
64. 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 has the equation  
 (A)  $x = 2$  (B)  $3x + y - 1 = 0$  (C)  $y = 1$  (D) none of these
65. The equations of the lines through  $(-1, -1)$  and making angle  $45^\circ$  with the line  $x + y = 0$  are given by  
 (A)  $x^2 - xy + x - y = 0$  (B)  $xy - y^2 + x - y = 0$   
 (C)  $xy + x + y = 0$  (D)  $xy + x + y + 1 = 0$
66. If a line is perpendicular to the line  $5x - y = 0$  and forms a triangle with coordinate axes of area 5 sq. units, then its equation is  
 (A)  $x + 5y \pm 5\sqrt{2} = 0$  (B)  $x - 5y \pm 5\sqrt{2} = 0$   
 (C)  $5x + y \pm 5\sqrt{2} = 0$  (D)  $5x - y \pm 5\sqrt{2} = 0$
67. The co-ordinates of foot of the perpendicular from the point  $(2, 4)$  on the line  $x + y = 1$  are  
 (A)  $\left(\frac{1}{2}, \frac{3}{2}\right)$  (B)  $\left(-\frac{1}{2}, \frac{3}{2}\right)$  (C)  $\left(\frac{4}{3}, \frac{1}{2}\right)$  (D)  $\left(\frac{3}{4}, -\frac{1}{2}\right)$
68. The distance of the line  $2x - 3y = 4$  from the point  $(1, 1)$  in the direction of the line  $x + y = 1$  is .....
69. If the point  $(2, a)$  lies between the lines  $x + y = 1$  and  $2(x + y) = 5$ , then  $a$  lies between ..... and .....
70. If  $mn = 1$ , then the lines  $mx + y = 1$  and  $y - nx = 2$  will be .....

71. If the point  $(2a - 3, a^2 - 1)$  is on the same side of the line  $x + y - 4 = 0$  as that of the origin, then the set of values of  $a$  is .....
72. The set of lines  $ax + by + c = 0$  where  $3a + 2b + 4c = 0$  is concurrent at the point .....
73. If the image of the point  $(-2, 1)$  by a line mirror be  $(2, -1)$  then the equation of the line mirror is .....
74. If the point  $(-2, 0)$ ,  $(-1, 1/\sqrt{3})$  and  $(\cos\theta, \sin\theta)$  are collinear then the number of values of  $\theta \in [0, 2\pi]$ .  
 (A) 0 (B) 1  
 (C) 2 (D) infinite
75. If 'a' and 'b' are real numbers between 0 and 1 such that the points  $(a, 1)$ ,  $(1, b)$  and  $(0, 0)$  form an equilateral triangle then the values of 'a' and 'b' respectively  
 (A)  $2 - \sqrt{3}$ ,  $2 - \sqrt{3}$  (B)  $-2 + \sqrt{3}$ ,  $-2 + \sqrt{3}$   
 (C)  $2 \pm \sqrt{3}$ ,  $2 \pm \sqrt{3}$  (D) none of these
76. If  $f(x) = \begin{cases} \frac{\log(1+ax) - \log(1-bx)}{x}, & x \neq 0 \\ -c, & x = 0 \end{cases}$ ,  
 is continuous at  $x = 0$ , then the line  $ax + by + c = 0$  passes through the point  
 (A)  $(1, -1)$  (B)  $(-1, 1)$   
 (C)  $(1, 1)$  (D)  $(0, 0)$

## LEVEL-II

1. The centroid  $\equiv (1, 2)$ , circumcentre  $\equiv (-2, 1)$  then co- ordinate of orthocentre is.  
 (A) (4, 7)      (B) (-4, 7)      (C) (7, 4)      (D) (5/2, 5/2)
2. If the co- ordinates of vertices of a triangle are (0, 5), (1, 4) and (2, 5) then the co- ordinate of circumcentre will be.  
 (A) (1, 5)      (B)  $\left(\frac{3}{2}, \frac{9}{2}\right)$       (C) (1, 4)      (D) none of these
3. The equation of the image of pair of rays  $y = |x|$  by the line  $x = 1$  is  
 (A)  $|y| = x + 2$       (B)  $|y| + 2 = x$   
 (C)  $y = |x - 2|$       (D) none of these
4. If the line segment on  $lx + my = n^2$  intercepted by the curve  $y^2 = ax$  subtends a right angle at the origin, then  
 (A)  $a, n, l$  are in G.P.      (B)  $l, m, n$  are in G.P.  
 (C)  $l, m, n^2$  are in G.P.      (D)  $l, n^2, m$  are in G.P.
5. If the line  $y = \sqrt{3}x$  cuts the curve  $x^4 + ax^2y + bxy + cx + dy + 6 = 0$  at A, B, C and D, then OA.OB.OC.OD ( where O is the origin) is  
 (A)  $a - 2b + c$       (B)  $2c^2d$       (C) 96      (D) 6
6. A ray of light travelling along the line  $x + y = 1$  is inclined on the x-axis and after refraction it enters the other side of the x-axis by turning  $15^\circ$  away from the x-axis. The equation of the line along which the refraction ray travels is  
 (A)  $\sqrt{3}y - x + 1 = 0$       (B)  $\sqrt{3}y + x + 1 = 0$   
 (C)  $\sqrt{3}y + x - 1 = 0$       (D) none of these .
7. The coordinates of the point(s) on the line  $x + y = 5$ , which is/are equidistant from the lines  $|x| = |y|$ , is/are  
 (A) (5, 0)      (B) (1, 4)  
 (C) (-5, 0)      (D) (0, -5)
8. If the point (a, a) falls between the lines  $|x + y| = 2$ , then  
 (A)  $|a| = 2$       (B)  $|a| = 1$   
 (C)  $|a| < 1$       (D)  $|a| < 1/2$
9. A line has intercepts a and b on the coordinate axes. If keeping the origin fixed, the coordinate axes are rotated through  $90^\circ$ , the same line has intercepts p and q, then  
 (A)  $p = a, q = b$       (B)  $p = b, q = a$   
 (C)  $p = -b, q = -a$       (D)  $p = b, q = -a$
10. Two sides of a rhombus OABC ( lying entirely in first quadrant or fourth quadrant ) of area equal to 2 sq. units, are  $y = \frac{x}{\sqrt{3}}, y = \sqrt{3}x$ . Then possible coordinates of B is / are ('O' being the origin)  
 (A)  $(1 + \sqrt{3}, 1 + \sqrt{3})$       (B)  $(-1 - \sqrt{3}, -1 - \sqrt{3})$   
 (C)  $(\sqrt{3} - 1, \sqrt{3} - 1)$       (D) none of these



13. Equation of the bisector of angle B of the triangle ABC is  $y = x$ . If A is (2, 6) and B is (1, 1); equation of side BC is  
 (A)  $2x + y - 3 = 0$  (B)  $x - 5y + 4 = 0$   
 (C)  $x - 6y + 5 = 0$  (D) none of these
14. Vertex opposite to the side  $x + y - 2 = 0$  of the equilateral triangle, with centroid at the origin; is  
 (A)  $(-1, 1)$  (B)  $(2, 2)$   
 (C)  $(-2, -2)$  (D) none of these
15.  $A = (\sqrt{1-t^2} + t, 0)$  and  $B = (\sqrt{1-t^2} - t, 2t)$  are two variable points where  $t$  is a parameter, the locus of the middle point of AB is  
 (A) a straight line (B) a pair of straight line  
 (C) circle (D) none of these
16. The ends of a diagonal of a square are (2, -3) and  $(-1, 1)$ . Another vertex of the square can be  
 (A)  $(-3/2, -5/2)$  (B)  $(-5/2, 3/2)$   
 (C)  $(1/2, 5/2)$  (D) None of these
17. If the equations of the three sides of a triangle are  $2x + 3y = 1$ ,  $3x - 2y + 6 = 0$  and  $x + y = 1$ , then the orthocentre of the triangle lies on the line  
 (A)  $13x + 13y = 1$  (B)  $169x + 26y = -178$   
 (C)  $169x + y = 0$  (D) none of these.
18. The orthocentre of the triangle formed by the lines  $2x^2 + 3xy - 2y^2 - 9x + 7y - 5 = 0$   $4x + 5y - 3 = 0$  lies at  
 (A)  $(3/5, 11/5)$  (B)  $(6/5, 11/5)$   
 (C)  $(5/6, 11/5)$  (D) None of these
19. The number of lines that can be drawn from the point (2, 3), so that its distance from  $(-1, 6)$  is equal to 6, is  
 (A) 1 (B) 2  
 (C) 0 (D) infinite
20. If  $\triangle OAB$  is an equilateral triangle (O is the origin and A is a point on the x-axis), then centroid of the triangle will be  
 (A) always rational (B) rational if B is rational  
 (C) rational if A is rational (D) never rational  
**(a point P(x, y) is said to be rational if both x and y are rational)**
21. Equation of a straight line passing through the point (4, 5) and equally inclined to the lines  $3x = 4y + 7$  and  $5y = 12x + 6$  is  
 (A)  $9x - 7y = 1$  (B)  $9x + 7y = 71$   
 (C)  $7x - 9y = 73$  (D)  $7x - 9y + 17 = 0$
22. Two vertices of a triangle are (5, -1) and (-2, 3). If the orthocentre of the triangle is the origin, then the third vertex is  
 (A)  $(-4, 7)$  (B)  $(-4, -7)$  (C)  $(4, -7)$  (D)  $(4, 7)$
23. Drawn from the origin are two mutually perpendicular lines forming an isosceles triangle with the straight line  $2x + y = a$ . Then the area of this triangle is .....

24. Two particles start from the same point  $(2, -1)$ , one moving 2 units along the line  $x + y = 1$  and the other 5 units along the line  $x - 2y = 4$ . If the particles move towards increasing  $y$ , then their new positions are ....., .....
25. The points  $(\alpha, \beta)$ ,  $(\gamma, \delta)$ ,  $(\alpha, \delta)$  and  $(\gamma, \beta)$  where  $\alpha, \beta, \gamma, \delta$  are different real numbers, are  
 (A) collinear (B) vertices of square  
 (C) vertices of rhombus (D) concyclic
26. A ray travelling along the line  $3x - 4y = 5$  after being reflected from a line  $l$  travels along the line  $5x + 12y = 13$ . Then the equation of line  $l$  is  
 (A)  $x + 8y = 0$  (B)  $x = 8y + 3$   
 (C)  $32x + 4y = 65$  (D)  $32x - 4y + 65 = 0$
27. A light ray emerging from the point source placed at  $P(2, 3)$  is reflected at a point 'Q' on the  $y$ -axis and then passes through the point  $R(5, 10)$ . Co-ordinates of 'Q' is  
 (A)  $(0, 3)$  (B)  $(0, 2)$   
 (C)  $(0, 5)$  (D) none of these
28. Equation  $ax^2 + 2hxy + by^2 = 0$  represents a pair of lines combined equation of lines that can be obtained by reflecting these lines about the  $x$ -axis is  
 (A)  $ax^2 - 2hxy + by^2$  (B)  $bx^2 - 2hxy + ay^2 = 0$   
 (C)  $bx^2 + 2hxy + ay^2$  (D) none of these
29. Let  $A(x_1, y_1)$ ,  $B(x_2, y_2)$  and  $C(x_3, y_3)$  be three points such that abscissae and ordinates form 2 different A.P.'s. Then these points  
 (A) form an equilateral triangle (B) are collinear  
 (C) are concyclic (D) none of these
30.  $a, b, c$  are in A.P. and  $ax + by + c = 0$  represents the family of line. Equation of line of this family passing through  $P(\alpha, \beta)$ ; where  $\alpha =$  values of ' $x$ ' where  $\frac{x^2 - 1}{x^2 + 1}$  has the least value and  $\beta = \int_{-1}^1 (x - [x])dx$ ; is  
 (A)  $3x + y - 1 = 0$  (B)  $x + y + 1 = 0$   
 (C)  $3x - 2y - 7 = 0$  (D) none of these
31. The co-ordinates of the vertices of rectangle ABCD; where  $A(0, 0)$ ,  $B(4, 0)$ ,  $C(4, 2)$ ,  $D(0, 2)$  undergoes following '3' successive transformations  
 a.  $(x, y) \rightarrow (y, x)$  b.  $(x, y) \rightarrow (x + 3y, y)$   
 c.  $(x, y) \rightarrow \left(\frac{x-y}{2}, \frac{x+y}{2}\right)$   
 Then the final figure formed will be  
 (A) a square (B) a rhombus  
 (C) a rectangle (D) a parallelogram

### LEVEL-III

1. If the straight lines  $ax + by + p = 0$  and  $x \cos \alpha + y \sin \alpha = p$  are inclined at an angle  $\pi/4$  and concurrent with the straight line  $x \sin \alpha - y \cos \alpha = 0$ , then the value of  $a^2 + b^2$  is  
 (A) 0 (B) 1  
 (C) 2 (D) none of these .
2. If one vertex of an equilateral triangle of side 2 is the origin and another vertex lies on the line  $x = \sqrt{3}y$ , then the third vertex can be  
 (A) (0, 2) (B)  $(-\sqrt{3}, -1)$   
 (C)  $(-2, -2)$  (D)  $(\sqrt{3}, 1)$
3. The locus of a point which divides a line segment  $AB = 4\text{cm}$  in  $1 : 2$ , where A lies on the line  $y = x$  and B lies on the  $y = 2x$  is  
 (A)  $234x^2 + 153y^2 - 378xy - 32 = 0$  (B)  $234x^2 + 153y^2 - 378xy + 32 = 0$   
 (C)  $234x^2 + 153y^2 + 378xy + 32 = 0$  (D) None of these
4. All points lying inside the triangle formed by the points (1, 3), (5, 0) and  $(-1, 2)$  satisfy  
 (A)  $3x + 2y \geq 0$  (B)  $2x + y - 13 \geq 0$   
 (C)  $2x - 3y - 12 \geq 0$  (D)  $-2x + y \geq 0$
5. A family of lines is given by  $(1 + 2\lambda)x + (1 - \lambda)y + \lambda = 0$ ,  $\lambda$  being the parameter. The line belonging to this family at the maximum distance from the point (1, 4) is  
 (A)  $4x - y + 1$  (B)  $12x + 33y = 7$   
 (C)  $13x + 12y + 9 = 0$  (D) none of these
6. If  $A \equiv (0, 1)$  and  $B(2, 0)$  be two points and 'P' be a point on the line  $4x + 3y + 9 = 0$ . Co-ordinates of the point 'P' such that  $|PA - PB|$  is minimum is  
 (A)  $\left(\frac{3}{20}, -\frac{14}{5}\right)$  (B)  $\left(-\frac{3}{20}, \frac{14}{5}\right)$   
 (C)  $\left(\frac{3}{20}, -\frac{12}{5}\right)$  (D)  $\left(-\frac{24}{5}, \frac{17}{5}\right)$
7. Consider the points A (0, 1) and B (2, 0). 'P' be a point on the line  $4x + 3y + 9 = 0$  Co-ordinates of the point 'P' such that  $|PA - PB|$  is maximum, is  
 (A)  $\left(\frac{-12}{5}, \frac{17}{5}\right)$  (B)  $\left(\frac{24}{5}, \frac{-17}{5}\right)$   
 (C)  $\left(\frac{-24}{5}, \frac{17}{5}\right)$  (D)  $\left(\frac{12}{5}, \frac{-17}{5}\right)$
8. A straight line passing through P (3, 1) meet the co-ordinate axes at 'A' and 'B'. It is given that distance of this straight line from the origin 'O' is maximum. Area of  $\Delta OAB$  is equal to  
 (A)  $\frac{50}{3}$  sq. units (B)  $\frac{100}{3}$  sq. units  
 (C)  $\frac{25}{3}$  sq. units (D) 1 sq. units
9. Consider the points A (0, 1) and B (2, 0) P be a point on the line  $y = x$ . Co-ordinates of the point 'P' such that  $PA + PB$  is minimum, is  
 (A)  $(2/3, 2/3)$  (B)  $(3/2, 3/2)$   
 (C)  $(1, 1/2)$  (D)  $(-2, 2)$

10. Consider the points A (3, 4) and B (4, 13). If 'P' be a point on the line  $y = x$  such that  $PA + PB$  is minimum, then 'P' is
- (A)  $\left(\frac{-31}{7}, \frac{-31}{7}\right)$  (B)  $\left(\frac{31}{7}, \frac{31}{7}\right)$   
 (C)  $\left(\frac{13}{7}, \frac{13}{7}\right)$  (D)  $\left(\frac{23}{7}, \frac{23}{7}\right)$
11. Equation  $ax^2 + 2bxy + by^2 = 0$  represents a pair of lines. Combined equation of lines that can be obtained by reflecting these lines about the  $x$ -axis is
- (A)  $b x^2 - 2 b x y + a y^2 = 0$  (B)  $a x^2 + 2 b x y + b y^2 = 0$   
 (C)  $b x^2 + 2 b x y + a y^2 = 0$  (D)  $a x^2 - 2 b x y + b y^2 = 0$
12. If the point P ( $a, a^2$ ) lies completely inside the triangle formed by the lines  $x = 0$ ,  $y = 0$  and  $x + y = 2$ , then exhaustive range of 'a' is
- (A)  $a \in (0, 2)$  (B)  $a \in (0, 1)$   
 (C)  $a \in (1, \sqrt{2})$  (D)  $a \in (-\sqrt{2}, 1)$
13. Equation of the straight line belonging to the family of lines  $(x + y) + \lambda (2x - y + 1) = 0$ , that is farthest from (1, -3) is
- (A)  $13y - 6x = 7$  (B)  $13y + 6x = 0$   
 (C)  $15y + 6x = 7$  (D)  $15y - 6x = 7$
14. If  $a < b < c < d$  and 'k' is the number of real roots of the equation  $(x - a)(x - c) + 2(x - b)(x - d) = 0$ , then equation of the line parallel to  $y$ -axis and cutting an intercept 'k' on  $x$ -axis is,
- (A)  $x = 0$  (B)  $x = 1$   
 (C)  $x = 2$  (D) None of these
15. If  $a, b, c$  are in A. P., then the straight lines  $ax + 2y + 1 = 0$ ,  $bx + 3y + 1 = 0$  and  $cx + 4y + 1 = 0$
- (A) are concurrent (B) form a triangle  
 (C) are parallel (D) Can't say
16. If  $a, b, c$  are in A. P. then the image of the point of intersection of the family of lines  $ax + by + c = 0$  in the line  $y = 0$  lies on the line
- (A)  $x + 2y - 5 = 0$  (B)  $2x + y = 0$   
 (C)  $3x + 4y + 5 = 0$  (D)  $3x + 4y - 11 = 0$
17. If  $f(x) = \frac{\log(1+ax) - \log(1-bx)}{x}$ ,  $x \neq 0$  and is continuous at  $x = 0$ ,  
 $= -c$ ,  $x = 0$   
 then the line  $ax + by + c = 0$  passes through the point
- (A) (1, -1) (B) (-1, 1)  
 (C) (-1, -1) (D) (1, 1)
18. If  $m = \left(\frac{i+\sqrt{3}}{2}\right)^{200} + \left(\frac{i-\sqrt{3}}{2}\right)^{200}$ , then equation of the image of the line having slope 'm' and passing through (0, 0) in the  $x$ -axis is
- (A)  $x - y = 0$  (B)  $x + y = 0$   
 (C)  $2x - 3y = 0$  (D)  $2x + 3y = 0$
19. If  $3a + 4b + 2c = 0$ , then the point of concurrent of the family of lines  $ax + by + c = 0$  and (1, 2) are
- (A) on the same sides of the line  $4x - y + 1 = 0$   
 (B) on the opposite side of the line  $4x - y + 1 = 0$   
 (C) are at equal distances from the origin.  
 (D) None of these

20. If  $a, b, c$  are three consecutive integers, then the family of lines  $ax + by + c = 0$  are concurrent at the point,
- (A)  $(1, 2)$  (B)  $(-2, 1)$   
(C)  $(1, -2)$  (D) None of these

# ANSWERS

## LEVEL -I

- |   |              |       |                     |
|---|--------------|-------|---------------------|
| 1. D  | 2. D         | 3. A  | 4. D                |
| 5. C  | 6. B         | 7. C  | 8. D                |
| 9. B  | 10. A        | 11. A | 12. A               |
| 13. C                                       | 14. A        | 15. C | 16. A               |
| 17. D                                       | 18. C        | 19. B | 20. D               |
| 21. B                                       | 22. B        |       |                     |
| 23. B                                       | 24. A        |       |                     |
| 25. C                                       | 26. D        |       |                     |
| 27. A                                       | 28. A        |       |                     |
| 29. A                                       | 30. A        | 31. B | 32. C               |
| 33. C                                       | 34. D        | 35. A | 36. A               |
| 37. B                                       | 38. A        | 39. C | 40. C               |
| 41. B                                       | 42. A        | 43. A | 44. D               |
| 45. A                                       | 46. B        | 47. B | 48. C               |
| 49. A                                       | 50. B        | 51. A |                     |
| 52. B                                       | 53. C        | 54. A | 55. B               |
| 56. C                                       | 57. C        | 58. B | 59. B               |
| 60. A                                       | 61. A        | 62. B | 63. C               |
| 64. A                                       | 65. D        | 66. A | 67. B               |
| 68. $\sqrt{2}$                              | 69. -1, 1/2  | 70. 1 | 71. $a \in (-4, 2)$ |
| 72. $\left(\frac{3}{2}, \frac{1}{2}\right)$ | 73. $y = 2x$ | 74. B | 75. A               |
| 76. C                                       |              |       |                     |

## LEVEL -II

- |                     |   |       |       |
|---------------------|---|-------|-------|
| 1. C                | 2. A  | 3. C  | 4. A  |
| 5. C                | 6. D  | 7. A  | 8. C  |
| 9. D                | 10. A, B  | 13. B | 14. C |
| 15. D               | 16. A   | 17. B | 18. A |
| 19. C               | 20. D   | 21. A | 22. B |
| 23. $\frac{a^2}{5}$ | 24. $(2 - \sqrt{2}, \sqrt{2} - 1)$ and $\left(2 + \frac{4}{\sqrt{5}}, -1 + \frac{2}{\sqrt{5}}\right)$ |       |       |
| 25. D               | 26.   | 27. C | 28. A |
| 29. B               | 30. A   | 31. D | 32. D |

## LEVEL -III

- |       |       |       |       |
|-------|-------|-------|-------|
| 1. C  | 2. A  | 3. A  | 4. C  |
| 5. B  | 6. D  | 7. d  | 8. A  |
| 9. A  | 10. B | 11. D | 12. B |
| 13. D | 14. C | 15. a | 16. A |
| 17. D | 18. b | 19. A | 20. C |