



## MATHS

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### STRAIGHT LINES

#### Illustration

1. Find the equation of line passing through point (2,3) which is

(i) parallel of the x-axis

(ii) parallel to the y-axis



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2. Find the equation of line passing through point (2,-5) which is

(i) parallel to the line  $3x + 2y - 4 = 0$

(ii) perpendicular to the line  $3x + 2y - 4 = 0$



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3. Find the equation of the perpendicular bisector of the line segment joining the points  $A(2, 3)$  and  $B(6, -5)$ .



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4. Find the locus of a point  $P$  which moves such that its distance from the line  $y = \sqrt{3}x - 7$  is the same as its distance from  $(2\sqrt{3}, -1)$



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5. Consider a triangle with vertices  $A(1, 2)$ ,  $B(3, 1)$ , and  $C(-3, 0)$ . Find the equation of altitude through vertex  $A$  the equation of median through vertex  $A$  the equation of internal angle bisector of  $\angle A$



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6. Find the coordinates of the foot of the perpendicular drawn from the point P(1,-2) on the line  $y = 2x + 1$ . Also, find the image of P in the line.



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7. If the line  $\left(\frac{x}{a}\right) + \left(\frac{y}{b}\right) = 1$  moves in such a way that  $\left(\frac{1}{a^2}\right) + \left(\frac{1}{b^2}\right) = \left(\frac{1}{c^2}\right)$ , where  $c$  is a constant, prove that the foot of the perpendicular from the origin on the straight line describes the circle  $x^2 + y^2 = c^2$ .



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8. In what ratio does the line joining the points (2, 3) and (4, 1) divide the segment joining the points (1, 2) and (4, 3)?



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9.  $ABCD$  is a square whose vertices are  $A(0, 0)$ ,  $B(2, 0)$ ,  $C(2, 2)$ , and  $D(0, 2)$ . The square is rotated in the  $XY$  - plane through an angle  $30^\circ$  in the anticlockwise sense about an axis passing through  $A$  perpendicular to the  $XY$  - plane. Find the equation of the diagonal  $BD$  of this rotated square.



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10. In a triangle  $ABC$ , side  $AB$  has equation  $2x + 3y = 29$  and side  $AC$  has equation  $x + 2y = 16$ . If the midpoint of  $BC$  is  $(5, 6)$ , then find the equation of  $BC$ .



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11. Two consecutive sides of a parallelogram are  $4x + 5y = 0$  and  $7x + 2y = 0$ . If the equation of one diagonal is  $11x + 7y = 9$ , find the equation of the other diagonal.



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12. If one of the sides of a square is  $3x - 4y - 12 = 0$  and the center is  $(0, 0)$ , then find the equations of the diagonals of the square.



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13. A vertex of an equilateral triangle is  $2, 3$  and the opposite side is  $x + y = 2$ . Find the equations of other sides.



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14. A line  $4x + y = 1$  passes through the point  $A(2, -7)$  and meets line BC at B whose equation is  $3x - 4y + 1 = 0$ , the equation of line AC such that  $AB = AC$  is (a)  $52x + 89y + 519 = 0$  (b)  $52x + 89y - 519 = 0$  (c)  $82x + 52y + 519 = 0$  (d)  $89x + 52y - 519 = 0$



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15. A ray of light is sent along the line  $x - 2y - 3 = 0$  upon reaching the line  $3x - 2y - 5 = 0$ , the ray is reflected from it. Find the equation of the line containing the reflected ray.

A. (a)  $2x - 29y - 30 = 0$

B. (b)  $29x - 2y - 31 = 0$

C. (c)  $3x - 39y + 37 = 0$

D. (d)  $31x - 3y + 37 = 0$

**Answer:**



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16. Find the equation of the line which intersects the y-axis at a distance of 2 units above the origin and makes an angle of  $30^\circ$  with the positive direction of the x-axis.



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17. Find the equation of a straight line cutting off an intercept -1 from y-axis and being equally inclined to the axes.



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18. Find the equation of a line that has y-intercept 4 and is perpendicular to the line joining  $(2, -3)$  and  $(4, 2)$ .



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19. Find equation of the line passing through the point  $(2, 2)$  and cutting off intercepts on the axes whose sum is 9.



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20. Find the equation of the straight line that (i) makes equal intercepts on the axes and passes through the point  $(2, 3)$  (ii) passes through the

point  $(-5;4)$  and is such that the portion intercepted between the axes is divided by the point in the ratio  $1:2$



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**21.** Line segment AB of fixed length  $c$  slides between coordinate axes such that its ends A and B lie on the axes. If O is origin and rectangle OAPB is completed, then show that the locus of the foot of the perpendicular drawn from P to AB is  $x^{\frac{2}{3}} + y^{\frac{2}{3}} = c^{\frac{2}{3}}$ .



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**22.** Reduce the line  $2x - 3y + 5 = 0$  in slope-intercept, intercept, and normal forms.



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**23.** Find the equation of the line which satisfy the given conditions :  
Perpendicular distance from the origin is 5 units and the angle made by the perpendicular with the positive xaxis is  $30^\circ$  .



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**24.** A straight line is drawn through the point P(2,3) and is inclined at an angle of  $30^\circ$  with the x-axis . Find the coordinates of two points on it at a distance 4 from point P.



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**25.** The line joining two points A(2,0) and B(3,1) is rotated about A in anticlockwise direction through an angle of  $15^\circ$  . find the equation of line in the new position. If B goes to C in the new position what will be the coordinates of C.



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**26.** A line through point  $A(1,3)$  and parallel to the line  $x-y+1=0$  meets the line  $2x-3y+9=0$  at point  $P$ . Find distance  $AP$  without finding point  $P$ .



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**27.** Two adjacent vertices of a square are  $(1, 2)$  and  $(-2, 6)$ . Find the other vertices.



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**28.** A Line through the variable point  $A(1+k, 2k)$  meets the lines  $7x+y-16=0$ ;  $5x-y-8=0$  and  $x-5y+8=0$  at  $B, C, D$  respectively. Prove that  $AC, AB$  and  $AD$  are in HP.



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29. if  $P$  is the length of perpendicular from origin to the line  $\frac{x}{a} + \frac{y}{b} = 1$  then prove that  $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2}$



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30. Find the coordinates of a point on  $x + y + 3 = 0$ , whose distance from  $x + 2y + 2 = 0$  is  $\sqrt{5}$ .



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31. Find the least and greatest values of the distance of the point  $(\cos \theta, \sin \theta)$ ,  $\theta \in R$ , from the line  $3x - 4y + 10 = 0$ .



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32. Prove that the product of the lengths of the perpendiculars drawn from the points  $(\sqrt{a^2 - b^2}, 0)$  and  $(-\sqrt{a^2 - b^2}, 0)$  to the line  $\frac{x}{a} \cos \theta$

$$+ \frac{y}{b} \sin \theta = 1 \text{ is } b^2.$$



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**33.** Find the least value of  $(x - 1)^2 + (y - 2)^2$  under the condition  $3x + 4y - 2 = 0$ .



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**34.**  $ABC$  is an equilateral triangle with  $A(0, 0)$  and  $B(a, 0)$ , ( $a > 0$ ).  $L$ ,  $M$  and  $N$  are the foot of the perpendiculars drawn from a point  $P$  to the side  $AB$ ,  $BC$ , and  $CA$ , respectively. If  $P$  lies inside the triangle and satisfies the condition  $PL^2 = PM^2 + PN^2$ , then find the locus of  $P$ .



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

A. (a)  $a^2 + b^2 = p^2 + q^2$

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

C. (c)  $a^2 + p^2 = b^2 + q^2$

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

**Answer:**



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**36.** Two sides of a square lie on the lines  $x + y = 1$  and  $x + y + 2 = 0$ .

What is its area?



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**37.** Find equation of the line which is equidistant from parallel lines  $9x + 6y - 7 = 0$  and  $3x + 2y + 6 = 0$ .



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**38.** If one side of the square is  $2x - y + 6 = 0$ , then one of the vertices is  $(2, 1)$ . Find the other sides of the square.



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**39.** Prove that the area of the parallelogram contained by the lines  $4y - 3x - a = 0$ ,  $3y - 4x + a = 0$ ,  $4y - 3x - 3a = 0$ , and  $3y - 4x + 2a = 0$  is  $\left(\frac{2}{7}\right)a^2$ .



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40. The equation of straight line passing through  $(-2, -7)$  and having an intercept of length 3 between the straight lines :  $4x + 3y = 12$  ,  $4x + 3y = 3$  are :

(A)  $7x + 24y + 182 = 0$

(B)  $7x + 24y + 18 = 0$

(C)  $x + 2 = 0$

(D)  $x - 2 = 0$



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41. A line  $L$  is drawn from  $P(4, 3)$  to meet the lines  $L_1$  and  $L_2$  given by  $3x + 4y + 5 = 0$  and  $3x + 4y + 15 = 0$  at points  $A$  and  $B$ , respectively. From  $A$ , a line perpendicular to  $L$  is drawn meeting the line  $L_2$  at  $A_1$ . Similarly, from point  $B$ , a line perpendicular to  $L$  is drawn meeting the line  $L_1$  at  $B_1$ . Thus, a parallelogram  $AA_1BB_1$  is formed. Then the equation of  $L$  so that the area of the parallelogram  $AA_1BB_1$  is the least is  $x - 7y + 17 = 0$   $7x + y + 31 = 0$   $x - 7y - 17 = 0$   $x + 7y - 31 = 0$



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42. Are the points  $(3, 4)$  and  $(2, -6)$  on the same or opposite sides of the line  $3x - 4y = 8$ ?



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



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44. If the point  $(a^2, a + 1)$  lies in the angle between the lines  $3x - y + 1 = 0$  and  $x + 2y - 5 = 0$  containing the origin, then find the value of  $a$ .



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45. If the point  $(a, a)$  is placed in between the lines  $|x + y| = 4$ , then find the values of  $a$ .



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46. The complete set of real values of 'a' such that the point lies triangle  $p(a, \sin a)$  lies inside the triangle formed by the lines  $x - 2y + 2 = 0$ ;  $x + y = 0$  and  $x - y - \pi = 0$



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47. Find  $\alpha$  if  $(\alpha, \alpha^2)$  lies inside the triangle having sides along the lines  $2x+3y=1$ ,  $x+2y-3=0$ ,  $6y=5x-1$ .



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48. Sketch the region in which the points satisfying the following inequality lie.

$$(i) 2x - 3y - 5 > 0 \quad (ii) -3x + 4y + 7 > 0$$

$$(iii) x > 2 \quad (iv) y > -3$$



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**49.** Sketch the origin in which the points satisfying the following inequalities lie.

$$(i) |x + y| < 2 \quad (ii) |2x - y| > 3 \quad (iii) |x| > |y|$$



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**50.** Find the values of  $b$  for which the points  $(2b + 3, b^2)$  lies above of the line  $3x - 4y - a(a - 2) = 0 \quad \forall a \in R$ .



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**51.** Plot the region of the points  $P(x, y)$  satisfying  $|x| + |y| < 1$ .



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52. Plot the region of the points  $P(x,y)$  satisfying  $2 > \max.$

$$\{|x|, |y|\}.$$



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53. If one of the vertices of a square is  $(3,2)$  and one of the diagonals is along the line  $3x+4y+8=0$ , then find the centre of the square and other vertices.



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54. In  $\triangle ABC$ , vertex  $A$  is  $(1, 2)$ . If the internal angle bisector of  $\angle B$  is  $2x - y + 10 = 0$  and the perpendicular bisector of  $AC$  is  $y = x$ , then find the equation of  $BC$



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55. Find the locus of image of the variable point  $(\lambda^2, 2\lambda)$  in the line mirror  $x-y+1=0$ , where  $\lambda$  is a parameter.



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56. Lines  $L_1 \equiv ax + by + c = 0$  and  $L_2 \equiv lx + my + n = 0$  intersect at the point  $P$  and make an angle  $\theta$  with each other. Find the equation of a line different from  $L_2$  which passes through  $P$  and makes the same angle  $\theta$  with  $L_1$ .



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57. For the straight lines  $4x + 3y - 6 = 0$  and  $5x + 12y + 9 = 0$ , find the equation of the bisector of the obtuse angle between them, bisector of the acute angle between them, and bisector of the angle which contains  $(1, 2)$



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**58.** The equations of bisectors of two lines  $L_1$  &  $L_2$  are  $2x - 16y - 5 = 0$  and  $64x + 8y + 35 = 0$ . If the line  $L_1$  passes through  $(-11, 4)$ , the equation of acute angle bisector of  $L_1$  &  $L_2$  is:



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**59.** If  $x + y = 0$  is the angle bisector of the angle containing the point  $(1, 0)$ , for the line  $3x + 4y + b = 0$ ;  $4x + 3y + b = 0$ ,  $4x + 3y - b = 0$  then find the range of  $b$



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**60.** Two equal sides of an isosceles triangle are given by  $7x - y + 3 = 0$  and  $x + y = 3$ , and its third side passes through the point  $(1, -10)$ . Find the equation of the third side.



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61. The vertices  $B$  and  $C$  of a triangle  $ABC$  lie on the lines  $3y = 4x$  and  $y = 0$ , respectively, and the side  $BC$  passes through the point  $\left(\frac{2}{3}, \frac{2}{3}\right)$ . If  $ABOC$  is a rhombus lying in the first quadrant,  $O$  being the origin, find the equation of the line  $BC$ .



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62. Two sides of a rhombus lying in the first quadrant are given by  $3x - 4y = 0$  and  $12x - 5y = 0$ . If the length of the longer diagonal is 12, then find the equations of the other two sides of the rhombus.



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63. If the line  $ax + by = 1$  passes through the point of intersection of  $y = x \tan \alpha + p \sec \alpha$ ,  $y \sin(30^\circ - \alpha) - x \cos(30^\circ - \alpha) = p$ , and is inclined at  $30^\circ$  with  $y = \tan \alpha x$ , then prove that  $a^2 + b^2 = \frac{3}{4p^2}$ .



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64. Find the value of  $\lambda$ , if the line  $3x - 4y - 13 = 0$ ,  $8x - 11y - 33 = 0$  and  $2x - 3y + \lambda = 0$  are concurrent.



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65. If the lines  $a_1x + b_1y + 1 = 0$ ,  $a_2x + b_2y + 1 = 0$  and  $a_3x + b_3y + 1 = 0$  are concurrent, show that the point  $(a_1, b_1)$ ,  $(a_2, b_2)$  and  $(a_3, b_3)$  are collinear.



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66. Show that the straight lines given by  $x(a + 2b) + y(a + 3b) = a + b$  for different values of  $a$  and  $b$  pass through a fixed point.



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**67.** Let  $ax + by + c = 0$  be a variable straight line, where  $a, b$  and  $c$  are the 1st, 3rd, and 7th terms of an increasing AP, respectively. Then prove that the variable straight line always passes through a fixed point. Find that point.



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**68.** Prove that all the lines having the sum of the intercepts on the axes equal to half of the product of the intercepts pass through the point. Find the fixed point.



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**69.** Find the straight line passing through the point of intersection of  $2x + 3y + 5 = 0$ ,  $5x - 2y - 16 = 0$ , and through the point  $(-1, 3)$ .



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**70.** Consider a family of straight lines  $(x + y) + \lambda(2x - y + 1) = 0$ . Find the equation of the straight line belonging to this family that is farthest from  $(1, -3)$ .



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**71.** Let the sides of a parallelogram be  $U=a$ ,  $U=b$ ,  $V=a'$  and  $V=b'$ , where  $U=lx+my+n$ ,  $V=l'x+m'y+n'$ . Show that the equation of the diagonal through the point of intersection of

$$U = a, V = a' \text{ and } U = b, V = b' \text{ is given by } \begin{vmatrix} U & V & 1 \\ a & a' & 1 \\ b & b' & 1 \end{vmatrix} = 0.$$



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**72.** Find the values of non-negative real number  $h_1, h_2, h_3, k_1, k_2, k_3$  such that the algebraic sum of the perpendiculars drawn from the points  $(2, k_1), (3, k_2), (7, k_3), (h_1, 4), (h_2, 5), (h_3, -3)$  on a variable line passing through  $(2, 1)$  is zero.

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### Example

1. Show that the lines  $4x + y - 9 = 0$ ,  $x - 2y + 3 = 0$ ,  $5x - y - 6 = 0$  make equal intercepts on any line of slope 2.

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2. The equations of two sides of a triangle are  $3y - x - 2 = 0$  and  $y + x - 2 = 0$ . The third side, which is variable, always passes through the point  $(5, -1)$ . Find the range of the values of the slope of the third side, so that the origin is an interior point of the triangle.

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3. Find the locus of the circumcenter of a triangle whose two sides are along the coordinate axes and the third side passes through the point of intersection of the line  $ax + by + c = 0$  and  $lx + my + n = 0$ .



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4. Let  $ABC$  be a triangle with  $AB = AC$ . If  $D$  is the midpoint of  $BC$ ,  $E$  is the foot of the perpendicular drawn from  $D$  to  $AC$ , and  $F$  is the midpoint of  $DE$ , then prove that  $AF$  is perpendicular to  $BE$ .



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5. A diagonal of rhombus  $ABCD$  is member of both the families of lines  $(x + y - 1) + \lambda(2x + 3y - 2) = 0$  and  $(x - y + 2) + \lambda(2x - 3y + 5) = 0$  and rhombus is  $(3, 2)$ . If the area of the rhombus is  $12\sqrt{5}$  sq. units, then find the remaining vertices of the rhombus.



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



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7. 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  $AB$  such that  $\frac{(m+n)}{OP} = \frac{m}{OR} + \frac{n}{OS}$ . Show that the locus of  $P$  is a straight line passing through the point of intersection of the given lines  $R, S, R$  are on the same side of  $O$ ).



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8. Let points A, B and C lie on lines  $y-x=0$ ,  $2x-y=0$  and  $y-3x=0$ , respectively. Also, AB passes through fixed point  $P(1,0)$  and BC passes through fixed point  $Q(0,-1)$ . Then prove that AC also passes through a fixed point and find that point.



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9. 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  $2 \leq d(P, L_1) + d(P, L_2) \leq 4$ , find the area of region  $R$ .



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10. Let  $O(0, 0)$ ,  $A(2, 0)$ , and  $B\left(1, \frac{1}{\sqrt{3}}\right)$  be the vertices of a triangle. Let  $R$  be the region consisting of all those points  $P$  inside  $OAB$  which

satisfy  $d(P, OA) \leq \min [d(P, OB), d(P, AB)]$ , where  $d$  denotes the distance from the point to the corresponding line. Sketch the region  $R$  and find its area.



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11. A line through  $A(-5, -4)$  meets the lines  $x+3y+2=0$ ,  $2x+y+4=0$  and  $x-y-5=0$  at the points  $B$ ,  $C$  and  $D$  respectively. If  $\left(\frac{15}{AB}\right)^2 + \left(\frac{10}{AC}\right)^2 = \left(\frac{6}{AD}\right)^2$  find the equation of the line.



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12. 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  $R$ .



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## Concept Application Exercise 2 1

1. Find the equation of the right bisector of the line segment joining the points  $(3,4)$  and  $(-1,2)$ .



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2. What will be the tens digit of  $1!+2!+3!+\dots+49!$  ?



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3. If the coordinates of the vertices of triangle  $ABC$  are  $(-1, 6)$ ,  $(-3, -9)$  and  $(5, -8)$ , respectively, then find the equation of the median through  $C$ .



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4. Find the equation of the line perpendicular to the line  $\frac{x}{a} - \frac{y}{b} = 1$  and passing through a point at which it cuts the x-axis.



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5. If the middle points of the sides  $BC$ ,  $CA$ , and  $AB$  of triangle  $ABC$  are  $(1, 3)$ ,  $(5, 7)$ , and  $(-5, 7)$ , respectively, then find the equation of the side  $AB$ .



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6. Find the equations of the lines which pass through the origin and are inclined at an angle  $\tan^{-1} m$  to the line  $y = mx + c$ .



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7. If  $(-2, 6)$  is the image of the point  $(4, 2)$  with respect to line  $L=0$ , then  $L$  is:

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8. Find the area bounded by the curves  $x + 2|y| = 1$  and  $x = 0$ .

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9. Find the equation of the straight line passing through the intersection of the lines  $x - 2y = 1$  and  $x + 3y = 2$  and parallel to  $3x + 4y = 0$ .

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10. If the foot of the perpendicular from the origin to a straight line is at  $(3, -4)$ , then find the equation of the line.

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11. A straight line through the point  $(2, 2)$  intersects the lines  $\sqrt{3}x + y = 0$  and  $\sqrt{3}x - y = 0$  at the point  $A$  and  $B$ , respectively. Then find the equation of the line  $AB$  so that triangle  $OAB$  is equilateral.



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12. The equation of the straight line passing through the point  $(4, 3)$  and making intercepts on the co ordinate axes whose sum is  $-1$ , is



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13. A straight line through the point  $A(3, 4)$  is such that its intercept between the axes is bisected at  $A$ . Its equation is :



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14. A straight line  $L$  is perpendicular to the line  $5x - y = 1$ . The area of the triangle formed by line  $L$ , and the coordinate axes is 5. Find the equation of line  $L$ .



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15. 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.



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16. A line  $L_1 = 3y - 2x - 6 = 0$  is rotated about its point of intersection with the y-axis in the clockwise direction to make it  $L_2$  such that the area formed by  $L_1$ ,  $L_2$ , the x-axis, and line  $x = 5$  is  $\frac{49}{3}$  square units if its point of intersection with  $x = 5$  lies below the x-axis. Find the equation of  $L_2$ .



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17. The diagonals  $AC$  and  $BD$  of a rhombus intersect at  $(5, 6)$ . If  $A = (-3, 2)$ , then find the equation of diagonal  $BD$ .



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18. Find the equation of the straight line which passes through the origin and makes angle  $60^\circ$  with the line  $x + \sqrt{3}y + \sqrt{3} = 0$ .



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19. A line intersects the straight lines  $5x - y - 4 = 0$  and  $3x - 4y - 4 = 0$  at  $A$  and  $B$ , respectively. If a point  $P(1, 5)$  on the line  $AB$  is such that  $AP : PB = 2 : 1$  (internally), find point  $A$ .



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20. In the given figure, PQR is an equilateral triangle and OSPT is a square.

If  $OT = 2\sqrt{2}$  units find the equation of lines  $OT, OS, SP, QR, PR,$  and  $PQ$ .



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21. Two fixed point A and B are taken on the coordinate axes such that  $OA = a$  and  $OB = b$ . Two variable points A' and B' are taken on the same axes such that  $OA' + OB' = OA + OB$ . Find the locus of the point of intersection of AB' and A'B.



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22. A regular polygon has two of its consecutive diagonals as the lines  $\sqrt{3}x + y - \sqrt{3}$  and  $2y = \sqrt{3}$ . Point  $(1, c)$  is one of its vertices. Find the equation of the sides of the polygon and also find the coordinates of the vertices.



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**23.** Find the direction in which a straight line must be drawn through the point  $(1, 2)$  so that its point of intersection with the line  $x + y = 4$  may be at a distance of 3 units from this point.

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### Concept Application Exercise 2.2

**1.** Two particles start from point  $(2, -1)$ , one moving two units along the line  $x + y = 1$  and the other 5 units along the line  $x - 2y = 4$ , If the particle move towards increasing  $y$ , then their new positions are:

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**2.** The center of a square is at the origin and its one vertex is  $A(2, 1)$ . Find the coordinates of the other vertices of the square.

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3. The straight line passing through  $P(x_1, y_1)$  and making an angle  $\alpha$  with x-axis intersects  $Ax + By + C = 0$  in Q then  $PQ =$ \_\_\_\_\_

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4. The centroid of an equilateral triangle is  $(0,0)$ . If two vertices of the triangle lie on  $x+y = 2\sqrt{2}$ , then one of them will have its coordinates

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### Concept Application Exercise 2 3

1. Find the points on  $y$  - axis whose perpendicular distance from the line  $4x - 3y - 12 = 0$  is 3.

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2. If  $p$  and  $q$  are the lengths of the perpendiculars from the origin to the straight lines  $x \sec \alpha + y \operatorname{cosec} \alpha = a$  and  $x \cos \alpha - y \sin \alpha = a \cos 2\alpha$ , then prove that  $4p^2 + q^2 = a^2$ .



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3. Prove that the lengths of the perpendiculars from the points  $(m^2, 2m)$ ,  $(mm', m + m')$ , and  $(m'^2, 2m')$  to the line  $x + y + 1 = 0$  are in GP.



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



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5. Find the incentre of a triangle formed by the lines

$$x \cos \frac{\pi}{9} + y \sin \frac{\pi}{9} = \pi, \quad x \cos \frac{8\pi}{9} + y \sin \frac{8\pi}{9} = \pi \quad \text{and}$$
$$x \cos \frac{13\pi}{9} + y \sin \left( \frac{13\pi}{9} \right) = \pi.$$



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6. Find the equations of lines parallel to  $3x - 4y - 5 = 0$  at a unit distance from it.



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7. Find the equation of a straight line passing through the point  $(-5, 4)$  and which cuts off an intercept of  $\sqrt{2}$  units between the lines  $x + y + 1 = 0$  and  $x + y - 1 = 0$ .



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1. The point  $(8, -9)$  with respect to the lines  $2x + 3y - 4 = 0$  and  $6x + 9y + 8 = 0$  lies on

- A. (a) the same side of the lines
- B. (b) the different sides of the line
- C. (c) one of the line
- D. (d) none of these

**Answer:** Both the lines lie on the same side of point  $(8,-9)$



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2. How the following pairs of points are placed w.r.t the line  $3x-8y-7=0$ ?

(i)  $(-3, -4)$  and  $(1, 2)$       (ii)  $(-1, -1)$  and  $(3, 7)$



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3. Find the range of  $(\alpha, 2 + \alpha)$  and  $\left(\frac{3\alpha}{2}, a^2\right)$  lie on the opposite sides of the line  $2x + 3y = 6$ .



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4. If the point  $P(a^2, a)$  lies in the region corresponding to the acute angle between the lines  $2y = x$  and  $4y = x$ , then find the values of  $a$ .



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5. If  $(a, 3a)$  is a variable point lying above the straight line  $2x + y + 4 = 0$  and below the line  $x + 4y - 8 = 0$ , then find the values of  $a$ .



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6. Find the values of  $\alpha$  such that the variable point  $(\alpha, \tan\alpha)$  lies inside the triangle whose sides are

$$y = x + \sqrt{3} - \frac{\pi}{3}, x + y + \frac{1}{\sqrt{3}} + \frac{\pi}{6} = 0 \text{ and } x - \frac{\pi}{2} = 0$$



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7. Find the area of the region in which points satisfy

$$3 \leq |x| + |y| \leq 5.$$



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8. Find the area of the region formed by the points satisfying

$$|x| + |y| + |x + y| \leq 2.$$



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### Concept Application Exercise 2 5

1. Find the equation of the bisector of the obtuse angle between the lines

$$3x - 4y + 7 = 0 \text{ and } 12x + 5y - 2 = 0.$$



A. (a)  $21x + 77y - 101 = 0$

B. (b)  $99x - 27y + 81 = 0$

C. (c)  $21x - 77y + 101 = 0$

D. (d) None of the above

**Answer:  $21x+77y-101=0$**



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2. The incident ray is along the line  $3x - 4y - 3 = 0$  and the reflected ray is along the line  $24x + 7y + 5 = 0$ . Find the equation of mirrors.



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3. If the two sides of rhombus are  $x + 2y + 2 = 0$  and  $2x + y - 3 = 0$ , then find the slope of the longer diagonal.



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4. In triangle  $ABC$ , the equation of the right bisectors of the sides  $AB$  and  $AC$  are  $x + y = 0$  and  $y - x = 0$ , respectively. If  $A \equiv (5, 7)$ , then find the equation of side  $BC$ .



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5. Show that the reflection of the line  $ax + by + c = 0$  on the line  $x + y + 1 = 0$  is the line  $bx + ay + (a + b - c) = 0$  where  $a \neq b$ .



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6. The joint equation of two altitudes of an equilateral triangle is  $(\sqrt{3}x - y + 8 - 4\sqrt{3})(-\sqrt{3}x - y + 12 + 4\sqrt{3}) = 0$ . Find the third altitude equation.



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7.



A rod AB is moving on a fixed circle of radius  $R$  with constant velocity  $v$  as shown in figure. P is the point of intersection of the rod and the circle. At an instant the rod is at a distance  $x = \frac{3R}{5}$  from centre of the circle. The velocity of the rod is perpendicular to the rod and the rod is always parallel to the diameter CD.

- (i) Find the speed of point of intersection P.
- (b) Find the angular speed of point of intersection P with respect to centre of the circle.



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8. 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, then vertex A can be



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1. If  $a$  and  $b$  are two arbitrary constants, then prove that the straight line  $(a - 2b)x + (a + 3b)y + 3a + 4b = 0$  will pass through a fixed point.

Find that point.



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2. If  $a, b, c$  are in harmonic progression, then the straight line  $\left(\frac{x}{a}\right) + \left(\frac{y}{b}\right) + \left(\frac{1}{c}\right) = 0$  always passes through a fixed point. Find that point.



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3. 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 coordinate of the point P.



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4. Consider the family of lines  $5x + 3y - 2 + \lambda_1(3x - y - 4) = 0$  and  $x - y + 1 + \lambda_2(2x - y - 2) = 0$ . Find the equation of a straight line that belongs to both the families.



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5. If the straight lines  $x + y - 2 = 0$ ,  $2x - y + 1 = 0$  and  $ax + by - c = 0$  are concurrent, then the family of lines  $2ax + 3by + c = 0$  ( $a, b, c$  are nonzero) is concurrent at (a)  $(2, 3)$  (b)  $\left(\frac{1}{2}, \frac{1}{3}\right)$  (c)  $\left(-\frac{1}{6}, -\frac{5}{9}\right)$  (d)  $\left(\frac{2}{3}, -\frac{7}{5}\right)$



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Exercise Single Correct Answer Type

1. Find the equations of the diagonals of the square formed by the lines

$$x = 0, y = 0, x = 1 \text{ and } y = 1.$$

A.  $y=x, y+x=1$

B.  $y=x, x+y=2$

C.  $2y = x, y+x = 1/3$

D.  $y=2x, y+2x =1$

**Answer: A**



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2. The coordinates of two consecutive vertices A and B of a regular hexagon ABCDEF are (1,0) and (2,0) respectively. The equation of the diagonal CE is:

A.  $\sqrt{3}x + y = 4$

B.  $x + \sqrt{3}y + 4 = 0$

C.  $x + \sqrt{3}y = 4$

D. none of these

**Answer: C**



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3. If each of the points  $(x_1, 4)$ ,  $(-2, y_1)$  lies on the line joining the points  $(2, -1)$ ,  $(5, -3)$ , then the points  $P(x_1, y_1)$  lies on the line :

A.  $6(x+y)-25 = 0$

B.  $2x+6y+1=0$

C.  $2x+3y-6=0$

D.  $6(x+y)+25=0$

**Answer: B**



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4. The equation to the straight line passing through the point  $(a\cos^3\theta, a\sin^3\theta)$  and perpendicular to the line  $x\sec\theta + y\csc\theta = a$  is

A.  $x\cos\theta - y\sin\theta = a\cos 2\theta$

B.  $x\cos\theta + y\sin\theta = a\cos 2\theta$

C.  $x\sin\theta + y\cos\theta = a\cos 2\theta$

D. none of these

**Answer: A**



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5. The line  $PQ$  whose equation is  $x - y = 2$  cuts the x-axis at  $P$ , and  $Q$  is  $(4,2)$ . The line  $PQ$  is rotated about  $P$  through  $45^\circ$  in the anticlockwise direction. The equation of the line  $PQ$  in the new position is

A.  $y = -\sqrt{2}$

B.  $y=2$



C.  $x=2$

D.  $x=-2$

**Answer: C**



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6. A line moves in such a way that the sum of the intercepts made by it on the axes is always  $c$ . The locus of the mid- point of its intercept between the axes is (A)  $x + y = 2c$  (B)  $x + y = c$  (C)  $2(x + y) = c$  (D) None of these

A.  $x+y=2c$

B.  $x+y=c$

C.  $2(x+y)=c$

D.  $2x+y=c$

**Answer: C**



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7. If the x intercept of the line  $y = mx + 2$  is greater than  $\frac{1}{2}$  then the gradient of the line lies in the interval

A.  $(-1, 0)$

B.  $\left(\frac{-1}{4}, 0\right)$

C.  $(-\infty, -4)$

D.  $(-4, 0)$

**Answer: D**

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8. The equation of a straight line on which the length of perpendicular from the origin is four units and the line makes an angle of  $120^\circ$  with the x-axis is (a)  $x\sqrt{3} + y + 8 = 0$  (b)  $x\sqrt{3} - y = 8$  (c)  $x\sqrt{3} - y = 8$  (d)  $x - \sqrt{3}y + 8 = 0$

A.  $x\sqrt{3} + y + 8 = 0$

B.  $x\sqrt{3} - y = 8$

C.  $x\sqrt{3} - y = 8$

D.  $x - \sqrt{3} + 8 = 0$

**Answer: A**



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9.  $ABCD$  is a square  $A \equiv (1, 2)$ ,  $B \equiv (3, -4)$ . If line  $CD$  passes through  $(3, 8)$ , then the midpoint of  $CD$  is (a)  $(2, 6)$  (b)  $(6, 2)$  (c)  $(2, 5)$  (d)  $\left(\frac{28}{5}, \frac{1}{5}\right)$

A.  $(2, 6)$

B.  $(6, 2)$

C.  $(2, 5)$

D.  $(28/5, 1/5)$

**Answer: D**



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**10.** The equation of straight line which passes through the point  $(-4,3)$  such that the portion of the line between the axes is divided by the point in ratio  $5:3$  is -

A.  $9x-20y+96=0$

B.  $9x+20y=24$

C.  $20x+9y+53=0$

D. none of these

**Answer: A**



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11. A square of side 'a' lies above the x-axis and has one vertex at the origin. The side passing through the origin makes an angle  $\alpha$  ( $0 < \alpha' < \pi/4$ ) with the positive direction of x-axis. Find the equation of diagonal not passing through the origin ?

A.  $y(\cos\alpha + \sin\alpha) + x(\sin\alpha - \cos\alpha) = a$

B.  $y(\cos\alpha + \sin\alpha) + x(\sin\alpha + \cos\alpha) = a$

C.  $y(\cos\alpha + \sin\alpha) + x(\cos\alpha - \sin\alpha) = a$

D.  $y(\cos\alpha - \sin\alpha) - x(\sin\alpha - \cos\alpha) = a$

**Answer: C**



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12. Let  $P = (-1, 0)$ ,  $Q = (0, 0)$  and  $R = (3, 3\sqrt{3})$  be three points. The equation of the bisector of the angle PQR

A.  $(\sqrt{3}/2)x + y = 0$

B.  $x + \sqrt{3}y = 0$

C.  $\sqrt{3}x + y = 0$

D.  $x + (\sqrt{3}/2)y = 0$

**Answer: C**



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**13.** The 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)  $y = 3x - 1$

A.  $y=2x$

B.  $y=x+1$

C.  $x+2y=5$

D.  $y=3x-1$

**Answer: A**

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14. One diagonal of a square is along the line  $8x - 15y = 0$  and one of its vertex is  $(1, 2)$ . Then the equations of the sides of the square passing through this vertex are

(a)  $23x + 7y = 9, 7x + 23y = 53$

(b)  $23x - 7y + 9 = 0, 7x + 23y + 53 = 0$

(c)  $23x - 7y - 9 = 0, 7x + 23y - 53 = 0$  (d) none of these

A.  $7x - 8y + 9 = 0, 8x + 7y - 22 = 0$

B.  $9x - 8y + 7 = 0, 8x + 9y - 26 = 0$

C.  $23x - 7y - 9 = 0, 7x + 23y - 53 = 0$

D. none of these

**Answer: C**

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15. Prove that the parallelogram formed by the lines  $\frac{x}{a} + \frac{y}{b} = 1$ ,  $\frac{x}{b} + \frac{y}{a} = 1$ ,  $\frac{x}{a} + \frac{y}{b} = 2$  and  $\frac{x}{b} + \frac{y}{a} = 2$  is a rhombus.



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16. A line with positive rational slope, passes through the point A(6,0) and is at a distance of 5 units from B (1,3). The slope of line is

A.  $\frac{15}{8}$

B.  $\frac{8}{15}$

C.  $\frac{5}{8}$

D.  $\frac{8}{5}$

**Answer: B**



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17. A projectile A is projected from ground. An observer B running on ground with uniform velocity of magnitude  $v$  observes A to move along a straight line. The time of flight of A as measured by B is T. Then the range R of projectile on ground is

A.  $3x+3y-1=0$

B.  $x-3y+2=0$

C.  $5x+5y-3=0$

D. none of these

**Answer: C**



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18. Given  $A = (1, 1)$  and  $AB$  is any line through it cutting the x-axis at  $B$ . If  $AC$  is perpendicular to  $AB$  and meets the y-axis in  $C$ , then the equation of the locus of midpoint  $P$  of  $BC$  is (a)  $x + y = 1$  (b)  $x + y = 2$  (c)  $x + y = 2xy$  (d)  $2x + 2y = 1$

A.  $x+y=1$

B.  $x+y=2$

C.  $x+y=2xy$

D.  $2x+2y=1$

**Answer: A**



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**19.** The number of possible straight lines passing through point(2,3) and forming a triangle with coordiante axes whose area is 12 sq. unit is: a. one  
b. two c. three d. four

A. one

B. two

C. three

D. four

**Answer: C**



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**20.** Two parallel lines lying in the same quadrant make intercepts  $a$  and  $b$  on  $x$  and  $y$  axes, respectively, between them. The distance between the

lines is (a)  $\frac{ab}{\sqrt{a^2 + b^2}}$  (b)  $\sqrt{a^2 + b^2}$  (c)  $\frac{1}{\sqrt{a^2 + b^2}}$  (d)  $\frac{1}{a^2} + \frac{1}{b^2}$

A.  $\sqrt{a^2 + b^2}$

B.  $\frac{ab}{\sqrt{a^2 + b^2}}$

C.  $\frac{1}{\sqrt{a^2 + b^2}}$

D.  $\frac{1}{a^2} + \frac{1}{b^2}$

**Answer: B**



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21. The line  $L_1 \equiv 4x + 3y - 12 = 0$  intersects the x-and y-axes at  $A$  and  $B$ , respectively. A variable line perpendicular to  $L_1$  intersects the x- and the y-axis at  $P$  and  $Q$ , respectively. Then the locus of the circumcenter of triangle  $ABQ$  is

A.  $3x - 4y + 2 = 0$

B.  $4x + 3y + 7 = 0$

C.  $6x - 8y + 7 = 0$

D. none of these

**Answer: C**



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22. A beam of light is sent along the line  $x - y = 1$ , which after refracting from the x-axis enters the opposite side by turning through  $30^\circ$  towards the normal at the point of incidence on the x-axis. Then the equation of the refracted ray is (a)  $(2 - \sqrt{3})x - y = 2 + \sqrt{3}$  (b)

$$(2 + \sqrt{3})x - y = 2 + \sqrt{3} \quad \text{(c)} \quad (2 - \sqrt{3})x + y = (2 + \sqrt{3}) \quad \text{(d)}$$

$$y = (2 - \sqrt{3})(x - 1)$$

A.  $(2 - \sqrt{3})x - y = 2 + \sqrt{3}$

B.  $(2 + \sqrt{3})x - y = 2 + \sqrt{3}$

C.  $(2 - \sqrt{3})x + y = (2 + \sqrt{3})$

D.  $y = (2 + \sqrt{3})(x - 1)$

**Answer: D**



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**23.** The number of integral 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 2 (b) 0 (c) 4 (d) 1

A. 2

B. 0

C. 4

D. 1

**Answer: A**



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**24.** If the sum of the distances of a point from two perpendicular lines in a plane is 1, then its locus is

(a) a square (b) a circle (c) a straight line (d) two intersecting lines

A. a square

B. a circle

C. a straight line

D. two intersecting lines

**Answer: A**



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25. The equation of set of lines which are at a constant distance 2 units from the origin is

A.  $x+y+2=0$

B.  $x+y+4=0$

C.  $x\cos\alpha + y\sin\alpha = 2$

D.  $x\cos\alpha + y\sin\alpha = \frac{1}{2}$

**Answer: C**



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26. The lines  $y = m_1x$ ,  $y = m_2x$  and  $y = m_3x$  make equal intercepts on the line  $x + y = 1$ . Then

$$2(1 + m_1)(1 + m_3) = (1 + m_2)(2 + m_1 + m_3)$$

$$(1 + m_1)(1 + m_3) = (1 + m_2)(1 + m_1 + m_3)$$

$$(1 + m_1)(1 + m_2) = (1 + m_3)(2 + m_1 + m_3)$$

$$2(1 + m_1)(1 + m_3) = (1 + m_2)(1 + m_1 + m_3)$$

A.  $2(1 + m_1)(1 + m_3) = (1 + m_2)(2 + m_1 + m_3)$

B.  $(1 + m_1)(1 + m_3) = (1 + m_2)(1 + m_1 + m_3)$

C.  $(1 + m_1)(1 + m_2) = (1 + m_3)(2 + m_1 + m_3)$

D.  $2(1 + m_1)(1 + m_3) = (1 + m_2)(1 + m_1 + m_3)$

**Answer: A**



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**27.** Find the condition in  $a, b$  such that the portion of the line  $ax+by=1$ , intercepted between the lines  $ax+y=0$  and  $x + by=0$  sustains a right angle at origin.

A.  $a = b$

B.  $a+b=0$

C.  $a=2b$

D.  $2a=b$



**Answer: B**



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**28.** The area of the triangle formed by the lines  $y = ax$ ,  $x + y - a = 0$ , and  $y$ -axis is equal to

A.  $\frac{1}{2|1 + a|}$

B.  $\frac{a^2}{|1 + a|}$

C.  $\frac{1}{2} \frac{a}{|1 + a|}$

D.  $\frac{a^2}{2|1 + a|}$

**Answer: D**



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**29.** The line  $\frac{x}{a} + \frac{y}{b} = 1$  meets the  $x$ -axis at  $A$ , the  $y$ -axis at  $B$ , and the line  $y = x$  at  $C$  such, that the area of  $\Delta AOC$  is twice the area of

Delta  $BOC$ . Then the coordinates of  $C$  are  $\left(\frac{b}{3}, \frac{b}{3}\right)$  (b)  $\left(\frac{2a}{3}, \frac{2a}{3}\right)$  (c)  $\left(\frac{2b}{3}, \frac{2b}{3}\right)$  (d) none of these

A.  $\left(\frac{b}{3}, \frac{b}{3}\right)$

B.  $\left(\frac{2a}{3}, \frac{2a}{3}\right)$

C.  $\left(\frac{2b}{3}, \frac{2b}{3}\right)$

D. none of these

**Answer: C**



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30. The line  $\frac{x}{3} + \frac{y}{4} = 1$  meets the y-axis and x-axis at A and B respectively. A square  $ABCD$  is constructed on the line segment  $AB$  away from the origin. The coordinates of the vertex of the square farthest from the origin are

A. 7,3

B. 4,7

C. 6,4

D. 3,8

**Answer: B**



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**31.** The area of a parallelogram formed by the lines  $ax \pm by \pm c = 0$  is

A.  $c^2 / (ab)$

B.  $2c^2 / (ab)$

C.  $c^2 / 2ab$

D. none of these

**Answer: B**



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32. One diagonal of a square is  $3x-4y+8=0$  and one vertex is  $(-1,1)$ , then the area of square is

A.  $\frac{1}{50}$  sq.unit

B.  $\frac{1}{25}$  sq.unit

C.  $\frac{3}{50}$  sq.unit

D.  $\frac{2}{25}$  sq.unit

**Answer: D**



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33. In an isosceles triangle OAB , O is the origin and  $OA=OB=6$  . The equation of the side AB is  $x-y+1=0$  Then the area of the triangle is

A.  $2\sqrt{21}$

B.  $\sqrt{142}$

C.  $\sqrt{\frac{142}{2}}$

D.  $\sqrt{\frac{71}{2}}$

**Answer: D**



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**34.** Find the sum of the series

$$1^2 - 2^2 + 3^2 - 4^2 + \dots - \{2008\}^2 + \{2009\}^2$$

A. `

B.

C.

D.

**Answer: B**



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35. The coordinates of the foot of the perpendicular from the point  $(2, 3)$  on the line  $-y + 3x + 4 = 0$  are given by

- A.  $(37/10, -1/10)$
- B.  $(-1/10, 37/10)$
- C.  $(10/37, -10)$
- D.  $(2/3, -1/3)$

**Answer: B**



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36. The straight lines  $7x - 2y + 10 = 0$  and  $7x + 2y - 10 = 0$  form an isosceles triangle with the line  $y = 2$ . The area of this triangle is equal to (a)  $\frac{15}{7}$  sq units (b)  $\frac{10}{7}$  sq units (c)  $\frac{18}{7}$  sq units (d) none of these

- A.  $15/7$  sq. units
- B.  $10/7$  sq. units

C.  $18/7$  sq. units

D. none of these

**Answer: C**



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37. The equations of the sides of a triangle are  $x + y - 5 = 0$ ,  $x - y + 1 = 0$ , and  $y - 1 = 0$ . Then the coordinates of the circumcentre are

A. 2,1

B. 1,2

C. 2,-2

D. 1,-2

**Answer: A**



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38. The equations of the sides of a triangle are  $x + y - 5 = 0$ ,  $x - y + 1 = 0$ , and  $y - 1 = 0$ . Then the coordinates of the circumcentre are

A.  $(-\infty, -4/3) \cup (4/3, +\infty)$

B.  $(-4/3, 4/3)$

C.  $(-3/4, 4/3)$

D. none of these

**Answer: A**



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39. The range of values of  $\theta$  in the interval  $(0, \pi)$  such that the points  $(3, 5)$  and  $(\sin \theta, \cos \theta)$  lie on the same side of the line  $x + y - 1 = 0$ , is

A.  $0 < \theta < \frac{\pi}{4}$



B.  $0 < \theta < \frac{\pi}{2}$

C.  $0 < \theta < \pi$

D.  $\frac{\pi}{4} < \theta < \frac{3\pi}{4}$

**Answer: B**



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**40.** Distance of origin from the line  $(1 + \sqrt{3})y + (1 - \sqrt{3})x = 10$  along the line  $y = \sqrt{3}x + k$  (1)  $\frac{2}{\sqrt{5}}$  (2)  $5\sqrt{2} + k$  (3) 10 (4) 5

A.  $\frac{5}{\sqrt{2}}$

B.  $5\sqrt{2} + k$

C. 10

D. 5

**Answer: D**



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41. Consider the points  $A(0, 1)$  and  $B(2, 0)$ , and  $P$  be a point on the line  $4x + 3y + 9 = 0$ . The coordinates of  $P$  such that  $|PA - PB|$  is maximum are (a)  $\left(-\frac{24}{5}, \frac{17}{5}\right)$  (b)  $\left(-\frac{84}{5}, \frac{13}{5}\right)$  (c)  $\left(\frac{31}{7}, \frac{31}{7}\right)$  (d)  $(-3, 0)$



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42. Consider the point  $A(3, 4)$  and  $B(7, 13)$ . If  $P$  be a point on the line  $y = x$ , the co-ordinate of point  $P$  if  $PA + PB$  is minimum.

A.  $(12/7, 12/7)$

B.  $(-24/5, 17/5)$

C.  $(31/7, 31/7)$

D.  $(0, 0)$

Answer: C



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43. The area enclosed by  $2|x| + 3|y| \leq 6$  is (a) 3 sq. units (b) 4 sq. units  
12 sq. units (d) 24 sq. units

A. 3 sq. units

B. 4 sq. units

C. 12 sq. units

D. 24 sq. units

**Answer: C**



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44.  $ABC$  is a variable triangle such that  $A$  is  $(1, 2)$ , and  $B$  and  $C$  on the line  $y = x + \lambda$  ( $\lambda$  is a variable). Then the locus of the orthocentre of triangle  $ABC$  is  $x + y = 0$  (b)  $x - y = 0$   $x^2 + y^2 = 4$  (d)  $x + y = 3$

A.  $x+y=0$

B.  $x-y=0$

C.  $x^2 + y^2 = 4$

D.  $x+y=3$

**Answer: D**



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**45.** In  $ABC$ , the coordinates of the vertex  $A$  are  $(4, -1)$ , and lines  $x - y - 1 = 0$  and  $2x - y = 3$  are the internal bisectors of angles  $B$  and  $C$ . Then, the radius of the encircle of triangle  $ABC$  is (a)  $\frac{4}{\sqrt{5}}$  (b)  $\frac{3}{\sqrt{5}}$  (c)  $\frac{6}{\sqrt{5}}$  (d)  $\frac{7}{\sqrt{5}}$

A.  $4/\sqrt{5}$

B.  $3/\sqrt{5}$

C.  $6/\sqrt{5}$

D.  $7/\sqrt{5}$

**Answer: C**



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**46.**  $P$  is a point on the line  $y + 2x = 1$ , and  $Q$  and  $R$  two points on the line  $3y + 6x = 6$  such that triangle  $PQR$  is an equilateral triangle. The length of the side of the triangle is

A.  $2/\sqrt{15}$

B.  $3/\sqrt{5}$

C.  $4/\sqrt{5}$

D. none of these

**Answer: A**



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47. If the equation of base of an equilateral triangle is  $2x - y = 1$  and the vertex is  $(-1, 2)$ , then the length of the sides of the triangle is

A.  $\sqrt{20/3}$

B.  $2/\sqrt{15}$

C.  $\sqrt{8/15}$

D.  $\sqrt{15/2}$

**Answer: A**



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48. The locus of a point that is equidistant from the lines  $x + y - 2\sqrt{2} = 0$  and  $x + y - \sqrt{2} = 0$  is (a)  $x + y - 5\sqrt{2} = 0$  (b)  $x + y - 3\sqrt{2} = 0$  (c)  $2x + 2y - 3\sqrt{2} = 0$  (d)  $2x + 2y - 5\sqrt{5} = 0$

A.  $x + y - 5\sqrt{2} = 0$

B.  $x + y - 3\sqrt{2} = 0$

C.  $2x + 2y - 3\sqrt{2} = 0$

D.  $2x + 2y - 5\sqrt{2} = 0$

**Answer: C**



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**49.** 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

**Answer: C**



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50. A line of fixed length 2 units moves so that its ends are on the positive x-axis and that part of the line  $x + y = 0$  which lies in the second quadrant. Then the locus of the midpoint of the line has equation.

A.  $x^2 + 5y^2 + 4xy - 1 = 0$

B.  $x^2 + 5y^2 + 4xy + 1 = 0$

C.  $x^2 + 5y^2 - 4xy - 1 = 0$

D.  $x^2 + 5y^2 - 4xy - 1 = 0$

**Answer: A**



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51. If the extremities of the base of an isosceles triangle are the points  $(2a, 0)$  and  $(0, a)$ , and the equation of one of the side is  $x = 2a$ , then the area of the triangle is

A.  $5a^2$  sq. units



B.  $5a^2 / 2$ sq. units

C.  $25a^2 / 2$ sq. units

D. none of these

**Answer: B**



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52.  $A \equiv (-4, 0)$ ,  $B \equiv (4, 0)$  and  $N$  are the variable points of the y-axis such that  $M$  lies below  $N$  and  $MN = 4$ . Lines  $AM$  and  $BN$  intersect at  $P$ . The locus of  $P$  is

A.  $2xy - 16 - x^2 = 0$

B.  $2xy + 16 - x^2 = 0$

C.  $2xy + 16 + x^2 = 0$

D.  $2xy - 16 + x^2 = 0$

**Answer: D**

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53. The number of triangles that the four lines  $y = x + 3$ ,  $y = 2x + 3$ ,  $y = 3x + 2$ , and  $y + x = 3$  form is (a) 4 (b) 2 (c) 3 (d) 1

A. 4

B. 2

C. 3

D. 1

**Answer: C**

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54. A variable line  $\frac{x}{a} + \frac{y}{b} = 1$  moves in such a way that the harmonic mean of  $a$  and  $b$  is 8. Then the least area of triangle made by the line with

the coordinate axes is (1) 8 sq. unit (2) 16 sq. unit (3) 32 sq. unit (4) 64 sq. unit

- A. 8 sq. unit
- B. 16 sq. unit
- C. 32 sq. unit
- D. 64 sq. unit

**Answer: C**



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55. Given  $A(0, 0)$  and  $B(x, y)$  with  $x \in (0, 1)$  and  $y > 0$ . Let the slope of the line AB equals  $m_1$ . Point C lies on the line  $x = 1$  such that the slope of BC equals  $m_2$  where  $0 < m_2 < m_1$ . If the area of the triangle ABC can be expressed as  $(m_1 - m_2)f(x)$ , then largest possible value of  $f(x)$  is:

- A. 1
- B.  $1/2$

C.  $1/4$

D.  $1/8$

**Answer: D**



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56. A triangle is formed by the lines  $x + y = 0$ ,  $x - y = 0$ , and

$lx + my = 1$ . If  $l$  and  $m$  vary subject to the condition  $l^2 + m^2 = 1$ , then

the locus of its circumcenter is (a)  $(x^2 - y^2)^2 = x^2 + y^2$  (b)

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

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

A.  $(x^2 - y^2)^2 = x^2 + y^2$

B.  $(x^2 - y^2)^2 = (x^2 - y^2)$

C.  $(x^2 - y^2) = 4x^2y^2$

D.  $(x^2 - y^2)^2 = (x^2 + y^2)^2$

**Answer: A**



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57. Let  $P$  be  $(5, 3)$  and a point  $R$  on  $y = x$  and  $Q$  on the  $x$ -axis be such that  $PQ + QR + RP$  is minimum. Then the coordinates of  $Q$  are  $\left(\frac{17}{4}, 0\right)$  (b)  $(17, 0)$   $\left(\frac{17}{2}, 0\right)$  (d) none of these

A.  $(17/4, 0)$

B.  $(17, 0)$

C.  $(17/2, 0)$

D. none of these

**Answer: A**



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58. If a pair of perpendicular straight lines drawn through the origin forms an isosceles triangle with the line  $2x + 3y = 6$ , then area of the triangle so formed is

- A.  $\frac{36}{13}$  sq. unit
- B.  $\frac{12}{17}$  sq. unit
- C.  $\frac{13}{5}$  sq. unit
- D.  $\frac{17}{13}$  sq. unit

**Answer: A**



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59. A point  $P(x,y)$  moves that the sum of its distance from the lines  $2x-y-3=0$  and  $x+3y+4=0$  is 7. The area bounded by locus P is (in sq. unit)

A. 70

B.  $70\sqrt{2}$

C.  $35\sqrt{2}$

D. 140

**Answer: B**



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**60.** If AD, BE and CF are the altitudes of  $\triangle ABC$  whose vertex A is (-4,5).

The coordinates of points E and F are (4,1) and (-1,-4), respectively.

Equation of BC is

A.  $3x-4y+28=0$

B.  $4x+3y+28=0$

C.  $3x-4y-28=0$

D.  $x+2y+7=0$

**Answer: C**



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61. The vertex A of  $\triangle ABC$  is (3,-1). The equation of median BE and angle bisector CF are  $x-4y+10=0$  and  $6x+10y-59=0$ , respectively. Equation of AC is

- A.  $5x+18y=37$
- B.  $15x+8y=37$
- C.  $15x-8y=37$
- D.  $15x+8y+37=0$

**Answer: B**



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62. Suppose A, B are two points on  $2x - y + 3 = 0$  and  $P(1, 2)$  is such that  $PA=PB$ . Then the mid point of AB is

- A.  $\left(\frac{-1}{5}, \frac{13}{5}\right)$
- B.  $\left(\frac{-7}{5}, \frac{9}{5}\right)$



C.  $\left(\frac{7}{5}, \frac{-9}{5}\right)$

D.  $\left(\frac{-7}{5}, \frac{-9}{5}\right)$

**Answer: A**



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**63.** Triangle formed by variable lines  $(a+b)x+(a-b)y-2ab=0$  and  $(a-b)x+(a+b)y-2ab=0$  and  $x+y=0$  is (where  $a, b \in R$ )

A. (a) equilateral

B. (b) Isoceses

C. (c) scalene

D. (d) none of these

**Answer: D**



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64. A light ray coming along the line  $3x + 4y = 5$  gets reflected from the line  $ax + by = 1$  and goes along the line  $5x - 12y = 10$ . Then,

A.  $a = \frac{14}{15}, b = \frac{112}{15}$

B.  $a = \frac{14}{15}, b = -\frac{18}{115}$

C.  $a = \frac{64}{115}, b = -\frac{8}{115}$

D.  $a = \frac{64}{15}, b = \frac{14}{15}$

**Answer: C**



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65. The point  $(2,1)$ , translated parallel to the line  $x - y = 3$  by the distance of 4 units. If this new position  $A'$  is in the third quadrant, then the coordinates of  $A'$  are-

A.  $(2 + 2\sqrt{2}, 1 + 2\sqrt{2})$

B.  $(-2 + \sqrt{2}, -1 - 2\sqrt{2})$

C.  $(2 - 2\sqrt{2}, 1 - 2\sqrt{2})$

D. none of these

**Answer: C**



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**66.** If one diagonal of square is the portion of the line  $\frac{x}{a} + \frac{y}{b} = 1$  intercepted by the axes, then the extremities of the other diagonal of the square are :

A.  $(5,5), (-1,1)$

B.  $(0,0), (4,6)$

C.  $(0,0), (-1,1)$

D.  $(5,5), (4,6)$

**Answer: A**



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67. The point  $P(2,1)$  is shifted through a distance  $3\sqrt{2}$  units measured parallel to the line  $x+y=1$  in the direction of decreasing ordinates, to reach at  $Q$ . The image of  $Q$  with respect to given line is

A.  $(3,-4)$

B.  $(-3,2)$

C.  $(0,-1)$

D. none of these

**Answer: A**



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68. Let  $O$  be the origin. If  $A(1, 0)$  and  $B(0, 1)$  and  $P(x, y)$  are points such that  $xy > 0$  and  $x + y < 1$ , then  $P$

A.  $P$  lies either inside the triangle  $OAB$  or in the third quadrant

B. P cannot lie inside the triangle OAB

C. P lies inside the triangle OAB

D. P lies in the first quadrant only

**Answer: A**



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**69.** In a triangle  $ABC$ , the bisectors of angles  $B$  and  $C$  lie along the lines  $x = y$  and  $y = 0$ . If  $A$  is  $(1, 2)$ , then the equation of line  $BC$  is

A.  $2x + y = 1$

B.  $3x - y = 5$

C.  $x - 2y = 3$

D.  $x + 3y = 1$

**Answer: B**



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70. Line  $ax + by + p = 0$  makes angle  $\frac{\pi}{4}$  with  $x \cos \alpha + y \sin \alpha = p, p \in R^+$ . If these lines and the line  $x \sin \alpha - y \cos \alpha = 0$  are concurrent, then

A.  $a^2 + b^2 = 1$

B.  $a^2 + b^2 = 2$

C.  $2(a^2 + b^2) = 1$

D. none of these

**Answer: B**



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71. The equation of the line AB is  $y = x$ . If A and B lie on the same side of the line mirror  $2x - y = 1$ , then the equation of the image of AB is

A.  $x+y=2$

B.  $8x+y=9$

C.  $7x-y=6$

D. none of these

**Answer: C**



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**72.** The equation of the bisector of the acute angle between the lines  $2x - y + 4 = 0$  and  $x - 2y = 1$  is

A.  $x+y+5=0$

B.  $x-y+1=0$

C.  $x-y=5$

D. none of these

**Answer: B**



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73. The straight line  $4ax + 3by + c = 0$  passes through which point, where  $a + b + c = 0$  (a)  $(4, 3)$  (b)  $\left(\frac{1}{4}, \frac{1}{3}\right)$  (c)  $\left(\frac{1}{2}, \frac{1}{3}\right)$  (d) none of these

A.  $(4, 3)$

B.  $(1/4, 1/3)$

C.  $(1/2, 1/3)$

D. none of these

**Answer: B**



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74. If the lines  $ax + y + 1 = 0$ ,  $x + by + 1 = 0$ ,  $x + y + c = 0$ , ( $a, b, c$  are distinct and not equal to 1), are concurrent, then find the value of  $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$

A. 0



B. 1

C.  $1/(a+b+c)$

D. none of these

**Answer: B**



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**75.** If lines  $x + 2y - 1 = 0$ ,  $ax + y + 3 = 0$ , and  $bx - y + 2 = 0$  are concurrent, and  $S$  is the curve denoting the locus of  $(a, b)$ , then the least distance of  $S$  from the origin is

A.  $5/\sqrt{57}$

B.  $5/\sqrt{51}$

C.  $5/\sqrt{58}$

D.  $5/\sqrt{59}$

**Answer: C**

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76. The straight lines  $x + 2y - 9 = 0$ ,  $3x + 5y - 5 = 0$ , 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) none of these

A.  $(a, b)$

B.  $(b, a)$

C.  $(-a, -b)$

D. none of these

**Answer: A**

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77. If the straight lines  $2x + 3y - 1 = 0$ ,  $x + 2y - 1 = 0$ , and  $ax + by - 1 = 0$  form a

triangle with the origin as orthocentre, then  $(a, b)$  is given by

A. (6,4)

B. (-3,3)

C. (-8,8)

D. (0,7)

**Answer: C**



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78. If  $\frac{a}{\sqrt{bc}} - 2 = \sqrt{\frac{b}{c}} + \sqrt{\frac{c}{b}}$ , where  $a, b, c > 0$ , then the family of lines  $\sqrt{a}x + \sqrt{b}y + \sqrt{c} = 0$  passes through the fixed point given by (a) (1, 1) (b) (1, -2) (c) (-1, 2) (d) (-1, 1)

A. (1,1)

B. (1,-2)

C. (-1,2)

D.  $(-1,1)$

**Answer: D**



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**79.** If it is possible to draw a line which belongs to all the given family of lines

$$y - 2x + 1 + \lambda_1(2y - x - 1) = 0, 3y - x - 6 + \lambda_2(y - 3x + 6) = 0,$$

$$ax + y - 2 + \lambda_3(6x + ay - a) = 0, \text{ then}$$

$$(a) a = 4 \quad (b) a = 3 \quad (c) a = -2 \quad (d) a = 2$$

A.  $a=4$

B.  $a=3$

C.  $a=-2$

D.  $a=2$

**Answer: A**



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80. If two members of family  $(2 + \lambda)x + (1 + 2\lambda)y - 3(1 + \lambda) = 0$  and line  $x+y=0$  make an equilateral triangle, the the incentre of triangle so formed is

- A.  $\left(\frac{1}{3}, \frac{1}{3}\right)$
- B.  $\left(\frac{7}{6}, -\frac{5}{6}\right)$
- C.  $\left(\frac{5}{6}, \frac{5}{6}\right)$
- D.  $\left(-\frac{3}{2}, -\frac{3}{2}\right)$

**Answer: A**



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81. The set of lines  $x \tan^{-1} a + y \sin^{-1} \left( \frac{1}{\sqrt{1+a^2}} \right) + 2 = 0$  where  $a \in (0, 1)$  are concurrent at (a)  $\left(\frac{1}{\pi}, \frac{1}{\pi}\right)$  (b)  $\left(-\frac{4}{\pi}, -\frac{4}{\pi}\right)$  (c)  $(\pi, \pi)$   
(d) none of these

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82. If  $\sin(\alpha + \beta)\sin(\alpha - \beta) = \sin \gamma(2\sin \beta + \sin \gamma)$ , where  $0$

A. (1,1)

B. (-1,1)

C. (1,-1)

D. none of these

**Answer: C**

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### Exercise Multiple Correct Answers Type

1. If  $P$  is a point  $(x, y)$  on the line  $y = -3x$  such that  $P$  and the point  $(3, 4)$  are on the opposite sides of the line  $3x - 4y = 8$ , then  $x > \frac{8}{15}$

(b)  $x > \frac{8}{5}$  (c)  $y < -\frac{8}{5}$  (d)  $y < -\frac{8}{15}$

A.  $x > 8/15$

B.  $x > 8/5$

C.  $x < -8/5$

D.  $y < -8/15$

**Answer: A::C**



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2. If  $(x, y)$  is a variable point on the line  $y = 2x$  lying between the lines

$2(x + 1) + y = 0$  and  $x + 3(y - 1) = 0$ , then  $x \in \left(-\frac{1}{2}, \frac{6}{7}\right)$  (b)

$x \in \left(-\frac{1}{2}, \frac{3}{7}\right)$   $y \in \left(-1, \frac{3}{7}\right)$  (d)  $y \in \left(-1, \frac{6}{7}\right)$

A.  $x \in \left(-1/2, 6/7\right)$

B.  $x \in \left(-1/2, 3/7\right)$

C.  $y \in \left(-1, 3/7\right)$

D.  $y \in \left(-1, 6/7\right)$

**Answer: B::D**



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3. Let  $P(\sin \theta, \cos \theta)$  ( $0 \leq \theta \leq 2\pi$ ) be a point and let  $OAB$  be a triangle with vertices  $(0, 0)$ ,  $\left(\sqrt{\frac{3}{2}}, 0\right)$  and  $\left(0, \sqrt{\frac{3}{2}}\right)$  Find  $\theta$  if  $P$  lies inside  $\triangle OAB$

A.  $0 < \theta < \pi/12$

B.  $5\pi/2 < \theta < \pi/2$

C.  $0 < \theta < 5\pi/2$

D.  $5\pi/2 < \theta < \pi$

**Answer: A::B**



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4. Three lines  $x + 2y + 3 = 0$ ,  $x + 2y - 7 = 0$ , and  $2x - y - 4 = 0$  form the three sides of two squares. The equation of the fourth side of each square is

A.  $2x - y + 6 = 0$

B.  $2x - y + 8 = 0$

C.  $2x - y - 10 = 0$

D.  $2x - y - 14 = 0$

Answer: A::D



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5. Angle made with the x-axis by 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)  $105^\circ$  (b)  $75^\circ$  (c)  $60^\circ$  (d)  $15^\circ$

A.  $105^\circ$

B.  $75^\circ$

C.  $60^\circ$

D.  $15^\circ$

**Answer: B::D**



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6. Three straight lines

$$2x + 11y - 5 = 0, 24x + 7y - 20 = 0 \text{ and } 4x - 3y - 2 = 0$$

A. they form a triangle

B. they are concurrent

C. one line bisects the angle between the other two

D. two of them are parallel

**Answer: C**



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7. A triangle is formed by the lines whose equations are AB:  $x+y-5=0$ , BC:  $x+7y-7=0$  and CA:  $7x+y+14=0$ .

Then

A. angle at A is acute

B. angle at C is acute

C. internal angle bisector at angle B is  $3x+6y-16=0$

D. external angle bisector at angle C is  $8x+8y+7=0$

**Answer: A,C,D**



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8. If the points  $\left(\frac{a^3}{(a-1)}\right), \left(\frac{(a^2-3)}{(a-1)}\right), \left(\frac{b^3}{(b-1)}\right), \left(\frac{(b^2-3)}{(b-1)}\right)$ , and  $\left(\frac{(c^2-3)}{(c-1)}\right)$ , where  $a, b, c$  are different from 1, lie on the line  $lx + my + n = 0$ , then

A. (1)  $a + b + c = -\frac{m}{l}$

B. (2)  $ab + bc + ca = \frac{n}{l}$

C. (3)  $abc = \frac{(m + n)}{l}$

D. (4)  $abc - (bc + ca + ab) + 3(a + b + c) = 0$

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



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9. 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.  $(3 + \sqrt{3}, 3 + \sqrt{3})$

D.  $(\sqrt{3} - 1, \sqrt{3} - 1)$

**Answer: A::B**



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10. If  $\left(\frac{x}{a}\right) + \left(\frac{y}{b}\right) = 1$  and  $\left(\frac{x}{c}\right) + \left(\frac{y}{d}\right) = 1$  intersect the axes at four concyclic points and  $a^2 + c^2 = b^2 + d^2$ , then these lines can intersect at,  $(a, b, c, d > 0)$  `

A. (1,1)

B. (1,-1)

C. (2,-2)

D. (3,3)

**Answer: A, B, C and D**



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11. The straight line  $3x + 4y - 12 = 0$  meets the coordinate axes at  $A$  and  $B$ . An equilateral triangle  $ABC$  is constructed. The possible coordinates of vertex  $C$

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

**Answer: A::D**



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12. The equation of the lines passing through the point  $(1, 0)$  and at a distance  $\frac{\sqrt{3}}{2}$  from the origin is (a)  $\sqrt{3}x + y - \sqrt{3} = 0$  (b)  $x + \sqrt{3}y - \sqrt{3} = 0$  (c)  $\sqrt{3}x - y - \sqrt{3} = 0$  (d)  $x - \sqrt{3}y - \sqrt{3} = 0$

A.  $\sqrt{3}x + y - \sqrt{3} = 0$

B.  $x + \sqrt{3}y - \sqrt{3} = 0$

C.  $\sqrt{3}x - y - \sqrt{3} = 0$

D.  $x - \sqrt{3}y - \sqrt{3} = 0$

**Answer: A::C**



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**13.** The sides of a triangle are the straight lines  $x + y = 1$ ,  $7y = x$ , and  $\sqrt{3}y + x = 0$ . Then which of the following is an interior point of the triangle? Circumcenter (b) Centroid Incenter (d) Orthocenter

A. Circumcenter

B. Centroid

C. Incenter

D. Orthocenter

**Answer: B::C**

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14. If the straight line  $ax + cy = 2b$ , where  $a, b, c > 0$ , makes a triangle of area 2 sq. units with the coordinate axes, then (a)  $a, b, c$  are in GP (b)  $a, -b, c$  are in GP (c)  $a, 2b, c$  are in GP (d)  $a, -2b, c$  are in GP

A.  $a, b, c$  are in GP

B.  $a, -b, c$  are in GP

C.  $a, 2b, c$  are in GP

D.  $a, -2b, c$  are in GP

**Answer: A::B**

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15. Consider the equation  $y - y_1 = m(x - x_1)$ . 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 fixed point (b) there will be a set of parallel lines (c) all



the lines intersect the line  $x = x_1$  (d) all the lines will be parallel to the line  $y = x_1$

- A. the lines will pass through a fixed point
- B. there will be a set of parallel lines
- C. all the lines intersect the line  $x = x_1$
- D. all the lines will be parallel to the line  $y = x_1$

**Answer: B::C**



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16. Equation(s) of the straight line(s), inclined at  $30^\circ$  to the x-axis such that the length of its (each of their) line segment(s) between the coordinate axes is 10 units, is (are)  $x + \sqrt{3}y + 5\sqrt{3} = 0$   
 $x - \sqrt{3}y + 5\sqrt{3} = 0$   $x + \sqrt{3}y - 5\sqrt{3} = 0$   $x - \sqrt{3}y - 5\sqrt{3} = 0$

A.  $x + \sqrt{3}y + 5\sqrt{3} = 0$

B.  $x - \sqrt{3}y + 5\sqrt{3} = 0$

C.  $x + \sqrt{3}y - 5\sqrt{3} = 0$

D.  $x - \sqrt{3}y - 5\sqrt{3} = 0$

**Answer: B::D**



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17. The lines  $x + y - 1 = 0$ ,  $(m - 1)x + (m^2 - 7)y - 5 = 0$ , and  $(m - 2)x + (2m - 5)y = 0$  are a.) concurrent for three values of  $m$  b.) concurrent for no value of  $m$  c.) parallel for one value of  $m$  d.) parallel for two value of  $m$



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18. The equation of a straight line passing through the point  $(2, 3)$  and inclined at an angle of  $\tan^{-1}\left(\frac{1}{2}\right)$  with the line  $y + 2x = 5$ , so the equation of the line is/ are: (a)  $y = 3$  (b)  $x = 2$  (c)  $3x + 4y - 18 = 0$  (d)  $4x + 3y - 17 = 0$

A.  $y=3$

B.  $x=2$

C.  $3x+4y-18=0$

D.  $4x+3y-17=0$

**Answer: B::C**



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**19.** Find the equation of a straight line on which the perpendicular from the origin makes an angle of  $30^0$  with  $x - axis$  and which forms a triangle of area  $\frac{50}{\sqrt{3}}$  with the axes.

A.  $\sqrt{3}x + y - 10 = 0$

B.  $\sqrt{3}x + y + 10 = 0$

C.  $x + \sqrt{3}y - 10 = 0$

D.  $x - \sqrt{3}y - 10 = 0$

**Answer: A::B**



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**20.** A line is drawn perpendicular to line  $y = 5x$ , meeting the coordinate axes at  $A$  and  $B$ . If the area of triangle  $OAB$  is 10 sq. units, where  $O$  is the origin, then the equation of drawn line is (a)  $3x - y - 9$  (b)  $x + 5y = 10$  (c)  $x + 4y = 10$  (d)  $x - 4y = 10$

A. 12

B. -12

C. 10

D. -10

**Answer: A::B**



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21. If  $x - 2y + 4 = 0$  and  $2x + y - 5 = 0$  are the sides of an isosceles triangle having area 10 sq units, the equation of the third side is (a)  $3x - y = -9$  (b)  $3x - y + 11 = 0$  (c)  $x - 3y = 19$  (d)  $3x - y + 15 = 0$

A.  $x + 3y = -1$

B.  $x + 3y = 19$

C.  $3x - y = -9$

D.  $3x - y = 11$

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



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22. Find the value of  $a$  for which the lines  $2x + y - 1 = 0$ ,  $ax + 3y - 3 = 0$ ,  $3x + 2y - 2 = 0$  are concurrent.

A. -3

B. -1

C. 1

D. infinite value

**Answer: infinite**



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**23.** The lines  $px + qy + r = 0$ ,  $qx + ry + p = 0$ ,  $rx + py + q = 0$ , are concurrent then

A.  $p+q+r=0$

B.  $p^2 + q^2 + r^2 = pr + rp + pq$

C.  $p^3 + q^3 + r^3 = 3pqr$

D. none of these

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



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24.  $\theta_1$  and  $\theta_2$  are the inclination of lines  $L_1$  and  $L_2$  with the x-axis. If  $L_1$  and  $L_2$  pass through  $P(x_1, y_1)$ , then the equation of one of the angle bisector of these lines is

A. 
$$\frac{x - x_1}{\cos\left(\frac{\theta_1 + \theta_2}{2}\right)} = \frac{y - y_1}{\sin\left(\frac{\theta_1 + \theta_2}{2}\right)}$$

B. 
$$\frac{x - x_1}{-\sin\left(\frac{\theta_1 - \theta_2}{2}\right)} = \frac{y - y_1}{\cos\left(\frac{\theta_1 - \theta_2}{2}\right)}$$

C. 
$$\frac{x - x_1}{\sin\left(\frac{\theta_1 + \theta_2}{2}\right)} = \frac{y - y_1}{\cos\left(\frac{\theta_1 + \theta_2}{2}\right)}$$

D. 
$$\frac{x - x_1}{-\sin\left(\frac{\theta_1 + \theta_2}{2}\right)} = \frac{y - y_1}{\cos\left(\frac{\theta_1 + \theta_2}{2}\right)}$$

**Answer: A::D**



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25. Consider the lines  $L_1 \equiv 3x - 4y + 2 = 0$  and  $L_2 \equiv 3y - 4x - 5 = 0$ . Now, choose the correct statement(s).

- A. The line  $x+y=0$  bisects the acute angle between  $L_1$  and  $L_2$  containing the origin.
- B. The line  $x-y+1=0$  bisects the obtuse angle between  $L_1$  and  $L_2$  not containing the origin.
- C. The line  $x+y+3=0$  bisects the obtuse angle between  $L_1$  and  $L_2$  containing the origin.
- D. The line  $x-y+1=0$  bisects the acute angle between  $L_1$  and  $L_2$  not containing the origin.

**Answer: A::B**



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**26.** The sides of a rhombus are parallel to the lines  $x + y - 1 = 0$  and  $7x - y - 5 = 0$ . It is given that the diagonals of the rhombus intersect at  $(1, 3)$  and one vertex,  $A$  of the rhombus lies on the line  $y = 2x$ . Then



the coordinates of vertex  $A$  are  $\left(\frac{8}{5}, \frac{16}{5}\right)$  (b)  $\left(\frac{7}{15}, \frac{14}{15}\right)$   $\left(\frac{6}{5}, \frac{12}{5}\right)$  (d)  $\left(\frac{4}{15}, \frac{8}{15}\right)$

A.  $(8/5, 16/5)$

B.  $(7/15, 14/15)$

C.  $(6/5, 12/5)$

D.  $(4/15, 8/15)$

**Answer: A::C**



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27. Two straight lines  $u = 0$  and  $v = 0$  pass through the origin and the angle between them is  $\tan^{-1}\left(\frac{7}{9}\right)$ . If the ratio of the slope of  $v = 0$  and  $u = 0$  is  $\frac{9}{2}$ , then their equations are

A.  $y+3x=0$  and  $3y+2x=0$

B.  $2y+3x=0$  and  $3y+x=0$

C.  $2y=3x$  and  $3y=0$

D.  $y=3x$  and  $3y=2x$

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



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**28.** Let  $u = ax + by + a^3\sqrt{b} = 0$ ,  $v = bx - ay + b^3\sqrt{a} = 0$ ,  $a, b \in R$ , be two straight lines. The equations of the bisectors of the angle formed by  $k_1u - k_2v = 0$  and  $k_1u + k_2v = 0$ , for nonzero and real  $k_1$  and  $k_2$  are

A.  $u=0$

B.  $k_2u + k_1v = 0$

C.  $k_2u - k_1v = 0$

D.  $v=0$

**Answer: A,D**



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29. Two sides of a triangle are parallel to the coordinate axes. If the slopes of the medians through the acute angles of the triangle are 2 and  $m$ , then  $m$  is (a)  $\frac{1}{2}$  (b) 2 (c) 4 (d) 8

A. a.  $1/2$

B. b. 2

C. c. 4

D. d. 8

**Answer: A::D**

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30. A line which makes an acute angle  $\theta$  with the positive direction of the x-axis is drawn through the point  $P(3, 4)$  to meet the line  $x = 6$  at  $R$  and  $y = 8$  at  $S$ . Then,

A.  $PR = 3\sec\theta$

B.  $PS = 4 \operatorname{cosec}\theta$

C.  $PR + PS = \frac{2(3\sin\theta + 4\cos\theta)}{\sin 2\theta}$

D.  $\frac{9}{(PR)^2} + \frac{16}{(PS)^2} = 1$

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



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### Exercise Linked Comprehension Type

1. Let  $l$  be the line belonging to the family of straight lines  $(a + 2b)x + (a - 3b)y + a - 8b = 0$ ,  $a, b \in R$ , which is farthest from the point  $(2, 2)$ , then area enclosed by the line  $L$  and the coordinate axes is

A.  $x+4y+7=0$

B.  $2x+3y+4=0$

C.  $4x-y-6=0$

D. none of these

**Answer: A**



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2. Let  $L$  be the line belonging to the family of straight lines  $(a+2b)x + (a-3b)y + a-8b = 0$ ,  $a, b \in \mathbb{R}$ , which is the farthest from the point  $(2, 2)$ .

The equation of line  $L$  is

A.  $4/3$  sq. units

B.  $9/2$  sq. units

C.  $49/8$  sq. units

D. none of these

**Answer: C**



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3. Let  $L$  be the line belonging to the family of straight lines  $(a+2b)x + (a-3b)y + a-8b = 0$ ,  $a, b \in \mathbb{R}$ , which is the farthest from the point  $(2, 2)$ .

If  $L$  is concurrent with the lines  $x-2y+1=0$  and  $3x - 4y + \lambda = 0$ , then the value of  $\lambda$  is

A. 2

B. 1

C. -4

D. 5

**Answer: D**



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4. The equation of an altitude of an equilateral triangle is  $\sqrt{3}x + y = 2\sqrt{3}$  and one of its vertices is  $(3, \sqrt{3})$  then the possible number of triangles is

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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5. The equation of an altitude of an equilateral triangle is  $\sqrt{3}x + y = 2\sqrt{3}$  and one of its vertices is  $(3, \sqrt{3})$  then the possible number of triangles is

A. 1

B. 2

C. 3

D. 4

**Answer: D**



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6. The equation of an altitude of an equilateral triangle is  $\sqrt{3}x + y = 2\sqrt{3}$ , and one of the vertices is  $(3, \sqrt{3})$ .

Which of the following is not one of the possible vertices of the triangle?

A.  $a. \sqrt{3}$

B.  $b. \sqrt{3}$

C.  $c. 2$

D.  $d. \text{none of these}$

**Answer: A**



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7. A variable line  $L$  is drawn through  $O(0,0)$  to meet the lines  $L_1 : y-x-10=0$  and  $L_2 : y-x-20=0$  at the points  $A$  and  $B$  respectively. A point  $P$  is taken on  $L$  such that  $OP^2 = OA^2 + OB^2$  and  $P, A, B$  lies on same side of origin  $O$ . The locus of  $P$  is

A.  $3x+3y=40$

B.  $3x+3y+40=0$

C.  $3x-3y=40$

D.  $3y-3x=40$

**Answer: D**



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

Locus of  $P$ , if  $OP^2 = OA \times OB$ , is a.  $(y+x)^2 = 50$  b.  $(y-x)^2 = 200$  c.  $(y-x)^2 = 100$  d. none of these

A.  $(y - x)^2 = 100$

B.  $(y + x)^2 = 50$

C.  $(y - x)^2 = 200$

D. none of these

**Answer: C**



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

Locus of  $P$ , if  $OP^2 = OA \times OB$ , is a.  $(y + x)^2 = 50$  b.  $(y - x)^2 = 200$  c.

$(y - x)^2 = 100$  d. none of these

A.  $(y - x)^2 = 80$

B.  $(y - x)^2 = 100$

C.  $(y - x)^2 = 64$

D. none of these

**Answer: A**



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10. The line  $6x+8y=48$  intersects the coordinates axes at A and B, respectively. A line L bisects the area and the perimeter of triangle OAB, where O is the origin.

The number of such lines possible is a. 1 b. 2 c. 3 d. 4

A. 1

B. 2

C. 3

D. more than 3

**Answer: A**



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11. if a line has direction ratio 2,-1,-2,determine its direction cosine



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12. The line  $6x+8y=48$  intersects the coordinates axes at A and B, respectively. A line L bisects the area and the perimeter of triangle OAB, where O is the origin.

The number of such lines possible is a. 1 b. 2 c. 3 d. 4

A. does not intersect AB

B. does not intersect OB

C. does not intersect OA

D. can intersect all the sides

**Answer: C**



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13. A(1,3) and C(-2, 5/5, -2/5) are the vertices of a triangle ABC and the equation of the internal angle bisector of  $\angle ABC$  is  $x + y = 2$ .

The coordinates of vertex B are

A.  $7x+3y-4=0$

B.  $7x+3y+4=0$

C.  $7x-3y+4=0$

D.  $7x-3y-4=0$

**Answer: B**



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14. A(1, 3) and  $C\left(-\frac{2}{5}, -\frac{2}{5}\right)$  are the vertices of a  $\triangle ABC$  and the equation of the angle bisector of  $\angle ABC$  is  $x + y = 2$ . Then the value of B is. (A) (3/10, 17/10) (B) (17/10, 3/10) (C) (-5/2, 9/2) (D) (-1,1)

A. (A) (3/10, 17/10)

B. (B) (17/10, 3/10)

C. (C)  $(-5/2, 9/2)$

D. (D)  $(-1,1)$

**Answer: C**



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15. A(1,3) and C(-2,5, -2/5) are the vertices of a triangle ABC and the equation of the internal angle bisector of  $\angle ABC$  is  $x + y = 2$ .

The equation of side BC is

A.  $7x+3y+4=0$

B.  $3x+7y+24=0$

C.  $13x+7y+8=0$

D.  $13x-7y+8=0$

**Answer: A**



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16. Let  $ABCD$  be a parallelogram the equation of whose diagonals are  $AC: x + 2y = 3$ ;  $BD: 2x + y = 3$ . If length of diagonal  $AC = 4$  units and area of  $ABCD = 8$  sq. units. Then find the length of the other diagonal

A.  $10/3$

B.  $2$

C.  $20/3$

D. none of these

**Answer: C**



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17. Let  $ABCD$  be a parallelogram the equation of whose diagonals are  $AC: x + 2y = 3$ ;  $BD: 2x + y = 3$ . If length of diagonal  $AC = 4$  units

and area of  $ABCD = 8$  sq. units. Then find the length of the other diagonal

A.  $\sqrt{232}/3$

B.  $4\sqrt{58}/9$

C.  $3\sqrt{58}/9$

D.  $4\sqrt{58}/9$

**Answer: A**



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**18.** Let  $ABCD$  be a parallelogram the equation of whose diagonals are  $AC: x + 2y = 3$ ;  $BD: 2x + y = 3$ . If length of diagonal  $AC = 4$  units and area of  $ABCD = 8$  sq. units. Then find the length of the other diagonal



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19. Consider a triangle PQR with coordinates of its vertices as P(-8,5), Q(-15, -19), and R (1, -7). The bisector of the interior angle of P has the equation which can be written in the form  $ax+2y+c=0$ .

The distance between the orthocenter and the circumcenter of triangle PQR is

A.  $25/2$

B.  $29/2$

C.  $37/2$

D.  $51/2$

**Answer: A**



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20. Consider a triangle PQR with coordinates of its vertices as P(-8,5), Q(-15, -19), and R (1, -7). The bisector of the interior angle of P has the equation which can be written in the form  $ax+2y+c=0$ .

The distance between the orthocenter and the circumcenter of triangle PQR is

A. 4

B. 5

C. 6

D. 8

**Answer: B**



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21. Consider a triangle PQR with coordinates of its vertices as P(-8,5), Q(-15, -19), and R (1, -7). The bisector of the interior angle of P has the equation which can be written in the form  $ax+2y+c=0$ . triangle PQR is

The sum  $a + c$  is

A. 129

B. 78

C. 89

D. none of these

**Answer: C**



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**22.** The base of an isosceles triangle measures 4 units base angle is equal to  $45^\circ$ . A straight line cuts the extension of the base at a point M at the angle  $\theta$  and bisects the lateral side of the triangle which is nearest to M. The area of quadrilateral which the straight line cuts off from the given triangle is

A.  $\frac{3 + \tan\theta}{1 + \tan\theta}$

B.  $\frac{3 + 5\tan\theta}{1 + \tan\theta}$

C.  $\frac{3 + \tan\theta}{1 - \tan\theta}$

D.  $\frac{3 + 2\tan\theta}{1 + \tan\theta}$

**Answer: B**



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23. The base of an isosceles triangle measures 4 units base angle is equal to  $45^\circ$ . A straight line cuts the extension of the base at a point M at the angle  $\theta$  and bisects the lateral side of the triangle which is nearest to M. The possible range of values in which area of quadrilateral which straight line cuts off from the given triangle lie in

A.  $\left(\frac{5}{2}, \frac{7}{2}\right)$

B. (4,3)

C. (4,5)

D. (3,4)

**Answer: D**



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24. The base of an isosceles triangle measures 4 units base angle is equal to  $45^\circ$ . A straight line cuts the extension of the base at a point M at the angle  $\theta$  and bisects the lateral side of the triangle which is nearest to M. The area of quadrilateral which the straight line cuts off from the given triangle is

A. (2,4)

B.  $\left(\frac{3}{2}, \sqrt{3}\right)$

C.  $(\sqrt{2}, 2)$

D.  $(\sqrt{2}, \sqrt{3})$

**Answer: C**



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25. Consider point A(6, 30), point B(24, 6) and line AB:  $4x+3y = 114$ .

Point  $P(0, \lambda)$  is a point on y-axis such that

$0 < \lambda < 38$  and point  $Q(0, \lambda)$  is a point on y-axis such that  $\lambda > 38$ .

For all positions of point P, angle APB is maximum when point P is

A. (0, 12)

B. (0, 15)

C. (0, 18)

D. (0, 21)

**Answer: C**



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**26.** Consider point A(6, 30), point B(24, 6) and line AB:  $4x+3y = 114$ .

Point  $P(0, \lambda)$  is a point on y-axis such that

$0 < \lambda < 38$  and point  $Q(0, \lambda)$  is a point on y-axis such that  $\lambda > 38$ .

The maximum value of angle APB is

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

B.  $\frac{\pi}{2}$

C.  $\frac{2\pi}{3}$

D.  $\frac{3\pi}{3}$

**Answer: B**



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27. Consider point A(6, 30), point B(24, 6) and line AB:  $4x+3y = 114$ .

Point  $P(0, \lambda)$  is a point on y-axis such that

$0 < \lambda < 38$  and point  $Q(0, \lambda)$  is a point on y-axis such that  $\lambda > 38$ .

For all positions of point P, angle APB is maximum when point P is

A. (0, 54)

B. (0, 58)

C. (0, 60)

D. (0, 1)

**Answer: B**





## Exercise Matrix Match Type

1. Match the following lists:

List I	List II
a. Four lines $x + 3y - 10 = 0$ , $x + 3y - 20 = 0$ , $3x - y + 5 = 0$ , and $3x - y - 5 = 0$ form a figure which is	p. a quadrilateral which is neither a parallelogram nor a trapezium
b. The points $A(1, 2)$ , $B(2, -3)$ , $C(-1, -5)$ , and $D(-2, 4)$ in order are the vertices of	q. a parallelogram
c. The lines $7x + 3y - 33 = 0$ , $3x - 7y + 19 = 0$ , $3x - 7y - 10 = 0$ , and $7x + 3y - 4 = 0$ form a figure which is	r. a rectangle of area 10 sq. units
d. Four lines $4y - 3x - 7 = 0$ , $3y - 4x + 7 = 0$ , $4y - 3x - 21 = 0$ , $3y - 4x + 14 = 0$ form a figure which is	s. a square



Match the following lists:





## 2. Match the following lists:

List I	List II
<b>a.</b> The lines $y = 0$ ; $y = 1$ ; $x - 6y + 4 = 0$ , and $x + 6y - 9 = 0$ constitute a figure which is	<b>p.</b> a cyclic quadrilateral
<b>b.</b> The points $A(a, 0)$ , $B(0, b)$ , $C(c, 0)$ , and $D(0, d)$ are such that $ac = bd$ and $a, b, c, d$ are all positive. The points $A, B, C$ , and $D$ always constitute	<b>q.</b> a rhombus
<b>c.</b> The figure formed by the four lines $ax \pm by \pm c = 0$ , $a \neq b$ , is	<b>r.</b> a square
<b>d.</b> The line pairs $x^2 - 8x + 12 = 0$ and $y^2 - 14y + 45 = 0$ constitute a figure which is	<b>s.</b> a trapezium



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## 3. Match the following lists:

List I	List II
<b>a.</b> If lines $3x + y - 4 = 0$ , $x - 2y - 6 = 0$ , and $\lambda x + 4y + \lambda^2 = 0$ are concurrent, then the value of $\lambda$ is	<b>p.</b> $-4$
<b>b.</b> If the points $(\lambda + 1, 1)$ , $(2\lambda + 1, 3)$ , and $(2\lambda + 2, 2\lambda)$ are collinear, then the value of $\lambda$ is	<b>q.</b> $-1/2$
<b>c.</b> If the line $x + y - 1 -  \lambda/2  = 0$ , passing through the intersection of $x - y + 1 = 0$ and $3x + y - 5 = 0$ , is perpendicular to one of them, then the value of $\lambda$ is	<b>r.</b> $4$
<b>d.</b> If the line $y - x - 1 + \lambda = 0$ is equidistant from the points $(1, -2)$ and $(3, 4)$ , then $\lambda$ is	<b>s.</b> $2$

## 5. Match the following lists:



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4. Match the following lists:

List I	List II
a. If lines $3x + y - 4 = 0$ , $x - 2y - 6 = 0$ , and $\lambda x + 4y + \lambda^2 = 0$ are concurrent, then the value of $\lambda$ is	p. $-4$
b. If the points $(\lambda + 1, 1)$ , $(2\lambda + 1, 3)$ , and $(2\lambda + 2, 2\lambda)$ are collinear, then the value of $\lambda$ is	q. $-1/2$
c. If the line $x + y - 1 -  \lambda/2  = 0$ , passing through the intersection of $x - y + 1 = 0$ and $3x + y - 5 = 0$ , is perpendicular to one of them, then the value of $\lambda$ is	r. $4$
d. If the line $y - x - 1 + \lambda = 0$ is equidistant from the points $(1, -2)$ and $(3, 4)$ , then $\lambda$ is	s. $2$

5. Match the following lists:



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5. Consider the lines represented by equation  $(x^2 + xy - x) \times (x - y) = 0$  forming a triangle. Then match the

following lists:

List I	List II
a. Orthocenter of triangle	p. $(1/6, 1/2)$
b. Circumcenter	q. $(1/(2 + 2\sqrt{2}), 1/2)$
c. Centroid	r. $(0, 1/2)$
d. Incenter	s. $(1/2, 1/2)$



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6. Match the following lists:

List I	List II
a. If $L = \lim_{x \rightarrow -1} \frac{\sqrt[3]{7-x} - 2}{(x+1)}$ , then $12L =$	p. $-2$
b. If $L = \lim_{x \rightarrow \pi/4} \frac{\tan^3 x - \tan x}{\cos\left(x + \frac{\pi}{4}\right)}$ , then $-L/4 =$	q. $2$
c. If $L = \lim_{x \rightarrow 1} \frac{(2x-3)(\sqrt{x}-1)}{2x^2+x-3}$ , then $20L =$	r. $1$
d. If $L = \lim_{x \rightarrow \infty} \frac{\log x^n - [x]}{[x]}$ , where $n \in N$ , $([x]$ denotes greatest integer less than or equal to $x$ ), then $-2L =$	s. $-1$



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7. Consider the lines given by

$L_1 : x + 3y - 5 = 0$

$L_2 : 3x - ky - 1 = 0$

$L_3 : 5x + 2y - 12 = 0$

Match the following lists.

List I	List 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. $k = -6/5$
c. $L_1, L_2, L_3$ form a triangle if	r. $k = 5/6$
d. $L_1, L_2, L_3$ do not form a triangle if	s. $k = 5$

8. Consider a  $\Delta ABC$  in which sides  $AB$  and  $AC$  are perpendicular to  $x - y - 4 = 0$  and  $2x - y - 5 = 0$ , respectively. Vertex  $A$  is  $(-2, 3)$  and the circumcenter of  $\Delta ABC$  is  $(3/2, 5/2)$ .

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8. Consider a  $\Delta ABC$  in which sides  $AB$  and  $AC$  are perpendicular to  $x - y - 4 = 0$  and  $2x - y - 5 = 0$ , respectively. Vertex  $A$  is  $(-2, 3)$  and the circumcenter of  $\Delta ABC$  is  $(3/2, 5/2)$ .

The equation of the line in List I is of the form  $ax + by + c = 0$ , where

$a, b, c \in I$ . Match it with the corresponding value of  $c$  in list II and then choose the correct code.

List I	List II
a. Equation of the perpendicular bisector of side $AB$	p. $-1$
b. Equation of the perpendicular bisector of side $AC$ .	q. $1$
c. Equation of side $AC$	r. $-16$
d. Equation of the median through $A$	s. $-4$

Codes :

$a \quad b \quad c \quad d$

$r \quad s \quad p \quad q$

$s \quad r \quad q \quad p$

$q \quad p \quad s \quad r$

$r \quad p \quad s \quad q$



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## Exercise Numerical Value Type

1. Find the number of permutations of the set  $\{1,2,3,4\}$  in which no two adjacent positions are filled by consecutive integers ( increasing orders).



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2. The number of values of  $k$  for which the lines  $(k + 1)x + 8y = 4k$  and  $kx + (k + 3)y = 3k - 1$  are coincident is \_\_\_\_\_



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3. What is the minimum value of  $2x + 3y$ , when  $xy = 6$ ?



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4. The absolute value of the sum of the abscissas of all the points on the line  $x + y = 4$  that lie at a unit distance from the line  $4x + 3y - 10 = 0$  is \_\_\_\_\_



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5. Two sides of a rectangle are  $3x+4y+5=0$ ,  $4x-3y+15=0$  and one of its vertices is  $(0, 0)$ . The area of rectangle is \_\_\_\_.



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6. Find the length of the subtangent to the curve  $x^2y^2 = a^4$  at  $(-a, a)$ .



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7. For all real values of  $a$  and  $b$  lines  $(2a + b)x + (a + 3b)y + (b - 3a) = 0$  and  $mx+2y+6=0$  are concurrent, then  $m$  is equal to



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8. The line  $3x + 2y = 24$  meets the y-axis at  $A$  and the x-axis at  $B$ . The perpendicular bisector of  $AB$  meets the line through  $(0, -1)$  parallel to the x-axis at  $C$ . If the area of triangle  $ABC$  is  $A$ , then the value of  $\frac{A}{13}$  is \_\_\_\_\_



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9. If  $y$  is function of  $x$  and  $\log(x+y)=2xy$ , then find the value of  $y'(0)$ .



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10. Triangle  $ABC$  with  $AB = 13$ ,  $BC = 5$ , and  $AC = 12$  slides on the coordinates axes with  $A$  and  $B$  on the positive x-axis and positive y-axis respectively. The locus of vertex  $C$  is a line  $12x - ky = 0$ . Then the value of  $k$  is \_\_\_\_\_



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11. The line  $y = \frac{3x}{4}$  meets the lines  $x - y + 1 = 0$  and  $2x - y = 5$  at A and B respectively. Find Coordinates of P on  $y = \frac{3x}{4}$  such that  $PA \cdot PB = 25$ .



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12. In a plane there are two families of lines  $y = x + r, y = -x + r$ , where  $r \in \{0, 1, 2, 3, 4\}$ . Find the number of squares of diagonals of length 2 formed by the lines



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13. If  $5a+4b+20c=t$ , then the value of t for which the line  $ax+by+c-1=0$  always passes through a fixed point is



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1. The line L given by  $\frac{x}{5} + \frac{y}{b} = 1$  passes through the point (13,32).the line K is parallel to L and has the equation  $\frac{x}{c} + \frac{y}{3} = 1$  then the distance between L and K is

A.  $\frac{23}{\sqrt{17}}$

B.  $\frac{23}{\sqrt{15}}$

C.  $\sqrt{17}$

D.  $\frac{17}{\sqrt{15}}$

**Answer: A**



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2. The lines  $L_1: y-x=0$  and  $L_2: 2x+y=0$  intersect the line  $L_3: y+2=0$  at P and Q respectively. The bisector of the acute angle between  $L_1$  and  $L_2$  intersects  $L_3$  at R

Statement - 1 : The ratio PR : PQ equals  $2\sqrt{2} : \sqrt{5}$

Statement - 2 : In any triangle , bisector of an angle divides the triangle into two similar triangle

- A. Statement 1 is true, statement 2 is false.
- B. Statement 1 is true, statement 2 is true, statement 2 is the correct explanation of statement 1.
- C. Statement 1 is true, statement 2 is true, statement 2 is not the correct explanation of statement 1.
- D. Statement 1 is false, statement 2 is true.

**Answer: A**



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

A.  $-\frac{1}{4}$

B. -4

C. -2

D.  $-\frac{1}{2}$

**Answer: C**



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4. 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

A.  $2 + \sqrt{2}$

B.  $2 - \sqrt{2}$

C.  $1 + \sqrt{2}$

D.  $1 - \sqrt{2}$

**Answer: B**



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5. 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.  $y = \sqrt{3}x - \sqrt{3}$

D.  $\sqrt{3}y = x - 1$

**Answer: B**



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6. 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

A.  $2bc - 3ad = 0$

B.  $2bc+3ad=0$

C.  $3bc-2ad=0$

D.  $3bc+2ad=0$

**Answer: C**



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7. 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 (1)  $4x - 7y - 11 = 0$  (2)  $2x + 9y + 7 = 0$  (3)  $4x + 7y + 3 = 0$  (4)  $2x - 9y - 11 = 0$

A.  $4x-7y-1=0$

B.  $2x+9y+7=0$

C.  $4x+7y+3=0$

D.  $2x-9y-11=0$

**Answer: B**



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8. Locus of the image of the point  $(2, 3)$  in the line

$$(2x - 3y + 4) + k(x - 2y + 3) = 0, k \in R, \text{ is a :}$$

(1) straight line parallel to x-axis. (2) straight line parallel to y-axis (3) circle of radius  $\sqrt{2}$  (4) circle of radius  $\sqrt{3}$

A. Straight line parallel to x-axis

B. straight line parallel to y-axis

C. circle of radius  $\sqrt{2}$

D. circle of radius 3

**Answer: C**



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9. 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 ? (1)  $(-3, -9)$  (2)  $(-3, -8)$  (3)  $\left(\frac{1}{3}, -\frac{8}{3}\right)$  (4)  $\left(-\frac{10}{3}, -\frac{7}{3}\right)$

A.  $(-3, -8)$

B.  $\left(\frac{1}{3}, -\frac{8}{3}\right)$

C.  $\left(-\frac{10}{3}, -\frac{7}{3}\right)$

D.  $(-3, -9)$

**Answer: B**



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

A. a hyperbola

B. a parabola

C. an ellipse

D. a straight line

**Answer: D**



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2. A straight line L through the point (3, 2) is inclined at an angle  $60^\circ$  to the line  $\sqrt{3}x + y = 1$ . If L also intersects the x-axis, then the equation of L is

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.  $\sqrt{3}y + x - 3 + 2\sqrt{3} = 0$

**Answer: B**



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3. 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

A.  $a + b - c > 0$

B.  $a - b + c < 0$

C.  $a - b + c > 0$

D.  $a + b - c < 0$

**Answer: A**



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1. 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  $2 \leq d_1(P) + d_2(P) \leq 4$ , is

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