10.STRAIGHT LINES

Single Correct Answer Type

1. The area of the triangle bounded by the straight line $ax+by+c=0,(a,b,c\neq 0)$ and the coordinate axes is
   a) $\frac{1}{2}\frac{a^2}{|bc|}$ b) $\frac{1}{2}\frac{c^2}{|ab|}$ c) $\frac{1}{2}\frac{b^2}{|ac|}$ d) 0
2. The points $(1,1),(-5,5)$ and $(13,\lambda)$ lie on the same straight line, if λ is equal to
   a) 7 b) -7 c) ± 7 d) 0
3. The equations to the straight lines passing through the origin and making an angle α with the straight line $y+x=0$ are given by
   a) $x^2+2xy\sec 2\alpha+y^2=0$
   b) $x^2-2\,xy\sec 2\alpha+y^2=0$
   c) $x^2+2\,xy\cos 2\alpha+y^2=0$
   d) None of these
4. Consider the points $A\equiv(3,4),B\equiv(7,13)$. If '$P$' be a point on the line $y=x$, such that $PA+PB$ is minimum, then coordinates of P is
   a) $\left(\frac{13}{7},\frac{13}{7}\right)$ b) $\left(\frac{23}{7},\frac{23}{7}\right)$ c) $\left(\frac{31}{7},\frac{31}{7}\right)$ d) $\left(\frac{33}{7},\frac{33}{7}\right)$
5. The length of the perpendicular from the origin of the line
   $\frac{x\sin\alpha}{b}-\frac{y\cos\alpha}{a}-1=0$ is
   a) $\frac{|ab|}{\sqrt{a^2\cos^2\alpha-b^2\sin^2\alpha}}$ b) $\frac{|ab|}{\sqrt{a^2\cos^2\alpha+b^2\sin^2\alpha}}$
   c) $\frac{|ab|}{\sqrt{a^2\sin^2\alpha-b^2\cos^2\alpha}}$ d) $\frac{|ab|}{\sqrt{a^2\sin^2\alpha+b^2\cos^2\alpha}}$
6. The angle between the straight line $x-y\sqrt{3}=5$ and $\sqrt{3}x+y=7$ is
   a) 90° b) 60° c) 75° d) 30°
7. Two consecutive sides of a parallelogram are $4x+5y=0$ and $7x+2y=0$. One diagonal of the parallelogram is $11x+7y=9$. If the other diagonal is $ax+by+c=0$, then
   a) $a=-1,b=-1,c=2$ b) $a=1,b=-1,c=0$
   c) $a=-1,b=-1,c=0$ d) $a=1,b=1,c=1$
8. The straight lines $ax+by=c, bx+cy=a$ and $cx+ay=b$ are concurrent, if
   a) $a+b=c$ b) $b+c=a$ c) $c+a=b$ d) $a+b+c=0$
9. If the angle between the pair of straight lines represented by the equation $x^2-3xy+\lambda y^2+3x-5y+2=0$, is $\tan^{-1}\left(\frac{1}{3}\right)$, where '$\lambda$' is a non-negative real number. Then, λ is
   a) 2 b) 0 c) 3 d) 1
10. The centroid of the triangle formed by the pair of straight lines $12x^2-20xy+7y^2=0$ and the line $2x-3y+4=0$ is
    a) $\left(-\frac{7}{3},\frac{7}{3}\right)$ b) $\left(-\frac{8}{3},\frac{8}{3}\right)$ c) $\left(\frac{8}{3},\frac{8}{3}\right)$ d) $\left(\frac{4}{3},\frac{4}{3}\right)$
11. If the angle between the lines represented by $2x^2+5xy+3y^2+6x+7y+4=0$ is $\tan^{-1}(m)$, then m is equal to
    a) 1/5 b) -1 c) $-2/3$ d) None of these
12. The lines represents by $ax^2+2hxy+by^2=0$ are perpendicular to each other, if
    a) $h^2=a+b$ b) $a+b=0$ c) $h^2=ab$ d) $h=0$
13. If the lines $3x+4y+1=0, 5x+\lambda y+3=0$ and $2x+y-1=0$ are concurrent, then λ is equal to
    a) -8 b) 8 c) 4 d) -4

14. The lines $p(p^2+1)x-y+q=0$ and $(p^2+1)^2x+(p^2+1)y+2q=0$ are perpendicular to a common line for
a) Exactly one value of p
b) Exactly two values of p
c) More than two values of p
d) No value of p
15. If $P(\sin\theta, 1/\sqrt{2})$ and $Q(1/\sqrt{2}, \cos\theta)$, $-\pi \le \theta \le \pi$ are two points on the same side of the line $x-y=0$, then θ belongs to the interval
a) $-\pi/4, \pi/4$
b) $(-\pi/4, \pi/4)$
c) $(\pi/4, 3\,\pi/4)$
d) None of these
16. The area of the triangle formed by the axes and the line $(\cos h\,\alpha - \sin h\,\alpha) + (\cos h\,\alpha + \sin h\,\alpha)y = 2$ in square units, is
a) 4
b) 3
c) 2
d) 1
17. If a, c, b are in G.P., then the line $ax+by+c=0$
a) Has a fixed direction
b) Always passes through a fixed point
c) Forms a triangle with the axes whose area is constant
d) Always cuts intercepts on the axes such that their sum is zero
18. The equation of the image of the lines $y=|x|$ in the line mirror $x=2$ is
a) $y=|x-4|$
b) $|y|=x+4$
c) $|y|+4=x$
d) None of these
19. The angle between the straight lines $x^2-y^2-2\,x-1=0$, is
a) 90°
b) 60°
c) 75°
d) 36°
20. The equation of the line passing through the intersection of the lines $x-3y+1=0$ and $2x+5y-9=0$ and at distance $\sqrt{5}$ from the origin, is
a) $2\,x-y=5$
b) $x+2\,y=5$
c) $2\,x+y=5$
d) $x+2\,y=1$
21. The area of the parallelogram formed by the lines $x\cos\alpha + y\sin\alpha = p$, $x\cos\alpha + y\sin\alpha = q$, $x\cos\beta + y\sin\beta = r$ and $x\cos\beta + y\sin\beta = s$ for given values of p, q, r and s is least, if $(\alpha-\beta) =$
a) $\pm\frac{\pi}{2}$
b) $\frac{\pi}{4}$
c) $\frac{\pi}{6}$
d) $\frac{\pi}{3}$
22. A rectangle has two opposite vertices at the points (1,2) and (5,5). If the other vertices lie on the line $x=3$, then their coordinates are
a) (3,1), (3,3)
b) (3,1), (3,6)
c) (3,1), (3,4)
d) None of these
23. A line is drawn from $P(x_1, y_1)$ in the direction α with the x-axis, to meet $A\,x+B\,y+C=0$ at Q. Then, the length PQ is equal to
a) $\left|\frac{A\,x_1+B\,y_1+C}{\sqrt{A^2+B^2}}\right|$
b) $-\frac{A\,x_1+B\,y_1+C}{A\cos\alpha + B\sin\alpha}$
c) $\frac{A\,x_1+B\,y_1+C}{A\cos\alpha\, B\sin\alpha}$
d) $-\frac{A\,x_1+B\,y_1+C}{A\sin\alpha + B\cos\alpha}$
24. The angle between the lines represented by the equation $2x^2+3xy-5y^2=0$, is
a) $\frac{\pi}{3}$
b) $\frac{\pi}{2}$
c) $\tan^{-1}\left|\frac{12}{5}\right|$
d) $\tan^{-1}\left|\frac{7}{3}\right|$
25. A point moves in such a way that the square of its distance from the point $(3,-2)$ is equal to numerically its distance from the line $5x-12y=13$. The equation of the locus of the point is
a) $x^2+y^2-11x-16y+26=0$
b) $x^2+y^2-11x+16y=0$
c) $13(x^2+y^2)-83x+64y+182=0$
d) $x^2+y^2-83x+64y+182=0$
26. The line $x+y=4$ divides the line joining $(-1,1)$ and $(5,7)$ in the ratio $\lambda : 1$, then the value of λ is
a) 2
b) 1/2
c) 3
d) None of these
27. If $ax^2-y^2+4x-y=0$ represents a pair of lines, then a is equal to
a) -16
b) 16
c) 4
d) -4
28. The locus of the point $P(x, y)$ satisfying the relation
$\sqrt{(x-3)^2+(y-1)^2} + \sqrt{(x+3)^2+(y-1)^2} = 6$ is
a) A straight line
b) A pair of straight lines
c) A circle
d) An ellipse
29. The value of k for which the lines $2x-3y+k=0$, $3x-4y-13=0$ and $8x-11y-33=0$ are concurrent, is
a) 20
b) -7
c) 7
d) -20

30. Points on the line $y = x$ whose perpendicular distance from the line $3x + 4y = 12$ are 4 have the coordinates
a) $\left(-\frac{8}{7}, -\frac{8}{7}\right), \left(-\frac{32}{7}, -\frac{32}{7}\right)$
b) $\left(\frac{8}{7}, \frac{8}{7}\right), \left(\frac{32}{7}, \frac{32}{7}\right)$
c) $\left(-\frac{8}{7}, -\frac{8}{7}\right), \left(\frac{32}{7}, \frac{32}{7}\right)$
d) None of these
31. The equation of the bisectors of the angles between the lines $|x| = |y|$ are
a) $y = \pm x$ and $x = 0$ b) $x = \frac{1}{2}$ and $y = \frac{1}{2}$ c) $y = 0$ and $x = 0$ d) None of these
32. Consider the family of lines $(x + y - 1) + \lambda(2x + 3y - 5) = 0$ and $(3x + 2y - 4) + \mu(x + 2y - 6) = 0$, equation of the straight line that belongs to both the families is
a) $x - 2y - 8 = 0$ b) $x - 2y + 8 = 0$ c) $2x + y - 8 = 0$ d) $2x - y - 8 = 0$
33. A straight line passing through P (3, 1) meet the coordinate axes at A and B. It is given that distance of this straight line from the origin 'O' is maximum. Area of $\Delta\, OAB$ is equal to
a) $\frac{50}{3}$ sq unit b) $\frac{25}{3}$ sq unit c) $\frac{20}{3}$ sq unit d) $\frac{100}{6}$ sq unit
34. The lines represented by the equation $x^2 - y^2 - x + 3y - 2 = 0$ are
a) $x + y - 1 = 0, x - y + 2 = 0$ b) $x - y - 2 = 0, x + y + 1 = 0$
c) $x + y + 2 = 0, x - y - 1 = 0$ d) $x - y + 1 = 0, x + y - 2 = 0$
35. If the bisectors of angles represented by $ax^2 + 2hxy + by^2 = 0$ and $a'x^2 + 2h'xy + b'y^2 = 0$ are same, then
a) $(a - b)h' = (a' - b')h$ b) $(a - b)h = (a' - b')h'$
c) $(a + b)h' = (a' - b')h$ d) $(a - b)h' = (a' + b')h$
36. 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 $3x - 4y - 8 = 0$, then
a) $x > \frac{8}{15}, y < -\frac{8}{5}$ b) $x > \frac{8}{5}, y < -\frac{8}{15}$ c) $x = \frac{8}{15}, y = -\frac{8}{5}$ d) None of these
37. A point equidistant from the lines $4\,x + 3\,y + 10 = 0, 5\,x - 12\,y + 26 = 0$ and $7\,x + 24\,y - 50 = 0$ is
a) $(1, -1)$ b) $(1,1)$ c) $(0,0)$ d) $(0,1)$
38. The straight line $4x + 3y = 12$ intersects the x-axis and y-axis at A and B respectively. Then the distance BI where I is the centre of the in-circle of $\Delta\, OAB$, where B is the origin, is equal to
a) $\sqrt{10}$ b) $2\sqrt{5}$ c) 3 d) 2
39. Let PQR be a right angled isosceles triangle, right angled at $P(2, 1)$. If the equation of the line QR is $2x + y = 3$, then the equation representing the pair of lines PQ and PR is
a) $3x^2 - 3y^2 + 8xy + 20x + 10y + 25 = 0$
b) $3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$
c) $3x^2 - 3y^2 + 8xy + 10x + 15y + 20 = 0$
d) $3x^2 - 3y^2 - 8xy - 10x - 15y - 20 = 0$
40. A point moves in the xy-plane such that the sum of its distance from two mutually perpendicular lines is always equal to 3. The area of the locus of the point is
a) 18 sq.units b) 9/2 sq.units c) 9 sq.units d) None of these
41. The equation of the lines through the point (3, 2) which makes an angle of 45° with the line $x - 2y = 3$, are
a) $3x - y = 7$ and $x + 3y = 9$ b) $x - 3y = 7$ and $3x + y = 9$
c) $x - y = 3$ and $x + y = 2$ d) $2x + y = 7$ and $x - 2y = 9$
42. Equation of the straight line making equal intercepts on the axes and passing through the point (2, 4), is
a) $4x - y - 4 = 0$ b) $2x + y - 8 = 0$ c) $x + y - 6 = 0$ d) $x + 2y - 10 = 0$
43. The point on the axis of x, whose perpendicular distance from the straight line

$\frac{x}{a}+\frac{y}{b}=1$ is a, are

a) $\frac{b}{a}(a \pm \sqrt{a^2+b^2}, 0$
b) $\left(\frac{a}{b}\left(b \pm \sqrt{a^2+b^2}\right), 0\right)$
c) $\frac{b}{a}(a+b, 0)$
d) $\frac{a}{b}(a \pm \sqrt{a^2+b^2}, 0)$

44. The difference of the tangents of the angles which the lines $x^2(\sec^2\theta - \sin^2\theta) - 2xy\tan\theta + y2\sin 2\theta = 0$ make with the x-axis is
a) $2\tan\theta$
b) 2
c) $2\cot\theta$
d) $\sin 2\theta$

45. The image of the origin with reference to the line $4x+3y-25=0$, is
a) $(-8, 6)$
b) $(8, 6)$
c) $(-3, 4)$
d) $(8, -6)$

46. Consider the following statements:
I. If $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \begin{vmatrix} a_1 & b_1 & 1 \\ a_2 & b_2 & 1 \\ a_3 & b_3 & 1 \end{vmatrix}$, then the two triangles with vertices $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ and $(a_1, b_1), (a_2, b_2), (a_3, b_3)$ must be congruent
II. Only one straight line can be drown through the origin at equal distance from the points $A(2, 2)$ and $B(4, 0)$
Which of these is/are correct
a) Only 1
b) Only 2
c) Both of these
d) None of these

47. All chords of the curve $3x^2 - y^2 - 2x + 4y = 0$ which subtend a right angle at the origin, pass through the fix point
a) $(1, 2)$
b) $(1, -2)$
c) $(-1, 2)$
d) $(-1, -2)$

48. Lines $2x + y = 1$ and $2x + y = 7$ are
a) On the same side of a point $\left(0, \frac{1}{2}\right)$
b) On the opposite side of a point $\left(0, \frac{1}{2}\right)$
c) Same lines
d) Perpendicular lines

49. The angle between the pair of lines
$2x^2 + 5xy + 2y^2 + 3x + 3y + 1 = 0$, is
a) $\cos^{-1}(4/5)$
b) $\tan^{-1}(4/5)$
c) 0
d) $\pi/2$

50. If the line $px^2 - qxy - y^2 = 0$ makes an angles α and β with x-axis, then the value of tan (α + β) is
a) $\frac{-q}{1+p}$
b) $\frac{q}{1+p}$
c) $\frac{p}{1+q}$
d) $\frac{-p}{1+q}$

51. If the distance of any point (x, y) from the origin is defined as $d(x, y) = \max\{|x|, |y|\}$, $d(x, y) = a$, non-zero constant, then the locus is
a) A circle
b) A straight line
c) A square
d) A triangle

52. The pair of lines joining origin to the points of intersection of the two curves
$ax^2 + 2hxy + by^2 + 2gx = 0$ and $a'x^2 + 2h'xy + b'y^2 + 2g'x = 0$ will be at right angles, if
a) $(a' + b')g' = (a + b)g$
b) $(a + b)g' = (a' + b')g$
c) $h^2 - ab = h'^2 - a'b'$
d) $a + b + h^2 = a' + b' + h'^2$

53. Two vertices of a triangle are $(5, -1)$ and $(-2, 3)$. If the orthocentre of the triangle is the origin, then coordinates of the third vertex are
a) $(4, 7)$
b) $(-4, -7)$
c) $(-4, 7)$
d) None of these

54. The distance between the parallel lines $y = x + a$, $y = x + b$ is
a) $\frac{|b-a|}{\sqrt{2}}$
b) $|a - b|$
c) $|a + b|$
d) $\frac{|b+a|}{\sqrt{2}}$

55. Consider the fourteen lines in the plane given by $y = x + r$, $y = -x + r$, where $r \in \{0, 1, 2, 3, 4, 5, 6\}$. The number of squares formed by these lines, whose sides are of length $\sqrt{2}$, is
a) 9
b) 16
c) 25
d) 36

56. The line $(p + 2q)x + (p - 3q)y = p - q$ for different values of p and q passes through the fixed point
a) $(3/2, 5/2)$
b) $(2/5, 2/5)$
c) $(3/5, 3/5)$
d) $(2/5, 3/5)$

57. A line passing through origin and is perpendicular to two given lines $2x + y + 6 = 0$ and $4x + 2y - 9 = 0$.

The ratio in which the origin divides this line, is

a) 1: 2 b) 2: 1 c) 4: 2 d) 4: 3

58. A straight line through the point (1, 1) meets the x-axis at 'A' and y-axis at 'B'. The locus of the mid point of AB is

a) $2xy + x + y = 0$ b) $x + y - 2xy = 0$ c) $x + y + 2 = 0$ d) $x + y - 2 = 0$

59. The distance between the lines $3x + 4y = 9$ and $6x + 8y = 15$ is

a) $\frac{3}{2}$ b) $\frac{3}{10}$ c) 6 d) None of these

60. The equation of the pair of straight lines parallel to x-axis and touching the circle $x^2 + y^2 - 6x - 4y - 12 = 0$ is

a) $y^2 - 4y - 21 = 0$ b) $y^2 + 4y - 21 = 0$ c) $y^2 - 4y + 21 = 0$ d) $y^2 + 4y + 21 = 0$

61. If the area of the triangle formed by the pair of lines given by $8x^2 - 6xy + y^2 = 0$ and the line $2x + 3y = a$ is 7, then $a =$

a) 14 b) $14\sqrt{2}$ c) 28 d) None of these

62. The equation of the line which is such that the portion of line segment intercepted between the coordinate axes is bisected at $(4, -3)$, is

a) $3x + 4y = 24$ b) $3x - 4y = 12$ c) $3x - 4y = 24$ d) $4x - 3y = 24$

63. Let α be the distance between lines $-x + y = 2$ and $x - y = 2$ and β be the distance between the lines $4x - 3y = 5$ and $6y - 8x = 1$, then

a) $20\sqrt{2}\beta = 11\alpha$ b) $20\sqrt{2}\alpha = 11\beta$ c) $11\sqrt{2}\beta = 20\alpha$ d) None of these

64. If the lines $x^2 + 2xy - 35y^2 - 4x + 44y - 12 = 0$ and $5x + \lambda y - 8 = 0$ are concurrent, then the value of λ is

a) 0 b) 1 c) -1 d) 2

65. The straight line $3x + 4y - 5 = 0$ and $4x = 3y + 15$ intersect at the point P. On these lines the points Q and R are chosen so that $PQ = PR$. The slopes of the lines QR passing through (1, 2) are

a) $-7, 1/7$ b) $7, 1/7$ c) $7, -1/7$ d) $3, -1/3$

66. The vertices of a triangle are $A(3,7)$, $B(3,4)$ and $C(5,4)$. The equation of the bisector of the angle ABC is

a) $y = x + 1$ b) $y = x - 1$ c) $y = 3x - 5$ d) $y = x$

67. The position of reflection of the point (4, 1) about the line $y = x - 1$ is

a) (1, 2) b) (3, 4) c) $(-1, 0)$ d) (2, 3)

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

a) $3x - 4y + 7 = 0$ b) $4x + 3y = 24$ c) $3x + 4y = 25$ d) $x + y = 7$

69. If $(-4, 5)$ is one vertex and $7x - y + 8 = 0$ is one diagonal of a square, then the equation of second diagonal is

a) $x + 3y = 21$ b) $2x - 3y = 7$ c) $x + 7y = 31$ d) $2x + 3y = 21$

70. The pair of lines joining origin to the points of intersection of the two curves $ax^2 + 2hxy + by^2 + 2gx = 0$ and $a'x^2 + 2h'xy + b'y^2 + 2g'x = 0$ will be at right angles, if

a) $(a' + b')g' = (a + b)g$ b) $(a + b)g' = (a' + b')g$

c) $h^2 - ab = h'^2 - a'b'$ d) $a + b + h^2 = a' + b' + h'^2$

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

a) $x + 3y = 0$ b) $x + 3y = 10$ c) $x + 3y = 10xy$ d) None of these

72. Distance between the two parallel lines $y = 2x + 7$ and $y = 2x + 5$ is

a) $\sqrt{5}/2$ b) $2/5$ c) $2/\sqrt{5}$ d) $1/\sqrt{5}$

73. If P is the length of the perpendicular from the origin on the line whose intercepts on the axes are a and b, then

a) $p^2 = a^2 + b^2$ b) $p^2 = a^2 - b^2$ c) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$ d) $\frac{1}{p^2} = \frac{1}{a^2} - \frac{1}{b^2}$

74. If the diagonals of a parallelogram $ABCD$ are along the lines $x + 5y = 7$ and $10x - 2y = 9$, then $ABCD$

must be a

a) Rectangle b) Square c) Cyclic quadrilateral d) Rhombus

75. The value of k such that the lines $2x - 3y + k = 0, 3x - 4y - 13 = 0$ and $8x - 11y - 33 = 0$ are concurrent, is

a) 20 b) -7 c) 7 d) -20

76. The area (in square units) of the quadrilateral formed by two pairs of lines $l^2 x^2 - m^2 y^2 - n(lx + my) = 0$ and $l^2 x^2 - m^2 y^2 + n(lx - my) = 0$, is

a) $\frac{n^2}{2\,|lm|}$ b) $\frac{n^2}{|lm|}$ c) $\frac{n}{2\,|lm|}$ d) $\frac{n^2}{4|lm|}$

77. A square of side a lies above the x-axis and has one vertex at origin. The side passing through the origin makes an angle α $\left(0 < \alpha < \frac{\pi}{4}\right)$ with the positive direction of x-axis. The equation of its diagonal not passing through the origin is

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

78. The equation of one of the lines parallel to $4x - 3y = 5$ and at a unit distance from the point $(-1, -4)$ is

a) $3x + 4y - 3 = 0$ b) $3x + 4y + 3 = 0$ c) $4x - 3y + 3 = 0$ d) $4x - 3y - 3 = 0$

79. The point $P(a, b)$ lies on the straight line $3x + 2y = 13$ and the point $Q(b, a)$ lies on the straight line $4x - y = 5$, then equation of the line PQ is

a) $x - 5 = 5$ b) $x + y = 5$ c) $x + y = -5$ d) $x - y = -5$

80. The equation $x^2 + kxy + y^2 - 5x - 7y + 6 = 0$ represents a pair of straight lines, then k is

a) 5/3 b) 10/3 c) 3/2 d) 3/10

81. If t_1 and t_2 are roots of the equation $t^2 + \lambda t + 1 = 0$, where λ is an arbitrary constant. Then, the line joining the points $(at_1^2, 2at_1)$ and $(at_2^2, 2at_2)$ always passes through a fixed point whose coordinates are

a) $(a, 0)$ b) $(-a, 0)$ c) $(0, a)$ d) $(0, -a)$

82. 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. The equation to the line AB so that the $\Delta\, OAB$ is equilateral is

a) $x - 2 = 0$ b) $y - 2 = 0$ c) $x + y - 4 = 0$ d) None of these

83. In order to eliminate the first degree terms from the equation $2x^2 + 4xy + 5y^2 - 4x - 22y + 7 = 0$, the point to which origin is to be shifted, is

a) $(1, -3)$ b) $(2, 3)$ c) $(-2, 3)$ d) $(1, 3)$

84. If the lines given by $ax^2 + 2hxy + by^2 = 0$ are equally inclined to the lines given by $ax^2 + 2hxy + by^2 + \lambda(x^2 + y^2) = 0$, then

a) λ is any real number b) $\lambda = 2$ c) $\lambda = 1$ d) None of these

85. The equation of the line bisecting perpendicularly the segment joining the points $(-4, 6)$ and $(8, 8)$, is

a) $6x + y - 19 = 0$ b) $y = 7$ c) $6x + 2y - 19 = 0$ d) $x + 2y - 7 = 0$

86. The value of λ for which the lines $3x + 4y = 5, 5x + 4 = 4$ and $\lambda x + 4y = 6$ meet at a point is

a) 2 b) 1 c) 4 d) 3

87. The parallelism condition for two straight lines one of which is specified by the equation $ax + by + c = 0$ and the other being represented parametrically by $x = \alpha t + \beta, y = \gamma t + \delta$, is given by

a) $a\gamma + \mathrm{b}\alpha = 0, \beta = \delta = \mathrm{c} = 0$ b) $a\alpha - b\gamma = 0, \beta = \delta = 0$

c) $a\alpha + b\gamma = 0$ d) $a\gamma = b\alpha = 0$

88. Origin containing angle bisector of two lines $L_1 \equiv a_1x + b_1y + c_1 = 0$ and $L_2 \equiv a_2x + b_2y + c_2 = 0$ (where $c_1c_2 < 0$) is

a) $\frac{a_1x + b_1y + c_1}{\sqrt{a_1^2 + b_1^2}} = \frac{a_2x + b_2y + c_2}{\sqrt{a_2^2 + b_2^2}}$ b) $\frac{a_1x + b_1y + c_1}{\sqrt{a_1^2 + b_1^2}} = -\frac{a_2x + b_2y + c_2}{\sqrt{a_2^2 + b_2^2}}$

c) $\frac{a_1x + b_1y + c_1}{a_1^2 + b_1^2} = \frac{a_2x + b_2y + c_2}{a_2^2 + b_2^2}$ d) Depends on the value of c_1 and c_2

89. The point of intersection of the two lines given by $2\,x^2 - 5\,xy + 2y^2 - 3\,x + 3\,y + 1 = 0$ is

a) (1/2,1/3) b) (−1/7, −1/7) c) (−1/3,1/3) d) None of these

90. If the slope of one of the lines given by $ax^2 - 6\,xy + y^2 = 0$ is square of the other, then $a =$
a) $8, -27$ b) $-8, 27$ c) $1, 8$ d) $-8, -27$
91. Equation of straight line belonging to families of straight lines
$(x + 2y) + \lambda(3x + 2y + 1) = 0$ and $(x - 2y) + \mu(x - y + 1) = 0$ is
a) $6x + 5y = 2$ b) $5x - 6y + 4 = 0$ c) $5x + 6y = 4$ d) None of these
92. A straight line through $P(1, 2)$ is such that intercept between the axes is bisected at P. Its equation is
a) $x + y = -1$ b) $x + y = 3$ c) $x + 2y = 5$ d) $2x + y = 4$
93. The equation $x^2 + 2\sqrt{2}xy + 2y^2 + 4x + 4\sqrt{2}\,y + 1 = 0$ represents a pair of lines which are parallel to each other. The distance between them is
a) 4 units b) $2\sqrt{3}$ units c) $4\sqrt{3}$ units d) 2 units
94. A straight rod of length 9 units slides with its ends A, B always on the X and Y axis respectively. then, the locus of the centroid of $\Delta\, OAB$ is
a) $x^2 + y^2 = 3$ b) $x^2 + y^2 = 9$ c) $x^2 + y^2 = 1$ d) $x^2 + y^2 = 81$
95. If the point $(1, \alpha)$ always remains in the interior of the triangle formed by the lines $y = x, y = 0$ and $x + y = 4$, then α lies in the interval
a) $(0,1)$ b) $[0,1]$ c) $[0,4]$ d) None of these
96. The angle between the pair of straight lines $y^2\sin^2\theta - xy\sin^2\theta + x^2(\cos^2\theta - 1) = 0$ is
a) $\pi/3$ b) $\pi/4$ c) $\pi/6$ d) $\pi/2$
97. The area of a pentagon whose vertices are $(4,1), (3,6), (-5,1), (-3,-3)$ and $(-3,0)$ is
a) 30 sq. units b) 60 sq. units c) 9 sq. units d) None of these
98. Let PS be the median of the triangle with vertices $P(2, 2)$, $Q(6, -1)$ and $R(7, 3)$. The equation of the line passing through $(1, -1)$ and parallel to PS is
a) $2x - 9y - 7 = 0$ b) $2x - 9y - 11 = 0$ c) $2x + 9y - 11 = 0$ d) $2x + 9y + 7 = 0$
99. If a line passes through the point (2,2) and encloses a triangle of area A square units with the coordinate axes, then the intercepts made by the line on the coordinate axes are the roots of the equations
a) $x^2 \pm Ax \mp 2A = 0$ b) $x^2 \pm Ax \pm 2A = 0$ c) $x^2 \pm 2Ax \pm A = 0$ d) $x^2 \pm 2Ax \mp A = 0$
100. Joint equation of the diagonals of the square formed the pairs of lines $xy + 4x - 3y - 12 = 0$ and $xy - 3x + 4y - 12 = 0$, is
a) $x^2 - y^2 + x - y = 0$
b) $x^2 - y^2 + x + y = 0$
c) $x^2 + 2xy + y^2 + x + y = 0$
d) $x^2 - 2\,xy + y^2 + x - y = 0$
101. The equation of the base of an equilateral triangle is $x + y = 2$ and the vertex is $(2, -1)$, then the length of the side of the triangle is
a) $\sqrt{3/2}\,/\sqrt{2/3}$ b) $\sqrt{2}$ c) $\sqrt{2/3}$ d) $\sqrt{3/2}$
102. The line $\frac{x}{a} - \frac{y}{b} = 1$ cuts the x-axis at P. The equation of the line through P perpendicular to the given line is
a) $x + y = ab$ b) $x + y = a + b$ c) $ax + by = a^2$ d) $bx + ay = b^2$
103. In the above question the coordinates of the other two vertices are
a) $(2, 0), (4,4)$ b) $(2,4), (4,0)$ c) $(-2, 0), (4, -4)$ d) $(2,0), (-4,4)$
104. The line $x + 2y = 4$ is translated parallel to itself by 3 units in the sense of increasing x and then rotated by 30° in the clockwise direction about the point where the shifted line cuts the x-axis. The equation of the line in the new position is
a) $y = \tan(\theta - 30°)\left(x - 4 - 3\sqrt{5}\right)$
b) $y = \tan(30° - \theta)(x - 4 - 3\sqrt{5})$
c) $y = \tan(\theta + 30°)(x + 4 + 3\sqrt{5})$
d) $y = \tan(\theta - 30°)(x + 4 + 3\sqrt{5})$
105. If $\lambda x^2 - 10\,xy + 12\,y^2 + 5\,x - 16\,y - 3 = 0$, represents a pair of straight lines, then the value of λ is
a) 4 b) 3 c) 2 d) 1
106. 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

a) 2 b) 0 c) 4 d) 1

107. The distance of the point (3, 5) from the line $2x + 3y - 14 = 0$ measured parallel to line $x - 2y = 1$, is

a) $\frac{7}{\sqrt{5}}$ b) $\frac{7}{\sqrt{13}}$ c) $\sqrt{5}$ d) $\sqrt{13}$

108. The equation $8x^2 + 8xy + 2y^2 + 26x + 13y + 15 = 0$ represents a pair of straight lines. The distance between then is

a) $\frac{7}{\sqrt{5}}$ b) $\frac{7}{2\sqrt{5}}$ c) $\frac{\sqrt{7}}{5}$ d) None of these

109. A system of lines is given as $y = m_i x + c_i$ where m_i can take any value out of $0, 1, -1$ and when m_i is positive, then c_i can be 1 or -1, when m_i equal 0, c_i can be 0 or 1 and when m_i equals to -1, c_i can take 0 or 2. Then, the area enclosed by all these straight line is

a) $\frac{3}{\sqrt{2}}(\sqrt{2} - 1)$sq unit b) $\frac{3}{\sqrt{2}}$ sq unit c) $\frac{3}{2}$ sq unit d) None of these

110. The angle between the lines represented by $x^2 - y^2 = 0$ is

a) 0° b) 45° c) 90° d) 180°

111. If the slope of one of the lines given by $36x^2 + 2hxy + 72y^2 = 0$ is four times the other, then $h^2 =$

a) 5040 b) 4050 c) 8100 d) None of these

112. If non-zero numbers a, b, c are in HP, then the straight line $\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes through a fixed point. That point is

a) $\left(1, -\frac{1}{2}\right)$ b) $(1, -2)$ c) $(-1, -2)$ d) $(-1, 2)$

113. The distance between the pair of lines given by $x^2 + y^2 + 2xy - 8ax - 8ay - 9a^2 = 0$ is

a) $2\sqrt{5}a$ b) $10\sqrt{a}$ c) 10a d) $5\sqrt{2}a$

114. The image of the origin with reference to the line $4x + 3y - 25 = 0$ is

a) $(-8, 6)$ b) $(8, 6)$ c) $(-3, 4)$ d) $(8, -6)$

115. The equation of a straight line passing through the point of intersection of $x - y + 1 = 0$ and $3x + y - 5 = 0$ and perpendicular to one of them, is

a) $x + y + 3 = 0$ b) $x - y - 3 = 0$ c) $x - 3y - 5 = 0$ d) $x - 3y + 5 = 0$

116. If the lines $kx - 2y - 1 = 0$ and $6x - 4y - m = 2$ are identical (coincident) lines, then the values of k and m are

a) $k = 3, m = 2$ b) $k = -3, m = 2$ c) $k = -3, m = -2$ d) $k = 3, m = -2$

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

a) $3x - 2y + 5$ b) $3x - 2y + 10$ c) $2x + 3y - 5$ d) $6x - 4y - 7$

118. $ax + by - a^2 = 0$, where a, b are non-zero, is the equation to the straight line perpendicular to a line l and passing through the point where l crosses the x-axis. Then, equation to the line l is

a) $\frac{x}{b} - \frac{y}{a} = 1$ b) $\frac{x}{a} - \frac{y}{b} = 1$ c) $\frac{x}{b} + \frac{y}{a} = ab$ d) $\frac{x}{a} - \frac{y}{b} = ab$

119. L is variable line such that the algebraic sum of the distances of the points (1, 1), (2, 0) and (0,2) from the line is equal to zero. The line L will always pass through

a) (1, 1) b) (2, 1) c) (1,2) d) (2, 2)

120. If $(-4, 5)$ is one vertex and $7x - y + 8 = 0$ is one diagonal of a square, then the equation of the second diagonal is

a) $x + 3y = 21$ b) $2x - 3y = 7$ c) $x + 7y = 31$ d) $2x + 3y = 21$

121. If the equations, $12x^2 - 10xy + 2y^2 + 11x - 5y + k = 0$ represents two straight lines, then the value of k is

a) 1 b) 2 c) 0 d) 3

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

a) $x^2 + y^2 = 4p^2$ b) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$ c) $x^2 + y^2 = \frac{4}{p^2}$ d) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{2}{p^2}$

123. The orthocentre of the triangle formed by $(0,0),(8,0),(4,6)$ is

a) $(4,8/3)$ b) $(3,4)$ c) $(4,3)$ d) $(-3,4)$

124. The orthocentre of the triangle with vertices $\left(2,\frac{\sqrt{3}-1}{2}\right),\left(\frac{1}{2},-\frac{1}{2}\right)$ and $\left(2,-\frac{1}{2}\right)$ is

a) $\left(\frac{3}{2},\frac{\sqrt{3}-3}{6}\right)$ b) $\left(2,-\frac{1}{2}\right)$ c) $\left(\frac{5}{4},\frac{(\sqrt{3}-2)}{4}\right)$ d) $\left(\frac{1}{2},-\frac{1}{2}\right)$

125. The image of the point $(3,8)$ in the line $x+3y=7$, is

a) $(1,4)$ b) $(4,1)$ c) $(-1,-4)$ d) $(-4,-1)$

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

a) Not concurrent b) Concurrent at $(1,1)$ c) Concurrent at $(2,-2)$ d) Concurrent at $(-2,2)$

127. The number of the straight lines which are equally inclined to both the exes, is

a) 4 b) 2 c) 3 d) 1

128. If one of the lines of $my^2+(1-m^2)xy-mx^2=0$ is a bisector of the angle between the lines $xy=0$, then m is/are

a) $-\frac{1}{2}$ b) -2 c) ±1 d) 2

129. An equilateral $\Delta\, ABC$ in first quadrant is such that A lies on x-axis, B lies on y-axis and BC is parallel to x-axis, then equation of straight line through C parallel to AB is ('a' is length of the side)

a) $y-\sqrt{3}x=\frac{3a\sqrt{3}}{2}$ b) $\sqrt{3}y+x=\frac{3a\sqrt{3}}{2}$ c) $y+\sqrt{3}x=\frac{3a\sqrt{3}}{2}$ d) None of these

130. The value 'p' for which the equation $x^2+pxy+y^2-5x-7y+6=0$ represents a pair of straight lines, is

a) $5/2$ b) 5 c) 2 d) $2/5$

131. The equation of the line with gradient $-3/2$ which is concurrent with the lines $4x+3y-7=0$ and $8x+5y-1=0$ is

a) $3x+2y-2=0$ b) $3x+2y-63=0$ c) $2y-3x-2=0$ d) None of these

132. Let ABC be an isosceles triangle with $AB=BC$. If base BC is parallel to x-axis and m_1 and m_2 are the slopes of medians drawn through the angular points B and C, then

a) $m_1m_2=-1$ b) $m_1+m_2=0$ c) $m_1m_2=2$ d) $m_1+2m_2=0$

133. y-intercept of line passes through (2, 2) and is perpendicular to the line $3x+y=3$, is

a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) 1 d) $\frac{4}{3}$

134. The equation of the bisector of the obtuse angle between the lines $3x-4y+7=0$ and $-12x-5y+2=0$, is

a) $21x+77y-101=0$ b) $99x-27y+81=0$

c) $21x-77y+101=0$ d) None of these

135. The equation of the line equidistant from the lines $2x+3y+5=0$ and $4x+6y=11$ is

a) $2x+3y-1=0$ b) $4x+6y-1=0$ c) $8x+12y-1=0$ d) None of these

136. The range of values of θ 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) $(0,\pi/2)$ b) $0,\pi/4$ c) $(\pi/4,\pi/2)$ d) None of these

137. Let θ_1 and θ_2 are the inclinations of lines L_1 and L_2 with x-axis. If L_1 and L_2 pass through $P(x_1,y_1)$, then 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) $\frac{x-x_1}{-\sin\left(\frac{\theta_1+\theta_2}{2}\right)}=\frac{y-y_1}{\sin\left(\frac{\theta_1+\theta_2}{2}\right)}$

138. Two verities of a triangle are $(5,-1)$ and $(-2,3)$. If the orthocenter of the triangle is the origin, then coordinates of third vertex are

a) $(4,7)$ b) $(-4,-7)$ c) $(-4,7)$ d) None of these

139. The product of the perpendicular distances from the origin on the pair of straight lines $12x^2+25xy+$

$12y^2 + 10x + 11y + 2 = 0$ is

a) $\frac{1}{25}$ b) $\frac{2}{25}$ c) $\frac{3}{25}$ d) $\frac{4}{25}$

140. If $A(2, -1)$ and $B(6, 5)$ are two points, then the ratio in which the foot of the perpendicular from $(4, 1)$ to AB divided it, is

a) $8: 15$ b) $5: 8$ c) $-5: 8$ d) $-8: 5$

141. If A and B are two fixed points, then the locus of a point which moves in such a way that the angle APB is a right angle is

a) A circle b) An ellipse c) A parabola d) None of these

142. If the lines joining the origin to the points of intersection of $x^2 + y^2 + 2gx + c = 0$ and $x^2 + y^2 + 2fy - c = 0$ are at right angles, then

a) $g^2 + f^2 = c$ b) $g^2 - f^2 = c$ c) $g^2 - f^2 = 2c$ d) $g^2 + f^2 = c^2$

143. If the lines $x + 3y - 9 = 0, 4x + by - 2 = 0$ and $2x - y - 4 = 0$ are concurrent, then b equals

a) -5 b) 5 c) 1 d) 0

144. If the line $y = mx$ meets the lines $x + 2y - 1 = 0$ and $2x - y + 3 = 0$ at the same point, then m is equal to

a) 1 b) -1 c) 2 d) -2

145. If the equation $kx^2 - 2xy - y^2 - 2x + 2y = 0$ represents a pair of lines, then k is equal to

a) 2 b) -2 c) -5 d) 3

146. The equation of a straight line passing through $(1, 2)$ and having intercept of length 3 between the straight lines $3x + 4y = 24$ and $3x\ 4y = 12$ is

a) $7x + 24y - 55 = 0$ b) $24x + 7y - 38 = 0$ c) $24x + 7y - 10 = 0$ d) None of these

147. The equation $x^2 + k_1y^2 + k_2xy = 0$ represents a pair of perpendicular lines if

a) $k_1 = -1$ b) $k_1 = 2\,k_2$ c) $2\,k_1 = k_2$ d) None of these

148. A line AB makes zero intercepts on x-axis and y-axis and it is perpendicular to another line CD which is $3x + 4y + 6 = 0$. The equation of line AB is

a) $y = 4$ b) $4x - 3y + 8 = 0$ c) $4x - 3y = 0$ d) $4x - 3y + 6 = 0$

149. The distance between the lines given by $(x + 7y)^2 + 4\sqrt{2}(x + 7y) - 42 = 0$, is

a) $4/5$ b) $4\sqrt{2}$ c) 2 d) $10\sqrt{2}$

150. The distance of the line $2x - 3y = 4$ from the point $(1, 1)$ measured parallel to the line $x + y = 1$, is

a) $\sqrt{2}$ b) $5/\sqrt{2}$ c) $1/\sqrt{2}$ d) 6

151. Distance between the lines $5x + 3y - 7 = 0$ and $15x + 9y + 14 = 0$ is

a) $\frac{35}{\sqrt{34}}$ b) $\frac{1}{3\sqrt{34}}$ c) $\frac{35}{3\sqrt{34}}$ d) $\frac{35}{2\sqrt{34}}$

152. If 'θ' is the angle between the lines $ax^2 + 2hxy + by^2 = 0$, then angle between $x^2 + 2xy\sec\theta + y^2 = 0$ is

a) θ b) 2θ c) $\frac{\theta}{2}$ d) 3θ

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

a) 7 : 3 b) 3 : 7 c) 2 : 3 d) None of these

154. The determinant $\begin{vmatrix} x & y & 1 \\ x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \end{vmatrix} = 0$ represents

a) A pair of straight lines b) A straight line

c) A circle d) None of these

155. Equation of the straight line making equal intercepts on the axes and passing through the point $(2, 4)$, is

a) $4x - y - 4 = 0$ b) $2x + y - 8 = 0$ c) $x + y - 6 = 0$ d) $x + 2y - 10 = 0$

156. The area enclosed within the curve $|x| + |y| = 1$, is

a) 1 sq. units b) 2 sq. units c) 3 sq. units d) 4 sq. units

157. If the line represented by $x^2 - 2\,pxy - y^2 = 0$ are rotated about the origin through an angle θ, one in clockwise direction and other in anti-clockwise direction, then the equation of the bisectors of the angle between the lines in the new position is

a) $px^2 + 2\,xy - py^2 = 0$
b) $px^2 + 2\,xy + py^2 = 0$
c) $x^2 - 2\,pxy + y^2 = 0$
d) None of these

158. The equation of the line passing through the intersection of $x - \sqrt{3}\,y + \sqrt{3} - 1 = 0$ and $x + y - 2 = 0$ and making an angle of 15° with the first line is
a) $x - y = 0$
b) $x - y + 1 = 0$
c) $y = 1$
d) $\sqrt{3}\,x - y + 1 - \sqrt{3} = 0$

159. The equation of straight line equally inclined to the axes and equidistance from the points $(1, -2)$ and $(3, 4)$ is $ax + by + c = 0$, where
a) $a = 1, b = -1, c = 3$ b) $a = 1, b = -1, c = -3$
c) $a = 1, b = 1, c = -3$ d) None of these

160. Separate equations of lines for a pair of lines whose equation is $x^2 + xy - 12y^2 = 0$, are
a) $x + 4y = 0$ and $x + 3y = 0$ b) $2x - 3y = 0$ and $x - 4y = 0$
c) $x - 6y = 0$ and $x - 3y = 0$ d) $x + 4y = 0$ and $x - 3y = 0$

161. The nearest point on the line $3x - 4y = 25$ from the origin is
a) $(-4, 5)$ b) $(3, -4)$ c) $(3, 4)$ d) $(3, 5)$

162. The equations of perpendicular bisectors of sides AB and AC of a $\Delta\,ABC$ are $x - y + 5 = 0$ and $x + 2y = 0$ respectively. If the coordinates of vertex A are $(1, -2)$, then equation of BC is
a) $23x + 14y - 40 = 0$ b) $14x - 23y + 40 = 0$ c) $23x - 14y + 40 = 0$ d) $14x + 23y - 40 = 0$

163. The equation of the bisector of the acute angle between the lines $3x - 4y + 7 = 0$ and $12x + 5y - 2 = 0$ is
a) $99x - 27y - 81 = 0$ b) $11x - 3y + 9 = 0$
c) $21x + 77y - 101 = 0$ d) $21x + 77y + 101 = 0$

164. The vertices of a triangle are (0,3), (−3,0) and (3,0). The coordinates of its orthocentre are
a) $(0, 2)$ b) $(0, -3)$ c) $(0, 3)$ d) $(0, -2)$

165. The coordinates of the foot of the perpendicular from the point (2,4) on the line $x + y = 1$ are
a) $(1/2, 3/2)$ b) $(-1/2, 3/2)$ c) $(4/3, 1/2)$ d) $3/4, -1/2$

166. If (sin θ, cos θ and (3,2) lies on the same side of the line $x + y = 1$ then θ lies between
a) $\left(0, \frac{\pi}{2}\right)$ b) $(0, \pi)$ c) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ d) $\left(0, \frac{\pi}{4}\right)$

167. Equation of the straight line cutting off an intercept 2 from the negative direction of the axis of y and inclined at 30° to the positive direction of x-axis, is
a) $y + x - \sqrt{3} = 0$ b) $y - x + 2 = 0$ c) $y - \sqrt{3}x - 2 = 0$ d) $\sqrt{3}y - x + 2\sqrt{3} = 0$

168. If the lines represented by the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ are equidistant from the origin, then
a) $f^4 - g^4 = c(bf^2 - ag^2)$
b) $f^4 - g^4 = c(af^2 - bg^2)$
c) $f^4 - g^4 = c(ag^2 - bf^2)$
d) None of these

169. Joint equation of pair of lines through $(3, -2)$ and parallel to $x^2 - 4xy + 3y^2 = 0$ is
a) $x^2 + 3y^2 - 4xy - 14x + 24y + 45 = 0$ b) $x^2 + 3y^2 + 4xy - 14x + 24y + 45 = 0$
c) $x^2 + 3y^2 + 4xy - 14x + 24y - 45 = 0$ d) $x^2 + 3y^2 + 4xy - 14x - 24y - 45 = 0$

170. The equation of straight line through the intersection of the lines $x - 2y = 1$ and $x + 3y = 2$ and parallel to $3x + 4y = 0$, is
a) $3x + 4y + 5 = 0$ b) $3x + 4y - 10 = 0$ c) $3x + 4y - 5 = 0$ d) $3x + 4y + 6 = 0$

171. Two lines are drown through (3, 4) each of which makes angle 45° which line $x - y = 2$, then area of the triangle formed by these lines is
a) 9 sq unit b) 9/2 sq unit c) 2 sq unit d) 2/9 sq unit

172. The area (in square unit) of the triangle formed by $x+y+1=0$ and the pair of straight lines $x^2-3xy+2y^2=0$ is

a) $\frac{7}{12}$ b) $\frac{5}{12}$ c) $\frac{1}{12}$ d) $\frac{1}{6}$

173. The length of perpendicular from the point $(a\cos\alpha, a\sin\alpha)$ upon the straight line $y=x\tan\alpha+c, c>0$, is

a) c b) $c\sin^2\alpha$ c) $c\cos\alpha$ d) $c\sec^2\alpha$

174. The equation to a pair of opposite sides of a parallelogram are $x^2-5x+6=0$ and $y^2-6y+5=0$, the equation to its diagonals are

a) $x+4y=13$ and $y=4x-7$ b) $4x+y=13$ and $4y=x-7$
c) $4x+y=13$ and $y=4x-7$ d) $y-4x=13$ and $y+4x=7$

175. The line passing through the point of intersection of $x+y=2, x-y=0$ and is parallel to $x+2y=5$, is

a) $x+2y=1$ b) $x+2y=2$ c) $x+2y=4$ d) $x+2y=3$

176. The coordinates of the foot of the perpendicular drawn from the point (3, 4) on the line $2x+y-7=0$ is

a) $\left(\frac{9}{5},\frac{17}{5}\right)$ b) $(1,5)$ c) $(-5,1)$ d) $(1,-5)$

177. A square of area 25 sq unit is formed by taking two sides as $3x+4y=k_1$ and $3x+4y=k_2$, then $|k_1-k_2|$ is

a) 5 b) 1 c) 25 d) None of these

178. 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

179. The locus of a point P which divides the line joining (1,0) and $(2\cos\theta, 2\sin\theta)$ internally in the ratio 2 : 3 for all θ, is a

a) Straight line b) Circle c) Pair of straight lines d) Parabola

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

a) $x-2=0$ b) $y-2=0$ c) $x+y-4=0$ d) None of these

181. The equation of the straight line which is perpendicular to $y=x$ and passes through (3, 2) is

a) $x-y=5$ b) $x+y=5$ c) $x+y=1$ d) $x-y=1$

182. If the angle between two lines represented by $2x^2+5xy+3y^2+7y+4=0$ is $\tan^{-1}m$, then $m=$

a) 1/5 b) 1 c) 7/5 d) 7

183. If the pair of straight lines given by $Ax^2+2Hxy+By^2=0 (H^2>AB)$ forms an equilateral triangle with line $ax+by+c=0$, then $(A+3B)(3A+B)$ is equal to

a) H^2 b) $-H^2$ c) $2H^2$ d) $4H^2$

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

a) $\frac{x}{a}+\frac{y}{a}=a\cos\theta$ b) $x\cos\theta - y\sin\theta=-a\cos 2\theta$
c) $x\cos\theta+y\sin\theta=a\cos 2\theta$ d) $x\cos\theta+y\sin\theta-a\cos 2\theta$

185. The distance between the lines $5x-12y+65=0$ and $5x-12y-39=0$ is

a) 4 b) 16 c) 2 d) 8

186. The perpendicular bisector of the line segment joining $P(1,4)$ and $Q(k,3)$ has y-intercept -4. Then, a possible value of k is

a) -4 b) 1 c) 2 d) -2

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

a) 1/3 b) 2/3 c) 1 d) 4/3

188. Points $A(1,3)$ and $C(5,1)$ are opposite vertices of a rectangle $ABCD$. If the slope of BD is 2, then its equation is

a) $2x-y=4$ b) $2x+y=4$ c) $2x+y-7=0$ d) $2x+y+7=0$

189. The combined equation of the pair of lines through the point (1, 0) and parallel to the lines represented by $2x^2-xy-y^2=0$, is

a) $2x^2 - xy - 2y^2 + 4x - y = 6$
b) $2x^2 - xy - y^2 - 4x - y + 2 = 0$
c) $2x^2 - xy - y^2 - 4x + y + 2 = 0$
d) None of the above

190. The three straight lines $ax + by = c, bx + cy = a$ and $cx + ay = b$ are collinear, if
a) $b + c = a$
b) $c + a = b$
c) $a + b + c = 0$
d) $a + b = c$

191. $P(2,1), Q(4,-1), R(3,2)$ are the vertices of a triangle and if through P and R lines parallel to opposite sides are drawn to intersect in S, then the area of $PQRS$ is
a) 6
b) 4
c) 8
d) 12

192. If the foot of the perpendicular from the origin to a straight line is at the point$(3,-4)$. Then, the equation of the line is
a) $3x - 4y = 25$
b) $3x - 4y + 25 = 0$
c) $4x + 3y - 25 = 0$
d) $4x - 3y + 25 = 0$

193. If two of the lines given by the equation $ay^4 + bxy^3 + cx^2y^2 + dx^3y + ex^4 = 0$ are at right angle, then
a) $(c + a + e)(e - a)^2 + (b + d)(ad + be) = 0$
b) $(c + a + e)(e - a)^2 - (b + d)(ad + be) = 0$
c) $(c + a + e)(e + a)^2 + (b + d)(ad + be) = 0$
d) None of these

194. Two points A and B move on the coordinate axes such that the distance between them remains same. The locus of the mid-point of AB is
a) A straight line
b) A pair of straight lines
c) A circle
d) None of these

195. The ends of the base of an isosceles triangle are at $(2a, 0)$ and $(0, a)$. The equation of one side is $x = 2a$. The equation of the other side is
a) $x + 2y - a = 0$
b) $x + 2y = 2a$
c) $3x + 4y - 4a = 0$
d) $3x - 4y + 4a = 0$

196. The equation of the pair of straight lines perpendicular of the pair $2x^2 + 3xy + 2y^2 + 10x + 5y = 0$ and passing through the origin, is
a) $2x^2 + 5xy + 2y^2 = 0$
b) $2x^2 - 3xy + 2y^2 = 0$
c) $2x^2 + 3xy + y^2 = 0$
d) $2x^2 - 5xy + 2y^2 = 0$

197. If the points (1,3) and (5,1) are two opposite vertices of a rectangle and the other two vertices lie on the line $y = 2x + c$, then the value of c is
a) 4
b) -4
c) 2
d) None of these

198. The equation of 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) $y = 3x - 1$

199. The equation of the lines parallel to the line common to the pair of lines given by $6x^2 - xy - 12y^2 = 0$ and $15x^2 + 14xy - 8y^2 = 0$ and the sum of whose intercepts on the axes is 7, is
a) $2x - 3y = 42$
b) $3x + 4y = 12$
c) $5x - 2y = 10$
d) None of these

200. Area of the parallelogram formed by the lines $y = mx, y = mx + 1, y = nx$ and $y = nx + 1$ equals
a) $\frac{|m + n|}{(m - n)^2}$
b) $\frac{2}{|m + n|}$
c) $\frac{1}{|m + n|}$
d) $\frac{1}{|m - n|}$

201. The members of the family of lines $(\lambda + \mu)x + (2\lambda + -\mu)y = \lambda + 2\mu$, where $\lambda \neq 0, \mu \neq 0$, pass through the point
a) $(3, -1)$
b) $-3,1$
c) $(1,1)$
d) None of these

202. If a line joining two points $A(2, 0)$ and $B(3,1)$ is rotated about A in anti-clockwise direction through an angle 15°, then the equation of the line in the new position is
a) $\sqrt{3}\,x - y = 2\sqrt{3}$
b) $\sqrt{3}\,x + y = 2\sqrt{3}$
c) $x + \sqrt{3}\,y = 2\sqrt{3}$
d) None of these

203. The centroid of the triangle whose three sides are given by the combined equation $(x^2 + 7xy + 2y^2)(y - 1=0$, is
a) $\left(\frac{2}{3}, 0\right)$
b) $\left(\frac{7}{3}, \frac{2}{3}\right)$
c) $\left(-\frac{7}{3}, \frac{2}{3}\right)$
d) None of these

204. The distance of the point (1, 2) from the line $x + y + 5 = 0$ measured along the line parallel to $3x - y = 7$

is equal to

a) $4\sqrt{10}$ b) 40 c) $\sqrt{40}$ d) $10\sqrt{2}$

205. The area bounded by the straight lines $y = 1$ and $\pm 2\,x + y = 2$ is

a) 1/2 sq. unit b) 1 sq. unit c) 3/2 sq. units d) 2 sq. units

206. The distance between the pair of parallel lines $x^2 + 4xy + 4y^2 + 3x + 6y - 4 = 0$ is

a) $\sqrt{5}$ b) $\frac{2}{\sqrt{5}}$ c) $\frac{1}{\sqrt{5}}$ d) $\frac{\sqrt{5}}{2}$

207. If the pair of straight lines $xy - x - y + 1 = 0$ and the line $ax + 2y - 3 = 0$ are concurrent, then a is equal to

a) -1 b) 0 c) 3 d) 1

208. Points on the line $x + y = 4$ that lie at a unit distance from the line $4x + 3y - 10 = 0$, are

a) (3, 1) and (−7, 11) b) (−3,7) and (2,2) c) (−3,7) and (−7,11) d) None of these

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

a) $x + y + 3 = 0$ b) $x - y - 3 = 0$ c) $x - y + 3 = 0$ d) $3x + y - 7 = 0$

210. If $a \neq b \neq c$, then the equations

$(b - c)x + (c - a)y + (a - b) = 0$

and, $(b^3 - c^3)x + (c^3 - a^3)y + (a^3 - b^3) = 0$

will represent the same line, if

a) $a + b = -c$ b) $c + a = -b$ c) $b + c = -a$ d) $a + b + c = 0$

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

a) 0 b) 1 c) 2 d) ∞

212. The ratio in which the line $3x - 2y + 5 = 0$ divides the join of (6, −7) and (−2,3), is

a) 1 : 1 b) 7 : 37 c) 37 : 7 d) None of these

213. The lines $2\,x + y - 1 = 0$, $ax + 3\,y - 3 = 0$ and $3x + 2\,y - 2 = 0$ are concurrent for

a) All a b) $a = 4$ only c) $-1 \leq a \leq 3$ d) $a > 0$ only

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

a) $x^2 + y^2 - 2\,x - 4\,y + 1 = 0$

b) $3(x^2 + y^2) - 2\,x - 4\,y + 1 = 0$

c) $x^2 + y^2 - 2\,x - 4\,y + 3 = 0$

d) None of these

215. If (a, a^2) falls inside the angle made by the lines $y = \frac{x}{2}, x > 0$ and $y = 3x, x > 0$, then a belongs to

a) $(3, \infty)$ b) $\left(\frac{1}{2}, 3\right)$ c) $\left(-3, -\frac{1}{2}\right)$ d) $\left(0, \frac{1}{2}\right)$

216. The pairs of straight lines $ax^2 + 2hxy - ay^2 = 0$ and $hx^2 - 2axy - hy^2 = 0$ are such that

a) One pair bisects the angle between the other pair

b) The lines of one pair are equally inclined to the lines of the other pair

c) The lines of each pair are perpendicular to other pair

d) All of these

217. If the straight line $ax + by + c = 0$ always passes through (1, −2) then a, b, c are in

a) AP b) HP c) GP d) None of these

218. If $A(1,1)$, $B(\sqrt{3} + 1, 2)$ and $C(\sqrt{3}, \sqrt{3} + 2)$ be three vertices of a square, then the diagonal through B is

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

b) $y = 0$

c) $y = x$

d) None of these

219. If the lines $4x + 3y - 1 = 0$, $x - y + 5 = 0$ and $kx + 5y - 3 = 0$ are concurrent, then k is equal to

a) 4 b) 5 c) 6 d) 7

220. The slopes of the lines represented by $x^2 + 2hxy + 2y^2 = 0$ are in the ratio 1 : 2, then h equals

a) $\pm\frac{1}{2}$ b) $\pm\frac{3}{2}$ c) ± 1 d) ± 3

221. If PM is the perpendicular from $P(2, 3)$ onto the line $x + y = 3$, then the coordinates of M are
a) (2,1) b) $(-1, 4)$ c) (1,2) d) $(4, -1)$

222. A line through the point $A(2, 0)$ which makes an angle of $30°$ with the positive direction of x-axis is rotated about A in clockwise direction through an angle of $15°$. Then, the equation of the straight line in the new position is
a) $(2-\sqrt{3})x + y - 4 + 2\sqrt{3} = 0$
b) $(2-\sqrt{3})x - y - 4 + 2\sqrt{3} = 0$
c) $(2-\sqrt{3})x - y + 4 + 2\sqrt{3} = 0$
d) $(2-\sqrt{3})x + y + 4 + 2\sqrt{3} = 0$

223. The distance between the pair of parallel lines $x^2 + 2xy + y^2 - 8ax - 8ay - 9a^2 = 0$ is
a) $2\sqrt{5}a$ b) $\sqrt{10}a$ c) $10\ a$ d) $5\sqrt{2}a$

224. One vertex of the equilateral triangle with centroid at the origin and one side as $x + y - 2 = 0$ is
a) $(-1, -1)$ b) $(2, 2)$ c) $(-2, -2)$ d) None of these

225. The equation of straight line through the intersection of the lines $x - 2y = 1$ and $x + 3y = 2$ and parallel to $3x + 4y = 0$, is
a) $3x + 4y + 5 = 0$ b) $3x + 4y - 10 = 0$ c) $3x + 4y - 5 = 0$ d) $3x + 4y + 6 = 0$

226. The straight line $3x + y = 9$ divided the line segment joining the points (1, 3) and (2,7) in the ratio
a) 3:4 externally b) 3:4 internally c) 4:5 internally d) 5:6 externally

227. Orthocentre of the triangle whose sides are given by $4\,x - 7\,y + 10 = 0, x + y - 5 = 0$ and $7\,x + 4\,y - 15 = 0$ is
a) $(-1, -2)$ b) $(1, -2)$ c) $(-1,2)$ d) (1,2)

228. The diagonals of the parallelogram whose sides are $lx + my + n = 0, lx + my + n' = 0, mx + ly + n = 0, mx + ly + n' = 0$ include an angle
a) $\pi/3$ b) $\pi/2$ c) $\tan^{-1}\left(\frac{l^2 - m^2}{l^2 + m^2}\right)$ d) $\tan^{-1}\left(\frac{2\,lm}{l^2 + m^2}\right)$

229. 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
a) $(\sqrt{2}+\sqrt{6}, \sqrt{2}-\sqrt{6})$ b) $(\sqrt{2}+\sqrt{3}, \sqrt{2}-\sqrt{3})$ c) $(\sqrt{2}+\sqrt{5}, \sqrt{2}-\sqrt{5})$ d) None of theses

230. If the lines $ax + 2\,y + 1 = 0, bx + 3\,y + 1 = 0, cx + 4\,y + 1 = 0$ are concurrent, then a, b, c are in
a) AP b) GP c) HP d) None of these

231. Locus of the centroid of triangle whose vertices are $(a\cos\ t, a\sin t), (b\sin t, -b\cos t)$ and (1,0), where t is a parameter, is
a) $(3x-1)^2 + (3y)^2 = a^2 - b^2$
b) $(3x-1)^2 + (3y)^2 = a^2 + b^2$
c) $(3x+1)^2 + (3y)^2 = a^2 + b^2$
d) $(3x+1)^2 + (3y)^2 = a^2 - b^2$

232. If θ is the acute angle between the lines given by $6x^2 + 5xy - 7x + 13y - 3 = 0$, then the equation of the line passing through the point of intersection of these lines and making angle θ with the positive x-axis is
a) $2x + 11y + 13 = 0$ b) $11x - 2y + 13 = 0$ c) $2x - 11y + 2 = 0$ d) $11x + 2y - 11 = 0$

233. If $\frac{x^2}{a} + \frac{y^2}{b} + \frac{2xy}{h} = 0$ represents a pair of straight lines such that slope of one line is twice the other, then $ab : h^2$ is
a) 9 : 8 b) 8 : 9 c) 1 : 2 d) 2 : 1

234. The lines bisecting the angle between the bisectors of the angles between the lines $ax^2 + 2hxy + by^2 = 0$ are given by
a) $(a-b)(x^2 - y^2) - 4\,hxy = 0$
b) $(a-b)(x^2 + y^2) + 4hxy = 0$
c) $(a-b)(x^2 - y^2) + 4\,hxy = 0$
d) None of these

235. The line passing through $\left(-1, \frac{\pi}{2}\right)$ and perpendicular to $\sqrt{3}\sin\theta + 2\cos\theta = \frac{4}{r}$ is

a) $2 = \sqrt{3}r\cos\theta - 2r\sin\theta$
b) $5 = -2\sqrt{3}r\sin\theta + 4r\cos\theta$
c) $2 = \sqrt{3}r\cos\theta + 2r\sin\theta$
d) $5 = 2\sqrt{3}r\sin\theta + 4r\cos\theta$

236. Given a family of lines $a(2x + y + 4) + b(x - 2y - 3) = 0$, the number of lines belonging to the family at a distance $\sqrt{10}$ from $P(2, -3)$ is
a) 0 b) 1 c) 2 d) 4

237. Let the perpendiculars from any point on the line $2x + 11y = 5$ upon the lines $24x + 7y - 20 = 0$ and $4x - 3y - 2 = 0$ have the lengths p_1 and p_2 respectively. Then,
a) $2p_1 = p_2$ b) $p_1 = p_2$ c) $p_1 = 2p_2$ d) None of these

238. The equation of bisectors of the angles between the lines $|x| = |y|$ are
a) $y = \pm x$ and $x = 0$ b) $x = \frac{1}{2}$ and $y = \frac{1}{2}$ c) $y = 0$ and $x = 0$ d) None of these

239. The pairs of straight lines $x^2 - 3xy + 2y^2 = 0$ and $x^2 - 3xy + 2y^2 + x - 2 = 0$ form a
a) Square but not rhombus
b) Rhombus
c) Parallelogram
d) Rectangle but not a square

240. The straight line whose sum of the intercepts on the axes is equal to half to the product of the intercepts, passes through the point whose coordinates are
a) $(1, 1)$ b) $(2, 2)$ c) $(3, 3)$ d) $(4, 4)$

241. A straight line through $P(1,2)$ is such that its intercept between the axes is bisected at P. Its equation is
a) $x + 2y = 5$ b) $x - y + 1 = 0$ c) $x + y - 3 = 0$ d) $2x + y - 4 = 0$

242. The incentre of the triangle formed by the lines $x = 0, y = 0$ and $3x\ 4y = 12$ is at
a) $(1/2,1/2)$ b) $(1, 1)$ c) $(1, 1/2)$ d) $(1/2,1)$

243. A pair of perpendicular straight lines passes through the origin and also through the point of intersection of the curve $x^2 + y^2 = 4$ with $x + y = a$. The set containing the value of 'a' is
a) $\{-2, 2\}$ b) $\{-3, 3\}$ c) $\{-4, 4\}$ d) $\{-5, 5\}$

244. If pairs straight lines $x^2 - 2pxy - y^2 = 0$ and $x^2 - 2qxy - y^2 = 0$ be such that each pair bisects the angle between the other pair, then
a) $pq = 1$ b) $pq = -1$ c) $pq = 2$ d) $pq = -2$

245. In a rhombus $ABCD$ the diagonals AC and BD intersect at the point $(3,4)$. If the point A is $(1,2)$ the diagonal BD has the equation
a) $x - y - 1 = 0$ b) $x + y - 1 = 0$ c) $x - y + 1 = 0$ d) $x + y - 7 = 0$

246. The gradient of one of the lines of $ax^2 + 2hxy + by^2 = 0$ is twice that of the other, then
a) $h^2 = ab$ b) $h = a + b$ c) $8h^2 = 9ab$ d) $9h^2 = 8ab$

247. The family of lines making an angle 30° with the line $\sqrt{3}y = x + 1$ is
a) $x = \lambda$(λ is parameter)
b) $y = -\sqrt{3}x + \lambda$(λ is parameter)
c) $y = \sqrt{3}x + \lambda$
d) None of the above

248. If the slope of one of the lines represented by $ax^2 + 2hxy + by^2 = 0$ be the square of the other, then $\frac{a+h}{h} + \frac{8h^2}{ab}$ is
a) 3 b) 4 c) 5 d) 6

249. The equation $y^2 - x^2 + 2x - 1 = 0$, represents
a) A pair of st. lines b) A circle c) A parabola d) An ellipse

250. The vertices of a $\Delta\ OBC$ are $(0, 0)$, $B(-3, -1)$ and $C(-1, -3)$. The equation of a line parallel to BC and intersecting sides OB and OC whose distance from the origin is $1/2$, is
a) $x + y + \frac{1}{2} = 0$ b) $x + y - \frac{1}{2} = 0$ c) $x + y - \frac{1}{\sqrt{2}} = 0$ d) $x + y + \frac{1}{\sqrt{2}} = 0$

251. The angle between the line joining the points $(1, -2)$, $(3, 2)$ and the line $x + 2y - 7 = 0$ is
a) π b) $\pi/2$ c) $\pi/3$ d) $\pi/6$

252. The equation $y^2 - x^2 + 2x - 1 = 0$ represents
a) A hyperbola
b) An ellipse
c) A pair of straight lines
d) A rectangular hyperbola

253. The equation to the bisecting the join of $(3, -4)$ and $(5,2)$ and having its intercepts on the x-axis and the y-

axis in the ratio 2 : 1 is

a) $x+y-3=0$ b) $2x-y=9$ c) $x+2y=2$ d) $2x+y=7$

254. $A(-5,0)$ and $B(3,0)$ are two of the vertices of a triangle ABC. Its area is 20 square cms. The vertex C lies on the line $x-y=2$. The coordinates of C are

a) $(-7,-5)$ or $(3,5)$ b) $(-3,-5)$ or $(-5,7)$ c) $(7,5)$ or $(3,5)$ d) $(-3,-5)$ or $(7,5)$

255. The point of concurrence of the lines $ax+by+c=0$ and a,b,c satisfy the relation $3a+2b+4c=0$ is

a) $\left(\frac{3}{2},\frac{1}{4}\right)$ b) $\left(\frac{3}{4},\frac{1}{4}\right)$ c) $\left(\frac{3}{4},\frac{1}{2}\right)$ d) $\left(\frac{3}{2},\frac{1}{2}\right)$

256. The angle between the straight line $x-y\sqrt{3}=5$ and $\sqrt{3}x+y=7$ is

a) $90°$ b) $60°$ c) $75°$ d) $30°$

257. The equation $y=\pm\sqrt{3}x, y=1$ are the sides of

a) An equilateral triangle b) A right angled triangle

c) An isosceles triangle d) An obtuse triangle

258. A line passes through the point of intersection of the lines $3x+y+1=0$ and $2x-y+3=0$ and makes equal intercepts with axes. Then, equation of the line is

a) $5x+5y-3=0$ b) $x+5y-3=0$ c) $5x-y-3=0$ d) $5x+5y+3=0$

259. The equation of the straight line which passes through the point $(1,-2)$ and cuts off equal intercepts from the axes will be

a) $x+y=1$ b) $x-y=1$ c) $x+y+1=0$ d) $x-y-2=0$

260. The orthocenter of a triangle formed by the lines $x+y=1, 2x+3y=6$ and $4x-y+4=0$ lies in the

a) Ist quadrant b) IInd quadrant c) IIIrd quadrant d) IVth quadrant

261. Equation of straight line cutting off an intercept 2 from the negative direction of the axes of y and inclined at 30° to the positive direction of axis of x, is

a) $y+x-\sqrt{3}=0$ b) $y-x+2=0$ c) $y-\sqrt{3}x-2=0$ d) $\sqrt{3}y-x+2\sqrt{3}=0$

262. Distance between the pair of lines represented by the equation $x^2-6xy+9y^2+3x-9y-4=0$, is

a) $\frac{15}{\sqrt{10}}$ b) $\frac{1}{2}$ c) $\sqrt{\frac{5}{2}}$ d) $\frac{1}{\sqrt{10}}$

263. The line $3x+2y=24$ meets y-axis at A and x-axis at B. The perpendicular bisector of AB meets the line through $(0,-1)$ parallel to x-axis at C. The area of the triangle ABC is

a) 182 sq. units b) 91 sq. units c) 48 sq. units d) None of these

264. The coordinates of three vertices of a quadrilateral in order are $(6,1)$, $(7,2)$ and $(-1,0)$. If the area of the quadrilateral is 4 square units, then the locus of the fourth vertex is

a) $x-7y=1$

b) $x-7y+15=0$

c) $(x-7y)^2+14(x-7y)-15=0$

d) None of these

265. Two points $(a,0)$ and $(0,b)$ are joined by a straight line. Another point on this line, is

a) $(3a,-2b)$ b) (a^2,ab) c) $(-3a,2b)$ d) (a,b)

266. The lines $(lx+my)^2-3(mx-ly)^2=0$ and $lx+my+n=0$ form

a) An isosceles triangle b) A right angled triangle

c) An equilateral triangle d) None of these

267. The distance between the pair of lines represented by the equation $x^2-6xy+9y^2+3x-9y-4=0$ is

a) $\frac{15}{\sqrt{10}}$ b) $\frac{1}{2}$ c) $\sqrt{\frac{5}{2}}$ d) $\frac{1}{\sqrt{10}}$

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

a) 0 b) 1 c) 2 d) 4

269. The equation $x^3-6x^2y+11xy^2-6y^3=0$ represents three straight lines passing through the origin, the

slopes of which form an

a) A.P. b) G.P. c) H.P. d) None of these

270. The equation of the line bisecting perpendicularly the segment joining the points $(-4,6)$ and $(8,8)$ is

a) $6x + y - 19 = 0$ b) $y = 7$ c) $6x + 2y - 19 = 0$ d) $x + 2y - 7 = 0$

271. The equation of the sides of a triangle are $x - 3y = 0, 4x + 3y = 5$ and $3x + y = 0$. The line $3x - 4y = 0$ passes through

a) The incentre b) The centroid c) The orthocenter d) The circumcentre

272. If the slope of one of the lines given by $ax^2 - 6xy + y^2 = 0$ is twice the other, then $a =$

a) 1 b) 2 c) 4 d) 8

273. The point (4, 1) undergoes the following three successive transformations

III. Reflection about the line $y = x - 1$

IV. Translation through a distance 1 unit along the positive direction of x-axis

V. Rotation through an angle $\frac{\pi}{4}$ about the origin in the anti-clockwise direction

Then, the coordinates of the final point are

a) $(4, 3)$ b) $\left(\frac{7}{2}, \frac{7}{2}\right)$ c) $(0, 3\sqrt{2})$ d) $(3, 4)$

274. Which of the following pair of straight lines intersect at right angle?

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

b) $(x + y)^2 = x(y + 3x)$

c) $2y(x + y) = xy$

d) $y = \pm 2x$

275. Given four lines whose equations are $x + 2y - 3 = 0, 2x + 3y - 4 = 0, 3x + 4y - 7 = 0$ and $4x + 5y - 6 = 0$, then the lines are

a) Concurrent b) Sides of a square c) Sides of a rhombus d) None of these

276. The equation $2x^2 - 24xy + 11y^2 = 0$ represents

a) Two parallel lines b) Two perpendicular lines

c) Two lines passing through the origin d) A circle

277. A straight line through $P(1,2)$ is such that its intercept between the axes is bisected at P. Its equation is

a) $x + y = -1$ b) $x + y = 3$ c) $x + 2y = 5$ d) $2x + y = 4$

278. The value of λ such that $\lambda x^2 - 10xy + 12y^2 + 5x - 16y - 3 = 0$ represent a pair of straight lines, is

a) 1 b) -1 c) 2 d) -2

279. If a straight line L is perpendicular to the line $5x - y = 1$ such that the area of the Δ formed by the line L and the coordinate axes is 5, then the equation of the line L is

a) $x + 5y + 5 = 0$ b) $x + 5y \pm \sqrt{2} = 0$ c) $x + 5y \pm \sqrt{5} = 0$ d) $x + 5y \pm 5\sqrt{2} = 0$

280. The position of a moving point in the xy plane at time t is given by $\left(u \cos \alpha \cdot t, u \sin \alpha \cdot t - \frac{1}{2} g t^2\right)$, where u, α, g are constants. The locus of the moving point is

a) A circle b) A parabola c) An ellipse d) None of these

281. The distance between the lines $4x + 3y = 11$ and $8x + 6y = 15$, is

a) 7/2 b) 4 c) 7/10 d) None of these

282. Given the four lines with equations $x + 2y = 3, 3x + 4y = 7, 2x + 3y = 4$ and $4x + 5y = 6$, then these lines are

a) Concurrent b) Perpendicular

c) The sides of a rectangle d) None of the above

283. The number of points on the line $3x + 4y = 5$, which are at a distance of $\sec^2 \theta + 2\text{cossec}^2 \theta, \theta \in R$, from the point (1, 3) is

a) 1 b) 2 c) 3 d) Infinite

284. If a variable line drown through the point of intersection of straight lines $\frac{x}{\alpha} + \frac{y}{\beta} = 1$ and $\frac{x}{\beta} + \frac{y}{\alpha} = 1$ meets the coordinate axes in A and B, then the locus of the mid point of AB is

a) $\alpha\beta(x+y)=xy(\alpha+\beta)$ b) $\alpha\beta(x+y)=2xy(\alpha+\beta)$
c) $(\alpha+\beta)(x+y)=2\alpha\beta xy$ d) None of these

285. The equation of the line passing through the point of intersection of the lines $x-3y+2=0$ and $2x+5y-7=0$ and perpendicular to the line $3x+2y+5=0$, is
a) $2x-3y+1=0$ b) $6x-9y+11=0$ c) $2x-3y+5=0$ d) $3x-2y+1=0$

286. The equation of line parallel to lines $L_1 \equiv x+2y-5=0$ and $L_2 \equiv x+2y+9=0$ and dividing the distance between L_1 and L_2 in the ratio 1 : 6 (internally), is
a) $x+2y-3=0$ b) $x+2y+2=0$ c) $x+2y+7=0$ d) None of these

287. The equation of a line passing through $(-2,-4)$ and perpendicular to the line $3x-y+5=0$ is
a) $3y+x-8=0$ b) $3x+y+6=0$ c) $x+3y+14=0$ d) None of these

288. If the equation $3x^2+xy-y^2-3x+6y+k=0$ represents a pair of straight lines, then the values of k is
a) 9 b) 1 c) -9 d) 0

289. The equation of line through the point (1, 1) and making angles of 45° with the line $x+y=0$ are
a) $x-1=0, x-y=0$ b) $x-1=0, y-1=0$
c) $x-y=0, y-1=0$ d) $x+y-2=0, y-1=0$

290. The equation of line bisecting perpendicularly the segment joining the points $(-4,6)$ and $(8,8)$, is
a) $y=7$ b) $6x+y-19=0$ c) $x+2y-7=0$ d) $6x+2y-19=0$

291. The triangle formed by $x^2-3y^2=0$ and $x=4$ is
a) Isosceles b) Equilateral c) Right angled d) None of these

292. The equation of one side of a rectangle is $3x-4y-10=0$ and the coordinates of two its vertices are $(-2,1)$ and $(2,4)$. Then, the area of the rectangle is
a) 20 sq. units b) 40 sq. units c) 10 sq. units d) 30 sq. units

293. The straight line whose sum of the intercepts on the axes is equal to half of the product of the intercepts, passes through the points
a) (1, 1) b) (2, 2) c) (3,3) d) (4, 4)

294. The equation of the sides of a triangle are $x-3y=0$, $4x+3y=5$ and $3x+y=0$. The line $3x-4y=0$ passes through
a) The incentre b) The centroid c) The orthocentre d) The circumcentre

295. A triangle ABC, right angled at A, has points A and B as (2,3) and $(0,-1)$ respectively. If $BC=5$ units, then the point C, is
a) $(-4,2)$ b) $(4,2)$ c) $(3,-3)$ d) $(0,-4)$

296. If the angle θ is acute, then the acute angle between $x^2(\cos\theta-\sin\theta)+2xy\cos\theta+y^2(\cos\theta+\sin\theta)=0$ is
a) 2θ b) $\frac{\theta}{3}$ c) θ d) $\frac{\theta}{2}$

297. The slopes of the lines which make an angle 45° with the line $3x-y=-5$ are
a) $1,-1$ b) $\frac{1}{2},-1$ c) $1,\frac{1}{2}$ d) $-2,\frac{1}{2}$

298. Given four lines with equations $x+2y-3=0$, $2x+3y-4=0$, $3x+4y-5=0$, $4x+5y-6=0$ These lines are
a) Concurrent b) The sides of a quadrilateral
c) The sides of a parallelogram d) The sides of a square

299. The distance of the $x+y-8=0$ from (4,1) measured along the direction whose slope is -2 is
a) $3\sqrt{5}$ b) $6\sqrt{5}$ c) $2\sqrt{5}$ d) None of these

300. The image of the point $(4,-3)$ with respect to the line $y=x$ is
a) $(-4,-3)$ b) $(3,4)$ c) $(-4,3)$ d) $(-3,4)$

301. The range of values of α for which the points $(\alpha, 2+\alpha)$and $\left(\frac{3\alpha}{2}, \alpha^2\right)$ lie on opposite sides of the line $2c+3y=6$, is
a) $(-2,1)$ b) $(-\infty,-2)\cup(0,1)$ c) $(-2,0)\cup(1,\infty)$ d) $(-1,0)\cup(2,\infty)$

302. If the pair of straight lines $ax^2+2hxy+by^2=0$ is rotated about the origin through 90°, then their

equations in the new position are given by

a) $ax^2 - 2\,hxy + by^2 = 0$

b) $ax^2 - 2\,hxy - by^2 = 0$

c) $bx^2 - 2\,hxy + ay^2 = 0$

d) $bx^2 + 2\,hxy + ay^2 = 0$

303. A ray of light passing through the point $(1, 2)$ is reflected on the x-axis at a point P and passes through the point $(5, 3)$, then the abscissa of a point P is

a) 3 b) 13/3 c) 13/5 d) 13/4

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

a) $x - 3y - 7 = 0$ or, $3x + y - 31 = 0$

b) $x - 3y - 31 = 0$ or, $3x + y - 7 = 0$

c) $x - 3y - 31 = 0$ or, $3x + y + 7 = 0$

d) None of these

305. The area of the triangle formed by y-axis, the straight line L passing through (1,1) and (2,0) and the straight line perpendicular to the line L and passing through (1/2,0)

a) $\frac{25}{8}$ sq. units b) $\frac{25}{4}$ sq. units c) $\frac{25}{16}$ sq. units d) $\frac{25}{2}$ sq. units

306. The equation $12x^2 + 7xy + ay^2 + 13x - y + 3 = 0$ represents a pair of perpendicular lines. Then, the value of $'a'$ is

a) $\frac{7}{2}$ b) -19 c) -12 d) 12

307. A beam of light is sent along the line $x - y = 1$. Which after refracting from the x-axis entres the opposite side by turning through 30° 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) $(2 + \sqrt{3})x - y = 2 + \sqrt{3}$

c) $(2 - \sqrt{3})x + y = 2 + \sqrt{3}$ d) None of these

308. If the equation $12\,x^2 + 7\,xy - py^2 - 18\,x + qy + 6 = 0$ represents a pair of perpendicular straight lines, then

a) $p = 12, q = 1$ b) $p = 1, q = 12$ c) $p = -1, q = 12$ d) $p = 1, q = -12$

309. If the point (a, a) falls between the lines $|x + y| = 4$, then

a) $|a| = 2$ b) $|a| = 3$ c) $|a| < 2$ d) $|a| < 3$

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

311. If non-zero numbers a, b, c are in HP, then the straight line

$\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes throught a fixed point. That point is

a) $\left(1, -\frac{1}{2}\right)$ b) $(1, -2)$ c) $(-1, -2)$ d) $(-2, 2)$

312. If the lines $x = a + m, y = -2$ and $y = mx$ are concurrent, then least value of $|a|$ is

a) 0 b) $\sqrt{2}$ c) $2\sqrt{2}$ d) None of these

313. The equations $a^2x^2 + 2h(a + b)xy + b^2y^2 = 0$ and $ax^2 + 2h\,xy + by^2 = 0$ represent

a) Two pairs of perpendicular straight lines

b) Two pairs of parallel straight lines

c) Two pairs of straight lines which are equally inclined to each other

d) None of these

314. The value of k such that $3\,x^2 - 11\,xy + 10\,y^2 - 7x + 13y + k = 0$ may represent a pair of straight lines, is

a) 3 b) 4 c) 6 d) 8

315. The equations of the lines which are parallel to the line common to the pair of the lines given by

$6x^2 - xy - 12y^2 = 0$ and $15\,x^2 + 14xy - 8y^2 = 0$ and at a distance of 7 units from it are

a) $3x + 4y = \pm 35$ b) $5x - 2y = \pm 7$ c) $2x - 3y = \pm 7$ d) None of these

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

a) $(0,0)$ b) $(-2,-2)$ c) $(-1,-1)$ d) $(-1,-2)$

317. If the sum of distances from a point P on two mutually perpendicular straight lines is 1 unit, then the locus of P is

a) A parabola b) A circle c) An ellipse d) A straight line

318. A line has slope m and y-intercept 4. The distance between the origin and the line is equal to

a) $\frac{4}{\sqrt{1-m^2}}$ b) $\frac{4}{\sqrt{m^2-1}}$ c) $\frac{4}{\sqrt{m^2+1}}$ d) $\frac{4m}{\sqrt{1+m^2}}$

319. If the equation $ax^2 + 2\,hxy + by^2 + 2\,gx + 2\,fy + c = 0$ represents a pair of parallel lines, then

a) $\frac{a}{h} = \frac{b}{h} = \frac{f}{g}$ b) $\frac{a}{h} = \frac{h}{b} = \frac{f}{g}$ c) $\frac{a}{h} = \frac{h}{b} = \frac{g}{f}$ d) None of these

320. If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in GP with the same common ratio, then the points (x_1, y_1), (x_2, y_2) and (x_3, y_3)

a) Lie on a parabola b) Lie on an ellipse

c) Lie on a circle d) Lie on a straight line

321. The equation of perpendicular bisectors of sides AB and AC of a $\Delta\,ABC$ are $x - y + 5 = 0$ and $x + 2y = 0$ respectively. If the coordinates of vertex A are $(1,-2)$, then equation of BC is

a) $14x + 23y - 40 = 0$ b) $14x - 23y + 40 = 0$ c) $23x + 14y - 40 = 0$ d) $23x - 14y + 40 = 0$

322. If the line $px - qy = r$ intersects the coordinate axes at $(a, 0)$ and $(0, b)$, thyen the value of $a + b$ is equal to

a) $r\left(\frac{q+p}{pq}\right)$ b) $r\left(\frac{q-p}{pq}\right)$ c) $r\left(\frac{p-q}{pq}\right)$ d) $r\left(\frac{p+q}{p-q}\right)$

323. The distance between the parallel lines $y = 2\,x + 4$ and $6x = 3y + 5$ is

a) $17/\sqrt{3}$ b) 1 c) $3/\sqrt{5}$ d) $17\sqrt{5}/15$

324. The value of $'a'$ for which the lines represented by $ax^2 + 5\,xy + 2\,y^2 = 0$ are mutually perpendicular is

a) 2 b) -2 c) $\frac{25}{8}$ d) None of these

325. The vertices of ΔOBC are $(0, 0)$, $(-3,-1)$ and $(-1,-3)$, then the equation of the line parallel to BC which is a distance $\frac{1}{2}$ from the origin and cut OB and OC intercept, is

a) $2x - 2y + \sqrt{2} = 0$ b) $2x + 2y + \sqrt{2} = 0$ c) $2x + 2y - \sqrt{2} = 0$ d) $x + y\sqrt{2} = 0$

326. Two consecutive sides of a parallelogram are $4x + 5y = 0$ and $7x + 2y = 0$. One diagonal of the parallelogram is $11x + 7y = 9$. If the other diagonal is $ax + by + c = 0$, then

a) $a = -1, b = -1, c = 2$ b) $a = 1, b = -1, c = 0$

c) $a = -1, b = -1, c = 0$ d) $a = 1, b = 1, c = 0$

327. The equations of the lines through (1, 1) and making angle of 45° with the line $x + y = 0$ are

a) $x - 1 = 0, x - y = 0$ b) $x - y = 0, y - 1 = 0$

c) $x + y - 2 = 0, y - 1 = 0$ d) $x - 1 = 0, y - 1 = 0$

328. The equation of the straight line perpendicular to $5x - 2y = 7$ and passing through the point of intersection of the lines $2x + 3y = 1$ and $3x + 4y = 6$, is

a) $2x + 5y + 17 = 0$ b) $2x + 5y - 17 = 0$ c) $2x - 5y + 17 = 0$ d) $2x - 5y = 17$

329. The orthocentre of the triangle whose vertices are $(5,-2)$, $(-1,2)$ and $(1,4)$, is

a) $(1/5,14/5)$ b) $(14/5,1/5)$ c) $(1/5,1/5)$ d) $(14/5,14/5)$

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

a) $3x = 19$ b) $3y = 7$ c) $3x = 19$ and $3y = 7$ d) None of these

331. Three straight lines $2x + 11y - 5 = 0$, $24x + 7y - 20 = 0$ and $4x - 3y - 2 = 0$

a) From a triangle b) Are only concurrent

c) Are concurrent with one line bisecting the angle d) None of the above between the other two

332. Let a and b be non-zero and real numbers. Then, the equation $(ax^2+by^2+c)(x^2-5xy+6y^2)=0$ represents

a) Four straight lines, when $c=0$ and a,b are of the same sign
b) Two straight lines and a circle, when $a=b$ and c is of sign opposite to that of a
c) Two straight lines and hyperbola, when a and b are of the same sign and c is of sign opposite to that of a
d) A circle and an ellipse , when a and b are of the same sign and c is of sign opposite to that of a

333. A line passes through the point of intersection of the lines $100x+50y-1=0$ and $75x+25y+3=0$ and makes equal intercept on the axes. Its equation is

a) $25x+25y-1=0$ b) $5x-5y+3=0$ c) $25x+25y-4=0$ d) $25x-25y+6=0$

334. If the line segment joining (2,3) and (−1,2) is divided internally in the ratio 3 : 4 by the line $x+2y=\lambda$, then $\lambda=$

a) $\frac{41}{7}$ b) $\frac{5}{7}$ c) $\frac{36}{7}$ d) $\frac{31}{7}$

335. The angle between the lines $\sqrt{3}x-y-2=0$ and $x-\sqrt{3}y+1=0$ is

a) 90° b) 60° c) 45° d) 30°

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

a) $5x+6y=0$ b) $5x-6y=0$ c) $6x-5y+14=0$ d) $6x-5y-14=0$

337. If a line with y-intercept 2, is perpendicular to the line $3x-2y=6$, then its x- intercept is

a) 1 b) 2 c) −4 d) 3

338. The distance between the pair of parallel lines given by $x^2-1005x+2006=0$ is

a) 1001 b) 1000 c) 1005 d) 2006

339. The pair of lines $\sqrt{3}\,x^2-4xy+\sqrt{3}\,y^2=0$ are rotated about the origin by $\pi/6$ in anticlockwise sense. The equation of the pair in the new position is

a) $\sqrt{3}\,x^2-xy=0$ b) $x^2-\sqrt{3}\,xy=0$ c) $xy-\sqrt{3}\,y^2=0$ d) None of these

340. The area of the parallelogram formed by the lines $3x-4y+1=0, 3x-4y+3=0, 4x-3y-1=0$ and $4x-3y-2=0$, is

a) $\frac{1}{6}$ sq. units b) $\frac{2}{7}$ sq. units c) $\frac{3}{8}$ sq. units d) None of these

341. The point $P(1,1)$ is translated parallel to $2x=y$ in the first quadrant through a unit distance. The coordinates of the new position of P are

a) $\left(1\pm\frac{2}{\sqrt{5}},1\pm\frac{1}{\sqrt{5}}\right)$ b) $\left(1\pm\frac{1}{\sqrt{5}},1\pm\frac{2}{\sqrt{5}}\right)$ c) $\left(\frac{1}{\sqrt{5}},\frac{2}{\sqrt{5}}\right)$ d) $\left(\frac{2}{\sqrt{5}},\frac{1}{\sqrt{5}}\right)$

342. If, $\frac{x^2}{a}+\frac{y^2}{b}+\frac{2xy}{h}=0$ represents pair of straight lines such that slope of one line is twice the other. Then, $ab:h^2$ is

a) 9: 8 b) 8: 9 c) 1: 2 d) 2: 1

343. If the vertices of a diagonal of a square are (−2,4) and (−2,−2), then its other two vertices are at

a) (1, −1), (5,1) b) (1,1), (5, −1) c) (1,1), (−5,1) d) None of these

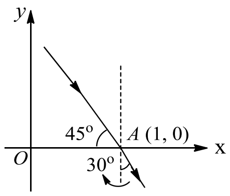
344. If one of the diagonals of a square is along the line $x=2y$ and one of its vertices is (3, 0), then its sides through this vertex are given by the equations

a) $y-3x+9=0, 3y+x-3=0$
b) $y+3x+9=0, 3y+x-3=0$
c) $y-3x+9=0, 3y-x+3=0$
d) $y-3x+3=0, 3y+x+9=0$

345. The line passing through $\left(-1,\frac{\pi}{2}\right)$ and perpendicular to $\sqrt{3}\sin\theta+2\cos\theta=\frac{4}{r}$, is

a) $2=\sqrt{3}r\cos\theta-2r\sin\theta$
b) $5=-2\sqrt{3}r\sin\theta+4r\cos\theta$
c) $2=\sqrt{3}r\cos\theta+2r\sin\theta$
d) $5=2\sqrt{3}r\sin\theta-4r\cos\theta$

346. In the adjacent figure, equation of refracted ray is



a) $y=\sqrt{3}x+1$ b) $y+\sqrt{3}x-3=0$ c) $\sqrt{3}x+y-\sqrt{3}=0$ d) None of these

347. Two points A and B have coordinates $(1, 1)$ and $(3, -2)$ rrespectively. The coordinates of a point at a distance $\sqrt{85}$ from B on the line through B perpendicular to AB, are
a) $(4, 7)$ b) $(7, 4)$ c) $(5, 7)$ d) $(-5, -3)$

348. 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
a) 0 b) 20 c) 30 d) None of these

349. The value of λ, for which the equation $x^2-y^2-x+\lambda y-2=0$ represents a pair of straight lines, are
a) $-3, 1$ b) $-1,1$ c) $3, -3$ d) $3,1$

350. The line which is parallel to x-axis and crosses the curve $y=\sqrt{x}$ at an angle 45°, is
a) $y=\frac{1}{4}$ b) $y=\frac{1}{2}$ c) $y=1$ d) $y=4$

351. Consider the following statements:
VI. The lines $2x+3y+19=0$ and $9x+6y-17=0$ cut the coordinates axes in concyclic points
VII. The points $(2, -5)$ and $(-1, 4)$ are equidistant from the line $3x+y+5=0$
Which of these is/are correct?
a) Only (1) b) Only (2) c) Both of these d) None of these

352. The angle between the lines $x^2+4xy+y^2=0$ is
a) 60° b) 15° c) 30° d) 45°

353. The y-intercept of the line passing through $(2,2)$ and perpendicular to the line $3x+y=3$ is
a) 1/3 b) 2/3 c) 1 d) 4/3

354. If one of the lines given by $6x^2-xy+4cy^2=0$ is $3x+4y=0$, then c equals
a) 1 b) -1 c) 3 d) -3

355. For what value of k is $4\,x^2+8\,xy+ky^2=9$ the equation of a pair of straight lines?
a) 0 b) 4 c) 9 d) -9

356. The equation of the line bisecting perpendicularly the segment joining the points $(-4,6)$ and $(8, 8)$ is
a) $y=7$ b) $6x+y-19=0$ c) $x+2y-7=0$ d) $6x+2y-19=0$

357. The locus of the point of intersection of lines $x\cos\alpha+y\sin\alpha=a$ and $x\sin\alpha-y\cos\alpha=b$ is (α is a variable)
a) $2(x^2+y^2)=a^2+b^2$ b) $x^2-y^2=a^2-b^2$ c) $x^2+y^2=a^2+b^2$ d) None of these

358. If the two pairs of lines $x^2-2\,mxy-y^2=0$ and $x^2-2\,nxy-y^2=0$ are such that one of them represents the dissector of the angles between the other, then
a) $mn+1=0$ b) $mn-1=0$ c) $\frac{1}{m}+\frac{1}{n}=0$ d) $\frac{1}{m}-\frac{1}{n}=0$

359. The equation of the line passing through the origin and the point of intersection of the lines $\frac{x}{a}+\frac{y}{b}=1$ and $\frac{x}{b}+\frac{y}{a}=1$ is
a) $bx-ay=0$ b) $x+y=0$ c) $ax-by=0$ d) $x-y=0$

360. The equation $4x^2-24xy+11y^2=0$ represents
a) Two parallel lines b) Two perpendicular lines
c) Two lines through the origin d) A circle

361. If the slopes of one of the lines given by $ax^2+2hxy+by^2=0$ is 5 times the other, then
a) $5h^2=9ab$ b) $5h^2=ab$ c) $h^2=ab$ d) $9h^2=5ab$

362. Points on the line $x+y=4$ which are equidistant from the lines $|x|=|y|$, are
a) $(4, 0), (0, 4)$
b) $(-4, 0), (0, -4)$

c) $(4, 0), (-4, 0)$

d) None of these

363. If 3, 4 are intercepts of a line $L \equiv 0$, then the distance of $L \equiv 0$ from the origin is

a) 5 units
b) 12 units
c) $\frac{5}{12}$ unit
d) $\frac{12}{5}$ unit

364. If the lines $y = 3x + 1$ and $2y = x + 3$ are equally inclined to the line $y = mx + 4, \left(\frac{1}{2} <, m < 3\right)$, then the value of m are

a) $\frac{1}{2}(1 \pm 5\sqrt{3})$
b) $\frac{1}{7}(1 \pm 5\sqrt{5})$
c) $\frac{1}{7}(1 \pm 5\sqrt{2})$
d) $\frac{1}{7}(1 \pm 2\sqrt{5})$

365. The point of intersection of the lines $\frac{x}{a} + \frac{y}{b} = 1$ and $\frac{x}{b} + \frac{y}{a} = 1$ lies on the line

a) $x - y = 0$

b) $(x + y)(a + b) = 2\,ab$

c) $(lx + my)(a + b) = (l + m)ab$

d) All of these

366. The equation of the bisector of the acute angle between the line $3x - 4y + 7 = 0$ and $12x + 5y - 2 = 0$ is

a) $99x - 27y - 81 = 0$
b) $11x - 3y + 9 = 0$
c) $21x + 77y - 101 = 0$
d) $21x + 77y + 101 = 0$

367. The sum of slopes of lines $3x^2 + 5xy - 2y^2 = 0$ is

a) $-\frac{5}{3}$
b) $\frac{5}{2}$
c) $-\frac{5}{2}$
d) $-\frac{2}{3}$

368. The line $2x - y = 1$ bisects angle between two lines. If equation of one line is $y = x$, then the equation of the other line is

a) $7x - y - 6 = 0$
b) $x - 2y + 1 = 0$
c) $3x - 2y - 1 = 0$
d) $x - 7y + 6 = 0$

369. The lines $(a + 2b)x + (a - 3b)y = a - b$ for different values of a and b pass through the fixed point whose coordinates are

a) $\left(\frac{2}{5}, \frac{2}{5}\right)$
b) $\left(\frac{3}{5}, \frac{3}{5}\right)$
c) $\left(\frac{1}{5}, \frac{1}{5}\right)$
d) $\left(\frac{2}{5}, \frac{3}{5}\right)$

370. If the straight line $ax + by + c = 0$ always passes through $(1, -2)$, then a, b, c are

a) in AP
b) in HP
c) in GP
d) None of these

371. The point moves such that the area of the triangle formed by it with the points $(1, 5)$ and $(3, -7)$ is 21 sq unit. The locus of the point is

a) $6x + y - 32$
b) $6x - y + 32 = 0$
c) $x + 6y - 32 = 0$
d) $6x - y - 32 = 0$

372. Orthocentre of triangle with vertices $(0, 0)$, $(3, 4)$ and $(4, 0)$ is

a) $(3, 5/4)$
b) $(3, 12)$
c) $(3, 3/4)$
d) $(3, 9)$

373. If one vertex of an equilateral triangle is at $(2, -1)$ and the base is $x + y - 2 = 0$, then the length of each side is

a) $\sqrt{3/2}$
b) $\sqrt{2/3}$
c) $2/3$
d) $3/2$

374. Orthocentre of the triangle formed by the lines $x + y = 1$ and $xy = 0$ is

a) $(0, 0)$
b) $(0, 1)$
c) $(1, 0)$
d) $(-1, 1)$

375. The angle between the line joining origin and intersection points of line $2x + y = 1$ and curve $3x^2 + 4yx - 4x + 1 = 0$ is

a) $\pi/2$
b) $\pi/3$
c) $\pi/4$
d) $\pi/6$

376. The coordinate of the foot of perpendicular from $(a, 0)$ on the line $y = mx + \frac{a}{m}$ are

a) $\left(0, \frac{a}{m}\right)$
b) $\left(0, -\frac{a}{m}\right)$
c) $\left(\frac{a}{m}, 0\right)$
d) $\left(-\frac{a}{m}, 0\right)$

377. Coordinate of the foot of the perpendicular drawn from $(0, 0)$ to the line joining $(a \cos \alpha, a \sin \alpha)$ and $(a \cos \beta, a \sin \beta)$ are

a) $\left(\frac{a}{2}, \frac{b}{2}\right)$
b) $\left[\frac{a}{2}(\cos \alpha + \cos \beta), \frac{a}{2}(\sin \alpha + \sin \beta)\right]$
c) $\left[\cos\frac{\alpha + \beta}{2}, \sin\frac{\alpha + \beta}{2}\right]$
d) $\left(0, \frac{b}{2}\right)$

378. The inclination of the straight line passing through the point $(-3, 6)$ and the mid point of the line joining the points $(4, -5)$ and $(-2, 9)$ is

a) $\frac{\pi}{4}$ b) $\frac{\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{3\pi}{4}$

379. The angle between the pair of lines $(x^2 + y^2)\sin^2\alpha = (x\cos\theta - y\sin\theta)^2$ is

a) θ b) 2θ c) α d) 2α

380. The acute angle between the lines joining the origin to the points of intersection of the line $\sqrt{3}x + y = 2$ and the circle $x^2 + y^2 = 4$, is

a) $\pi/2$ b) $\pi/3$ c) $\pi/4$ d) $\pi/6$

381. If the line $\frac{x}{a} + \frac{y}{b} = 1$ moves such that $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$ where c is a constant, then the locus of the foot of the perpendicular from the origin to the line is

a) Straight line b) Circle c) Parabola d) Ellipse

382. The base BC of $\Delta\, ABC$ is bisected at (p, q) and equation of sides AB and AC are $px + qy = 1$ and $qx + py = 1$ respectively. Then, the equation of the median through A is

a) $(2pq - 1)(px + qy - 1) = (p^2 + q^2 - 1)(qx + py - 1)$

b) $(qx + qy - 1)(qx + py - 1) = 0$

c) $(px + qy - 1)(qx - py - 1) = 0$

d) None of the above

383. The straight lines $x + y - 4 = 0, 3\,x + y - 4 = 0, x + 3\,y - 4$ form a triangle which is

a) Isosceles b) Right angled c) Equilateral d) None of these

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

a) (3,5) b) (5,3) c) $(1, -3)$ d) $(-1,3)$

385. The lines $x\cos\alpha + y\sin\alpha = p_1$ and $x\cos\beta + y\sin\beta = p_2$ will be perpendicular, if

a) $\alpha \pm \beta = \frac{\pi}{2}$ b) $\alpha = \frac{\pi}{2}$ c) $|\alpha - \beta| = \frac{\pi}{2}$ d) $\alpha = \beta$

386. The limiting position of the point of intersection of the lines $3x + 4y = 1$ and $(1 + c)x + 3c^2y = 2$ as c tends to 1, is

a) $(-5, 4)$ b) $(5, -4)$ c) $(4, -5)$ d) None of these

387. If the lines $ax + ky + 10 = 0, bx + (k + 1)y + 10 = 0$ and $cx + (k + 2)y + 10 = 0$ are concurrent, then

a) a, b, c are in GP b) a, b, c are in HP c) a, b, c are in AP d) $(a + b)^2 = c$

388. The distance between the parallel lines $9x^2 - 6xy + y^2 + 18x - 6y + 8 = 0$, is

a) $\frac{1}{\sqrt{10}}$ b) $\frac{2}{\sqrt{10}}$ c) $\frac{4}{\sqrt{10}}$ d) $\sqrt{10}$

389. If two of the lines given by the equation $ax^3 + bx^2y + cxy^2 + dy^3 = (a \neq 0)$ make complementary angles with x-axis in anticlockwise sense, then

a) $a(a - c) = d(b - d)$ b) $d(a - c) = a(d - b)$ c) $a(a - c) = d(d - b)$ d) None of these

390. The equation of the pair of straight lines parallel to x-axis and touching the circle $x^2 + y^2 - 6x - 4y - 12 = 0$ is

a) $y^2 - 4y - 21 = 0$ b) $y^2 + 4y - 21 = 0$ c) $y^2 - 4y + 21 = 0$ d) $y^2 + 4y + 21 = 0$

391. 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 is

a) $\sqrt{3}x + y = 0$ b) $x + \frac{\sqrt{3}}{2}y = 0$ c) $\frac{\sqrt{3}}{2}x + y = 0$ d) $x + \sqrt{3}y = 0$

392. Two of the lines represented by the equation $ay^4 + bxy^3 + cx^2y^2 + dx^3y + ex^4 = 0$ will be perpendicular, then

a) $(b + d)(ad + be) + (e - a)^2(a + c + e) = 0$ b) $(b + d)(ad + be) + (e + a)^2(a + c + e) = 0$

c) $(b - d)(ad - be) + (e - a)^2(a + b + e) = 0$ d) $(b - d)(ad - be) + (e + a)^2(a + b + c) = 0$

393. If $3x^2 + xy - y^2 - 3x + 6y + k = 0$ represents a pair of lines, then k is equal to

a) 0 b) 9 c) 1 d) -9

394. Let the base of a triangle lie along the line $x = a$ and be of length $2a$. The area of this triangle is a^2 if the vertex lies on the lines

a) $x = -a, x = 2a$ b) $x = 0, x = a$ c) $x = a/2, x = -a$ d) None of these

395. The distance of the point $(-2, 3)$ from the line $x - y = 5$ is

a) $5\sqrt{2}$ b) $2\sqrt{5}$ c) $3\sqrt{5}$ d) $5\sqrt{3}$

396. The angle between the lines in $x^2 - xy - 6y^2 - 7x + 31y - 18 = 0$ is

a) 60° b) 45° c) 30° d) 90°

397. The equation $12x^2 + 7xy + ay^2 + 13x - y + 3 = 0$, represents a pair of perpendicular lines. Then, the value of 'a' is

a) $\frac{7}{2}$ b) -19 c) -12 d) 12

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

a) $\sqrt{\frac{20}{3}}$ b) $\frac{2}{\sqrt{15}}$ c) $\sqrt{\frac{8}{15}}$ d) $\sqrt{\frac{15}{2}}$

399. The number of lines that are parallel to $2x + 6y + 7 = 0$ and have an intercept of length 10 between the coordinate axes, is

a) 1 b) 2 c) 4 d) Infinitely many

400. If $a \neq b \neq c$ and if $ax + by + c = 0, bx + cy + a = 0, cx + ay + b = 0$ are concurrent, then $2^{a^2b^{-1}c^{-1}} \cdot 2^{b^2c^{-1}b^{-1}} \cdot 2^{c^2a^{-1}b^{-1}}$ is equal to

a) 8 b) 0 c) 2 d) None of these

401. The lines parallel to the x-axis and passing through the intersection of the lines $ax + 2by + 3b = 0$ and $bx - 2ay - 3a = 0$, where $(a, b) \neq (0,0)$ is

a) Above the x-axis at a distance of (2/3) from it b) Above the x-axis at a distance of (3/2) from it

c) Below the x-axis at a distance of (2/3) from it d) Below the x-axis at a distance of (3/2) from it

402. The equations of two sides of a square whose area is 25 square units are $3x - 4y = 0$ and $4x + 3y = 0$. The equations of the other two sides of the square are

a) $3x - 4y \pm 25 = 0, 4x + 3y \pm 25 = 0$

b) $3x - 4y \pm 5 = 0, 4x + 3y \pm 5 = 0$

c) $3x - 4y \pm 5 = 0, 4x + 3y \pm 25 = 0$

d) None of these

403. The polar equation $\cos\theta + 7\sin\theta = \frac{1}{r}$ represents a

a) Circle b) Parabola c) Straight line d) Hyperbola

404. If $x^2 - k\,xy + y^2 + 2y + 2 = 0$ denotes a pair of straight lines then $k =$

a) 2 b) $1/\sqrt{2}$ c) $2\sqrt{2}$ d) $\sqrt{2}$

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

a) $x + y + 3 = 0$ b) $x - y - 3 = 0$ c) $x - y + 3 = 0$ d) $3x + y - 7 = 0$

406. If the points (1,2) and (3,4) were to be on the same side of the line $3x - 5y + a = 0$, then

a) $7 < a < 11$ b) $a = 7$ c) $a = 1$ d) $a < 7$ or $a > 11$

407. The equation of pair of lines joining origin to the points of intersection of $x^2 + y^2 = 9$ and $x + y = 3$ is

a) $x^2 + (3 - x)^2 = 9$ b) $xy = 0$ c) $(3 + y)^2 + y^2 = 9$ d) $(x - y)^2 = 9$

408. 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) $\frac{23}{\sqrt{15}}$ b) $\sqrt{17}$ c) $\frac{17}{\sqrt{15}}$ d) $\frac{23}{\sqrt{17}}$

409. The length of perpendicular from the point $(a\cos\alpha, a\sin\alpha)$ upon the straight line $y = x\tan\alpha + c, c > 0$, is

a) c b) $c\sin^2\alpha$ c) $c\cos\alpha$ d) $c\sec^2\alpha$

410. The equations $ax + by + c = 0$ and $dx + ey + f = 0$ represent the same straight line if and only if

a) $\frac{a}{d} = \frac{b}{c}$ b) $c = f$ c) $\frac{a}{d} = \frac{b}{e} = \frac{c}{f}$ d) $a = d, b = e, c = f$

411. The coordinates of the image of the origin O with respect to the line $x + y + 1 = 0$ are

a) $-1/2, -1/2$ b) $(-2, -2)$ c) $(1,1)$ d) $(-1, -1)$

412. The equation of the straight line joining the origin to the point of intersection of $y - x + 7 = 0$ and $y + 2x - 2 = 0$, is

a) $3x + 4y = 0$ b) $3x - 4y = 0$ c) $4x - 3y = 0$ d) $4x + 3y = 0$

413. If one of the lines of $ax^2 + 2\,hxy + by^2 = 0$ bisects the angle between the axes, in the first quadrant, then

a) $h^2 - ab = 0$ b) $h^2 + ab = 0$ c) $(a + b)^2 = h^2$ d) $(a + b)^2 = 4\,h^2$

414. If the angle between the lines represented by equations $y^2 + kxy - x^2\tan^2 A = 0$ is $2A$, then k is equal to

a) 0 b) 2 c) 4 d) -2

415. The image of the point $(-1, 3)$ by the line $x - y = 0$ is

a) $(3, -1)$ b) $(1, -3)$ c) $(-1, -1)$ d) $(3, 3)$

416. The joint equation of the straight lines $x + y = 1$ and $x - y = 4$, is

a) $x^2 - y^2 = -4$

b) $x^2 - y^2 = 4$

c) $(x + y - 1)(x - y - 4) = 0$

d) $(x + y + 1)(x - y + 4) = 0$

417. The equation of the straight lines passing through the point (4, 3) and making intercepts on the coordinate axes whose sum is -1, is

a) $\frac{x}{2} + \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$ b) $\frac{x}{2} - \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

c) $\frac{x}{2} + \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$ d) $\frac{x}{2} - \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$

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

a) $a_1^2 - a_2^2 + b_1^2 - b_2^2$

b) $\sqrt{a_1^2 + b_1^2 - a_2^2 - b_2^2}$

c) $\frac{1}{2}(a_1^2 + a_2^2 + b_1^2 + b_2^2)$

d) $\frac{1}{2}(a_2^2 + b_2^2 - a_1^2 - b_1^2)$

419. If the equation $4x^2 + hxy + y^2 = 0$ represent coincident lines, then h is equal to

a) 1 b) 3 c) 2 d) 4

420. The four sides of a quadrilateral are given by the equation $xy(x - 2)(y - 3) = 0$. The equation of the line parallel to $x - 4y = 0$ that divides the quadrilateral in two equal area is

a) $x - 4y + 5 = 0$ b) $x - 4y - 5 = 0$ c) $4y = x + 1$ d) $4y + 1 = x$

421. The angle between the pair of straight lines formed by joining the points of intersection of $x^2 + y^2 = 4$ and $y = 3x + c$ to the origin is a right angle. Then, c^2 is equal to

a) 20 b) 30 c) 1/5 d) 5

422. P is a point on either of two lines $y - \sqrt{3}|x| = 2$ at a distance 5 unit from their point of intersection. The coordinates of the foot of the perpendicular from P on the bisector of the angle between them are

a) $\left(0, \frac{4+5\sqrt{3}}{2}\right)$ or $\left(0, \frac{4-5\sqrt{3}}{2}\right)$ depending on which the point P is taken

b) $\left(0, \frac{4 + 5\sqrt{3}}{2}\right)$

c) $\left(0, \frac{4 - 5\sqrt{3}}{2}\right)$

d) $\left(\frac{5}{2}, \frac{5\sqrt{3}}{2}\right)$

423. The triangle formed by the lines $x + y = 0, 3x + y = 4, x + 3y = 4$ is

a) Isosceles b) Equilateral c) Right angled d) None of these

424. Equation of a line passing through the line of interception of lines $2x - 3y + 4 = 0$, $3x + 4y - 5 = 0$ and perpendicular to $6x - 7y + 3 = 0$, is

a) $119x + 102y + 125 = 0$ b) $119x + 102y = 125$

c) $119x - 102y = 125$ d) None of these

425. The lines $ax + by + c = 0, bx + cy + a = 0$ and $cx + ay + b = 0$ $(a \neq b \neq c)$ are concurrent, if

a) $a^3 + b^3 + c^3 + 3abc = 0$ b) $a^2 + b^2 + c^2 - 3abc = 0$

c) $a + b + c = 0$ d) None of the above

: ANSWER KEY :

1)	b	2)	b	3)	a	4)	c	189)	c	190)	c	191)	b	192)	a
5)	d	6)	a	7)	b	8)	d	193)	a	194)	c	195)	d	196)	b
9)	a	10)	c	11)	a	12)	b	197)	b	198)	c	199)	b	200)	d
13)	b	14)	a	15)	a	16)	c	201)	a	202)	a	203)	c	204)	c
17)	c	18)	a	19)	a	20)	c	205)	a	206)	a	207)	d	208)	a
21)	b	22)	b	23)	b	24)	d	209)	c	210)	d	211)	a	212)	c
25)	c	26)	b	27)	b	28)	b	213)	a	214)	b	215)	b	216)	d
29)	b	30)	c	31)	c	32)	b	217)	a	218)	d	219)	c	220)	b
33)	a	34)	d	35)	a	36)	a	221)	c	222)	b	223)	d	224)	c
37)	c	38)	a	39)	b	40)	a	225)	c	226)	b	227)	d	228)	b
41)	a	42)	c	43)	b	44)	b	229)	a	230)	a	231)	b	232)	b
45)	b	46)	d	47)	b	48)	a	233)	a	234)	c	235)	a	236)	b
49)	a	50)	a	51)	b	52)	b	237)	b	238)	c	239)	c	240)	b
53)	b	54)	a	55)	c	56)	d	241)	d	242)	b	243)	a	244)	b
57)	d	58)	b	59)	b	60)	a	245)	d	246)	c	247)	c	248)	d
61)	c	62)	c	63)	a	64)	d	249)	a	250)	d	251)	b	252)	c
65)	a	66)	a	67)	d	68)	b	253)	c	254)	d	255)	c	256)	a
69)	c	70)	b	71)	c	72)	c	257)	a	258)	a	259)	c	260)	a
73)	c	74)	d	75)	b	76)	a	261)	d	262)	c	263)	b	264)	c
77)	d	78)	d	79)	b	80)	b	265)	a	266)	c	267)	c	268)	c
81)	b	82)	b	83)	c	84)	a	269)	c	270)	a	271)	c	272)	d
85)	a	86)	b	87)	c	88)	b	273)	c	274)	a	275)	d	276)	c
89)	d	90)	a	91)	b	92)	d	277)	d	278)	c	279)	d	280)	b
93)	d	94)	b	95)	b	96)	d	281)	c	282)	d	283)	b	284)	b
97)	a	98)	d	99)	a	100)	a	285)	a	286)	a	287)	c	288)	c
101)	c	102)	c	103)	a	104)	a	289)	b	290)	b	291)	b	292)	a
105)	c	106)	a	107)	c	108)	b	293)	b	294)	c	295)	b	296)	c
109)	c	110)	c	111)	b	112)	b	297)	d	298)	a	299)	a	300)	d
113)	d	114)	b	115)	d	116)	a	301)	b	302)	c	303)	c	304)	c
117)	a	118)	b	119)	a	120)	c	305)	c	306)	c	307)	d	308)	a
121)	b	122)	d	123)	a	124)	b	309)	a	310)	a	311)	b	312)	c
125)	c	126)	c	127)	a	128)	c	313)	c	314)	b	315)	a	316)	c
129)	c	130)	a	131)	a	132)	b	317)	d	318)	c	319)	c	320)	d
133)	d	134)	a	135)	c	136)	a	321)	a	322)	b	323)	d	324)	b
137)	d	138)	b	139)	b	140)	b	325)	b	326)	b	327)	d	328)	a
141)	a	142)	c	143)	a	144)	b	329)	a	330)	a	331)	c	332)	b
145)	d	146)	d	147)	a	148)	c	333)	c	334)	a	335)	d	336)	c
149)	a	150)	a	151)	c	152)	a	337)	d	338)	a	339)	a	340)	b
153)	b	154)	b	155)	c	156)	b	341)	b	342)	a	343)	c	344)	a
157)	a	158)	a	159)	c	160)	d	345)	a	346)	c	347)	c	348)	b
161)	b	162)	d	163)	c	164)	c	349)	c	350)	b	351)	c	352)	a
165)	b	166)	a	167)	d	168)	a	353)	d	354)	d	355)	b	356)	b
169)	a	170)	c	171)	b	172)	c	357)	c	358)	a	359)	d	360)	c
173)	c	174)	c	175)	d	176)	a	361)	a	362)	a	363)	d	364)	c
177)	c	178)	d	179)	b	180)	b	365)	d	366)	c	367)	b	368)	b
181)	b	182)	a	183)	d	184)	b	369)	d	370)	a	371)	a	372)	c
185)	d	186)	a	187)	d	188)	a	373)	b	374)	a	375)	a	376)	a

377)	**b**	**378)**	**d**	**379)**	**d**	**380)**	**b**
381)	**b**	**382)**	**a**	**383)**	**a**	**384)**	**a**
385)	**c**	**386)**	**a**	**387)**	**c**	**388)**	**b**
389)	**c**	**390)**	**a**	**391)**	**a**	**392)**	**a**
393)	**d**	**394)**	**b**	**395)**	**a**	**396)**	**b**
397)	**c**	**398)**	**a**	**399)**	**b**	**400)**	**a**
401)	**d**	**402)**	**a**	**403)**	**c**	**404)**	**d**

405)	**c**	**406)**	**d**	**407)**	**b**	**408)**	**d**
409)	**c**	**410)**	**c**	**411)**	**d**	**412)**	**d**
413)	**d**	**414)**	**a**	**415)**	**a**	**416)**	**c**
417)	**d**	**418)**	**d**	**419)**	**d**	**420)**	**a**
421)	**a**	**422)**	**b**	**423)**	**a**	**424)**	**b**
425)	**c**						

: HINTS AND SOLUTIONS :

1 **(b)**

The vertices of the triangle are $A(0,0), B\left(-\frac{c}{a}, 0\right)$ and $(C\left(0, -\frac{c}{b}\right)$

$$\therefore \text{Area of } \Delta = \frac{1}{2}\begin{vmatrix} 0 & 0 & 1 \\ -\frac{c}{a} & 0 & 1 \\ 0 & -\frac{c}{b} & 1 \end{vmatrix}$$

$$= \frac{1}{2}1\left|\left\{\left(-\frac{c}{a}\right)\left(-\frac{c}{b}\right) - 0\right\}\right|$$

$$= \frac{c^2}{2|ab|}$$

2 **(b)**

The equation of any line passing through $(1, 1)$ and $(-5, 5)$ is

$$y - 1 = \frac{5-1}{-5-1}(x-1)$$

$\Rightarrow\ -6(y-1) = 4(x-1)$

Since, the point $(13, \lambda)$ lies on this line.

$\therefore\ -6(\lambda - 1) = 4(13-1)\ \Rightarrow\ \lambda = -7$

3 **(a)**

The equations of the lines passing through the origin and making angle α with $y + x = 0$ are

$$y - 0 = \frac{-1 \pm \tan\alpha}{1 \pm \tan\alpha}(x-0) \quad \left[\text{Using : } y - y_1 = \frac{m \pm \tan\alpha}{1 \mp \tan\alpha}(x - x_1)\right]$$

$$\Rightarrow y + \frac{1-\tan\alpha}{1+\tan\alpha}x = 0 \text{ and } y + \frac{1+\tan\alpha}{1-\tan\alpha}x = 0$$

The combined equations of these two lines is

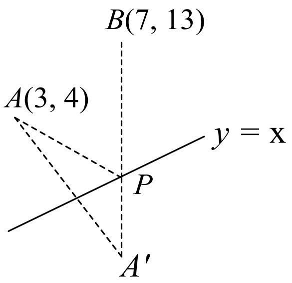
$$\left(y + \frac{1-\tan\alpha}{1+\tan\alpha}\right)\left(y + \frac{1+\tan\alpha}{1-\tan\alpha}\right) = 0$$

$$\Rightarrow y^2 + x^2 + 2xy\left(\frac{1+\tan^2\alpha}{1-\tan^2\alpha}\right) = 0$$

$$\Rightarrow x^2 + 2xy\sec 2\alpha + y^2 = 0$$

4 **(c)**

Points $(3, 4)$ and $(7, 13)$ are on the same side of straight line $y = x$. Take image of A about $y = x$ *ie*, $A'' \equiv (4, 3)$



Now, P is a intersection point of line $y = x$ and $A''B$

Equation of line $A''B$ is $y - 3 = \frac{10}{3}(x-4)$

$\Rightarrow 3y - 9 = 10x - 40$

$\Rightarrow 10x - 3y = 31$

$\Rightarrow \left(\frac{31}{7}, \frac{31}{7}\right)$ satisfy the line $A''B$ such that $PA + PB$ is minimum

$\therefore$ Coordinates of P are $\left(\frac{31}{7}, \frac{31}{7}\right)$

5 **(d)**

The length of perpendicular from the origin to the line

$\frac{x\sin\alpha}{b} - \frac{y\cos\alpha}{a} - 1 = 0$ is

$$d = \frac{|0-0-1|}{\sqrt{\frac{\sin^2\alpha}{b^2} + \frac{\cos^2\alpha}{a^2}}}$$

$$= \frac{|ab|}{\sqrt{a^2\sin^2\alpha + b^2\cos^2\alpha}}$$

6 **(a)**

Given equation is compared with $a_1x + b_1y = 0$ and $a_2x + b_2y = 0$

Now, $a_1a_2 + b_1b_2 = (1)(\sqrt{3}) + (-\sqrt{3})(1) = 0$

$\therefore$ Lines are perpendicular

Hence, $\theta = 90°$

7 **(b)**

Since, the coordinates of three verities A, B and C are $\left(\frac{5}{3}, -\frac{4}{3}\right)$, $(0,0)$ and $\left(-\frac{2}{3}, \frac{7}{3}\right)$ respectively. Also, the mid point of AC is $\left(\frac{1}{2}, \frac{1}{2}\right)$ Therefore, the equation of line passing through $\left(\frac{1}{2}, \frac{1}{2}\right)$ and $(0,0)$ is $x - y = 0$, which is the required equation of another diagonal

$\therefore\ a = 1, b = -1$ and $c = 0$

8 **(d)**

Given lines will be concurrent, if

$$\begin{vmatrix} a & b & -c \\ b & c & -a \\ c & a & -b \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} (a+b+c) & b & c \\ (a+b+c) & c & a \\ (a+b+c) & a & b \end{vmatrix} = 0 \quad \text{Applying}$$

$C_1 \to C_1 + C_2 + C_3$

$\Rightarrow (a+b+c)\begin{vmatrix} 1 & b & c \\ 1 & c & a \\ 1 & a & b \end{vmatrix} = 0$

$\Rightarrow (a+b+c)\begin{vmatrix} 1 & b & c \\ 0 & c-b & a-c \\ 0 & a-b & b-c \end{vmatrix} = 0$

Applying $R_2 \to R_2 - R_1$

$R_3 \to R_3 - R_1$

$\Rightarrow -(a+b+c)(a^2+b^2+c^2-ab-bc-ca) = 0$

$\Rightarrow a+b+c=0$ or $a^2+b^2+c^2-ab-bc-ca=0$

9 **(a)**

Given equation is compared with the standard form, we get

$a=1, h=-\frac{3}{2}, b=\lambda, g=\frac{3}{2}, f=\frac{-5}{2}, c=2$

Given that, $\theta = \tan^{-1}\left(\frac{1}{3}\right) \Rightarrow \tan\theta = \frac{1}{3}$

Since, $\tan\theta = \frac{2\sqrt{h^2-ab}}{a+b}$

$\Rightarrow \frac{1}{3} = \frac{2\sqrt{\left(-\frac{3}{2}\right)^2-\lambda}}{\lambda+1} \Rightarrow (\lambda+1)^2 = 9(9-4\lambda)$

$\Rightarrow \lambda^2+1+2\lambda = 81-36\lambda$

$\Rightarrow \lambda^2+38\lambda-80=0$

$\Rightarrow \lambda = \frac{-38\pm\sqrt{(38)^2+320}}{2}$

$\Rightarrow \lambda = \frac{-38\pm 42}{2} \Rightarrow \lambda = 2$

10 **(c)**

The separate equation of pair of straight lines of $12x^2-20xy+7y^2=0$ are $6x-7y=0$ and $2x-y=0$

Thus, equation of sides of triangle are

$6x-7y=0$ ...(i)

$2x-y=0$ ...(ii)

and $2x-3y+4=0$ ...(iii)

On solving these equations, we get the vertices of a triangle $A(0,0)$; $B(1,2)$and $C(7,6)$

∴ Centroid of triangle is

$\left(\frac{0+1+7}{3}, \frac{0+2+6}{3}\right) = \left(\frac{8}{3}, \frac{8}{3}\right)$

11 **(a)**

The angle between the lines represented by $2x^2+5xy+3y^2+6x+7y+4=0$ is given by

$\tan\theta = \pm\frac{2\sqrt{\frac{25}{4}-6}}{2+3} \Rightarrow \tan\theta = \pm\frac{1}{5}$

$\therefore m = \pm\frac{1}{5}$

12 **(b)**

We know, if the line are perpendicular to each other, then $\theta = 90°$

$\Rightarrow \tan 90° = \frac{2\sqrt{h^2-ab}}{a+b}$

$\Rightarrow a+b=0$ [$\because \tan 90° = \infty$]

13 **(b)**

Given equation of line are

$3x+4y+1=0$ ....(i)

$5x+\lambda y+3=0$ ...(ii)

and $2x+y-1=0$ ...(iii)

The intersection point of lines (i) and (iii) is $(1,-1)$.

Since, the line are concurrent, therefore the intersection point $(1,-1)$ lies on line (ii)

$\therefore 5(1)+\lambda(-1)+3=0 \Rightarrow \lambda = 8$

14 **(a)**

Line perpendicular to same line are parallel to each other.

$\therefore -p(p^2+1) = p^2+1$

$\Rightarrow p=-1$

∴ There is exactly one value of p.

15 **(a)**

If $P(\sin\theta, 1/\sqrt{2})$ and $Q(1/\sqrt{2}, \cos\theta)$ are on the same side of the line $x-y=0$. Then,

$\Rightarrow \left(\sin\theta - \frac{1}{\sqrt{2}}\right)\left(\frac{1}{\sqrt{2}} - \cos\theta\right) > 0$

$\Rightarrow \left(\sin\theta - \frac{1}{\sqrt{2}}\right)\left(\cos\theta - \frac{1}{\sqrt{2}}\right) < 0$

$\Rightarrow \sin\theta - \frac{1}{\sqrt{2}} > 0$ and $\cos\theta - \frac{1}{\sqrt{2}} < 0$

or, $\sin\theta - \frac{1}{\sqrt{2}} < 0$ and $\cos\theta - \frac{1}{\sqrt{2}} > 0$

$\Rightarrow \left(\sin\theta > \frac{1}{\sqrt{2}} \text{ and } \cos\theta < \frac{1}{\sqrt{2}}\right)$

or, $\left(\sin\theta < \frac{1}{\sqrt{2}} \text{ and } \cos\theta > \frac{1}{\sqrt{2}}\right)$

$\Rightarrow \theta \in (\pi/4, 3\pi/4)$ or, $\theta \in (-\pi/4, \pi/4)$

$\Rightarrow \theta \in (-\pi/4, \pi/4) \cup (\pi/4, 3\pi/4)$

16 **(c)**

Given line meets the coordinate axes at

$A\left(\frac{2}{\cos h\,\alpha - \sin h\,\alpha}, 0\right)$ and $B\left(0, \frac{2}{\cos h\,\alpha + \sin h\,\alpha}\right)$

∴ Area of $\Delta\, OAB$

$= \frac{1}{2} \times OA \times OB$

$= \frac{1}{2} \times \frac{2}{\cos h\,\alpha - \sin h\,\alpha} \times \frac{2}{\cos h\,\alpha + \sin h\,\alpha}$

$= \frac{2}{\cos h^2\,\alpha - \sin h^2\,\alpha} = 2$ sq. units

17 **(c)**

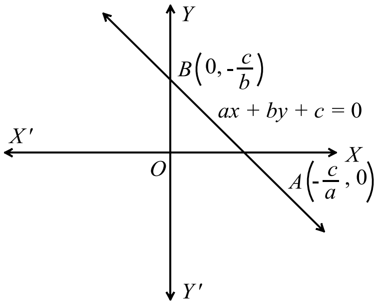
The line $ax+by+c=0$ cuts the coordinate axes at $A(-c/a, 0)$ and $B(0, -c/b)$

$\therefore$ Area of $\Delta\, OAB = \frac{1}{2} \times OA \times OB$

$\Rightarrow$ Area of $\Delta\, OAB = \frac{1}{2} \times \frac{-c}{a} \times \frac{-c}{b} = \frac{c^2}{2ab}$

$\Rightarrow$ Area of $\Delta\, OAB = \frac{ab}{2ab}$ $[\because a, c, b$ are in $G.P.\, c^2 = ab]$

$\Rightarrow$ Area of $\Delta\, OAB = \frac{1}{2} =$ Constant



18 **(a)**

The required lines are obtaining by shifting the origin at (4,0). So, the required equation is $y = |x - 4|$

19 **(a)**

We have, Coefff. of x^2 + Coeff. of $y^2 = 0$

Therefore, the angle between the lines is $\pi/2$

20 **(c)**

The equation of a line passing through the intersection of $x - 3\,y + 1 = 0$ and $2\,x + 5\,y - 9 = 0$ is

$(x - 3\,y + 1) + \lambda(2\,x + 5\,y - 9) = 0$

$\Rightarrow x(2\,\lambda + 1) + y(5\lambda - 3) + 1 - 9\lambda = 0$

This is at a distance of $\sqrt{5}$ units from the origin

$\therefore \left|\frac{1 - 9\,\lambda}{\sqrt{(2\,\lambda + 1)^2 + (5\,\lambda - 3)^2}}\right| = \sqrt{5} \Rightarrow \lambda = \frac{7}{8}$

Hence, the required line is $2\,x + y = 5$

21 **(b)**

The equations of the sides of the parallelogram are:

$x\cos\alpha + y\sin\alpha - p = 0$

$x\cos\alpha + y\sin\alpha - q = 0$

$x\cos\beta + y\sin\beta - r = 0$

$x\cos\beta + y\sin\beta - s = 0$

$\therefore$ Area of the parallelogram

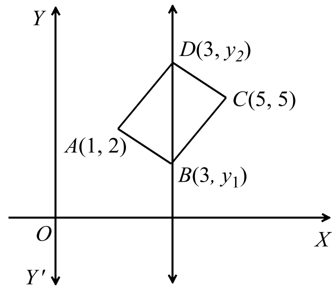
$= \left|\frac{\{(-p) - (-q)\}\{(-r) - (-s)\}}{\begin{vmatrix}\cos\alpha & \sin\alpha \\ \cos\beta & \sin\beta\end{vmatrix}}\right|$

$= \left|\frac{(p - q)(r - s)}{\sin(\alpha - \beta)}\right|$

Clearly, it is maximum when $\alpha - \beta = \pm\frac{\pi}{2}$

22 **(b)**

Let the coordinates of the other two vertices be $B(3, y_1)$ and $D(3, y_2)$. Since the diagonals of a rectangle bisect each other



$\therefore \frac{y_1 + y_2}{2} = \frac{2 + 5}{2} \Rightarrow y_1 + y_2 = 7$ ... (i)

Also, $AC = BD$

$\Rightarrow \sqrt{(5 - 1)^2 + (5 - 2)^2} = y_2 - y_1$

$\Rightarrow y_1 - y_1 = 5$ ...(ii)

From (i) and (ii), we get $y_1 = 1, y_2 = 6$

Hence, the coordinates of the other two vertices are (3,1) and (3,6)

23 **(b)**

Equation of a line passing through (x_1, y_1) and making angle α with x-axis is

$\frac{x - x_1}{\cos\ \alpha} = \frac{y - y_1}{\sin\alpha} = r$

Any point on this line is $(x_1 + r\cos\alpha, y_1 + r\sin\alpha$. It lies on the line $Ax+By+C=0$

$\therefore A(x_1 + r\cos\alpha) + B(y_1 + r\sin\alpha) + C = 0$

$\Rightarrow r = -\frac{A\,x_1 + B\,y_1 + C}{A\cos\alpha + B\sin\alpha}$

Thus, $PQ = r = -\frac{A\,x_1 + B\,y_1 + C}{A\cos\alpha + B\sin\alpha}$

24 **(d)**

Here, $a = 2$, $h = \frac{3}{2}$, $b = -5$

$\therefore\ \tan\theta = \left|\frac{2\sqrt{\left(\frac{3}{2}\right)^2 + 10}}{2 - 5}\right| = \left|\frac{\sqrt{49}}{-3}\right|$

$\Rightarrow\ \theta = \tan^{-1}\left|\frac{7}{3}\right|$

25 **(c)**

Let $(h, k\ )$ be the point such that

$(h - 3)^2 + (k + 2)^2 = \frac{5h - 12k - 13}{\sqrt{25 + 144}}$

$\Rightarrow 13(h^2 + 9 - 6h + k^2 + 4k + 4)$
$= 5h - 12k - 13$

$\Rightarrow 13(h^2 + k^2) - 83h + 64k + 182 = 0$

Thus, the locus of (h, k) is

$13(x^2 + y^2) - 83x + 64y + 182 = 0$

26 **(b)**

The coordinates of the point dividing the line joining $(-1,1)$ and $(5,7)$ in the $\lambda:1$ are

$\left(\frac{5\lambda-1}{\lambda+1}, \frac{7\lambda+1}{\lambda+1}\right)$

This point lies on the line $x+y=4$

$\therefore 5\lambda-1+7\lambda+1=4\lambda+4 \Rightarrow 8\lambda=4 \Rightarrow \lambda=\frac{1}{2}$

27 **(b)**

Here, $a=a, h=0, b=-1, f=-\frac{1}{2}, g=2, c=0$

Given equation represent a pair of straight line.

Then, $\begin{vmatrix} a & 0 & 2 \\ 0 & -1 & -1/2 \\ 2 & -1/2 & 0 \end{vmatrix}=0$

$\Rightarrow a\left[0-\left(\frac{1}{4}\right)\right]-0+2[2]=0 \Rightarrow a=16$

28 **(b)**

We have,

$\sqrt{(x-3)^2+(y-1)^2}+\sqrt{(x+3)^2+(y-1)^2}=6$

$\Rightarrow \sqrt{(x-3)^2+(y-1)^2}$

$=6-\sqrt{(x+3)^2+(y-1)^2}$

On squaring both sides, we get

$12x+36=12\sqrt{(x+3)^2+(y-1)^2}$

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

Again on squaring, we get

$x^2+9+6x=x^2+9+6x+y^2+1-2y$

$\Rightarrow y^2-2y+1=0$

Which represents a pair of straight lines

29 **(b)**

If given lines are concurrent, then

$\begin{vmatrix} 2 & -3 & k \\ 3 & -4 & -13 \\ 8 & -11 & -33 \end{vmatrix}=0$

$\Rightarrow -22+15-k=0 \Rightarrow k=-7$

30 **(c)**

Let the required point be (t,t). Then,

$\left|\frac{3t+4t-12}{5}\right|=4$

$\Rightarrow |7t-12|=20 \Rightarrow 7t-12=\pm 20 \Rightarrow t$

$=\frac{32}{7}, -\frac{8}{7}$

Hence, the required points are $(-8/7, -8/7)$ and $(32/7, 32/7)$

31 **(c)**

The equation of lines are $x+y=0$ and $x-y=0$

$\therefore$ The equation of bisectors of the angles between these lines are

$\frac{x+y}{\sqrt{1+1}}=\pm\frac{x-y}{\sqrt{1+1}} \Rightarrow x+y=\pm(x-y)$

Taking positive sign, $x+y=(x-y)$

$\Rightarrow y=0$

Taking positive sign, $x+y=-(x-y)$

$\Rightarrow x=0$

Hence, the equation of bisectors are $x=0$ and $y=0$

32 **(b)**

The family of lines

$(x+y-1)+\lambda(2x+3y-5)=0$

passes through a point such that

$x+y-1=0$

$2x+3y-5=0$

ie, $(-2,3)$ and family of lines

$(3x+2y-4)+\mu(x+2y-6)=0$

Passes through a point such that

$3x+2y-4=0$

and $x+2y-6=0$ *ie*, $(-1, 7/2)$

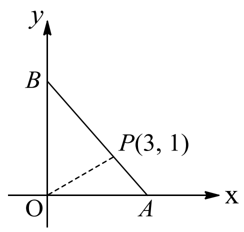
$\therefore$ Equation of the straight line that belongs to both the families passes through $(-2,3)$ and $(-1,7/2)$ is

$y-3=\frac{\frac{7}{2}-3}{-1+2}(x+2)$

$\Rightarrow y-3=\frac{x+2}{2} \Rightarrow x-2y+8=0$

33 **(a)**

Line passing through P farthest from O must be perpendicular to OP, so equation is



$y-1=-3(x-3)$

$\Rightarrow 3x+y=10$

This line meet the coordinate axes at

$A\equiv\left(\frac{10}{3},0\right)$ and $B\equiv(0,10)$

So, Area of $\Delta OAB=\frac{1}{2}\times\frac{10}{3}\times 10=\frac{50}{3}$ sq unit

34 **(d)**

The given equation of pair of straight line can be rewritten as

$(x-y+1)(x+y-2)=0$

$\therefore$ The equation of lines which are represented by the given equation, are

$x-y+1=0$ and $x+y-2=0$

35 **(a)**

Since, bisector are same, therefore

$\frac{a-b}{h}=\frac{a'-b'}{h'}$

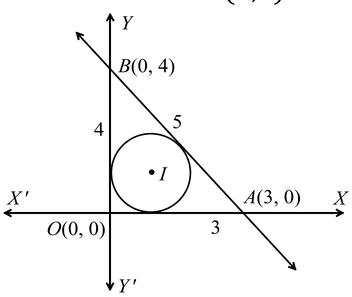
$\Rightarrow (a-b)h'=(a'-b')h$

36 **(a)**

Let $L_1 \equiv 3x - 4y - 8 = 0$
At point (3,0),
$L_1 \equiv 9 - 16 - 8 = -15 < 0$
At point (x, y) and (3, 4) opposite sides of L_1
$\therefore 3x - 4y - 8 > 0$ ...(i)
$\Rightarrow\ 3x - 4(-3x) - 8 > 0\ [\because y = -3x]$
$\Rightarrow\ 15x - 8 > 0 \quad x > \dfrac{8}{15}$
Again from Eq. (i),
$3\left(-\dfrac{y}{3}\right) - 4y - 8 > 0$
$\Rightarrow\ -5y - 8 > 0\ \Rightarrow\ y < -\dfrac{8}{5}$

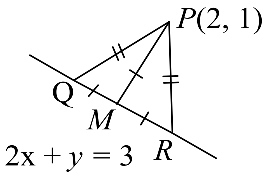
37 **(c)**
Clearly, lengths of perpendiculars from (0,0) on the gives lines are each equal to 2.
Hence, required point is (0,0)

38 **(a)**
The coordinates of I are
$\left(\dfrac{3\times 0 + 4\times 3 + 5\times 0}{3+4+5}, \dfrac{3\times 4 + 4\times 0 + 5\times 0}{3+4+5}\right)$
$= (1,1)$



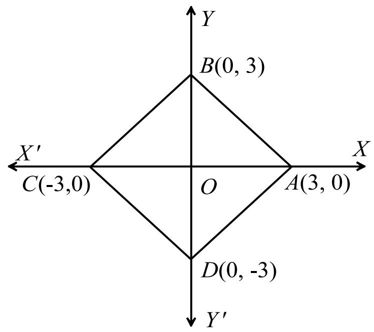
$\therefore BI = \sqrt{(0-1)^2 + (4-1)^2} = \sqrt{10}$

39 **(b)**
Let M be mid point of QR. As PQR is an isosceles triangle, $PM \perp QR$. Slope of QR is -2



$\Rightarrow$ Slope of PM is 1/2. Since, ΔQPR is a right angled triangle, Q, P, R lie on a circle with centre at M.
$\therefore MQ = MP = MR$
$\Rightarrow\ \angle QPM = 45°$
Let m be slope of PQ. Thus,
$\pm \tan 45° = 1 = \dfrac{m - \frac{1}{2}}{1 + \frac{m}{2}}$
$\Rightarrow\ \pm 1 = \dfrac{2m - 1}{2 + m}$
$\Rightarrow\ \pm(2 + m) = 2m - 1 \Rightarrow m = 3, -\dfrac{1}{3}$
$\therefore$ Equation of PQ and PR are
$y - 1 = 3(x - 2)$
and $y - 1 = -\frac{1}{3}(x - 2)$
$\Rightarrow 3(y - 1) + (x - 2) = 0$
Thus, joint equation of PQ and PR is
$[3(x-2) - (y-1)][(x-2) + 3(y-1)] = 0$
$\Rightarrow 3(x-2)^2 - 3(y-1)^2 + 8(x-2)(y-1) = 0$
$\Rightarrow\ 3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$

40 **(a)**
Let $P(h, k)$ be the variable point. Then, by hypothesis, we have
$|h| + |k| = 3$
$\therefore$ Locus of P is $|x| + |y| = 3$
Clearly, it represents a square a shown in Fig. S.19
$\therefore$ Required Area $= \frac{1}{2} \times AC \times BD = \frac{1}{2} \times 6 \times 6 =$ 18 sq. units



41 **(a)**
The slope of line $x - 2y = 3$ is $\frac{1}{2}$
Let the slope of required lines is m
$\therefore \tan 45° = \pm \left|\dfrac{\frac{1}{2} - m}{1 + \frac{m}{2}}\right|$
$\Rightarrow 1 + \dfrac{m}{2} = \pm\left(\dfrac{1}{2} - m\right) \Rightarrow m = -\dfrac{1}{3}, 3$
$\therefore$ Equation of line with slope $m = -\frac{1}{3}$ and passing through (3, 2), is
$(y - 2) = -\dfrac{1}{3}(x - 3)\ \Rightarrow\ x + 3y = 9$
and another equation of line with slope $m = 3$ and passing through (3, 2) is
$(y - 2) = 3(x - 3)\ \Rightarrow\ 3x - y = 7$

42 **(c)**
Line making equal intercepts therefore, its equation is
$x \pm y = a$ ...(i)
Since, it passes through (2, 4)
$\therefore\ \ a = -2, 6$
Hence, equation of the required lines are
$x \pm y = a$
$\Rightarrow x + y = -2$
or $x + y = 6$
$\Rightarrow\ x + y - 6 = 0$

43 **(b)**

Let the point on the x-axis be $(h, 0)$.

The perpendicular distance from $(h, 0)$ to the line

$$= \frac{\left|\frac{h}{a} - 1\right|}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}} = a \text{ [given]}$$

$$\Rightarrow \frac{h}{a} - 1 = \pm a \frac{\sqrt{a^2 + b^2}}{ab}$$

$$\Rightarrow h - a = \pm \frac{a}{b}\sqrt{a^2 + b^2}$$

$$\Rightarrow h = a \pm \frac{a}{b}\sqrt{a^2 + b^2}$$

$$= \frac{a}{b}\left(b \pm \sqrt{a^2 + b^2}\right)$$

$\therefore$ Required point is $\left(\frac{a}{b}\left(b \pm \sqrt{a^2 + b^2}\right), 0\right)$

45 **(b)**

Let the image or (reflection) of the origin with reference to the line

$4x + 3y - 25 = 0$ is (h, k)

$$\therefore \frac{h - 0}{4} = \frac{k - 0}{3} = \frac{-2(0 + 0 - 25)}{16 - 9} = \frac{50}{25} = 2$$

$$\therefore \frac{h}{4} = 2 \Rightarrow h = 8$$

and $\frac{k}{3} = 2 \Rightarrow k = 6$

$\therefore$ The required point is (8, 6)

46 **(d)**

(1) We have, $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \begin{vmatrix} a_1 & b_1 & 1 \\ a_2 & b_2 & 1 \\ a_3 & b_3 & 1 \end{vmatrix}$

This shows that the area of both the triangles are same. But the equality of the areas of the triangles do not ensure the congruence of the triangle

(2) The equation of a line passing through the origin is $y = mx$. If it is equidistant from the points $A(2, 2)$ and $B(4, 0)$, then

$$\left|\frac{2m - 2}{\sqrt{m^2 + 1}}\right| = \left|\frac{4m - 0}{\sqrt{m^2 + 1}}\right|$$

$$\Rightarrow (2m - 2)^2 = (4m)^2$$

$$\Rightarrow (m - 1)^2 = 4m^2$$

$$\Rightarrow 3m^2 + 2m - 1 = 0$$

$$\Rightarrow m = \frac{1}{3}, -1$$

Hence, there are two lines $y = \frac{x}{3}$ and $y = -x$ passing through the origin and equidistance from $A(2, 2)$ and $B(4, 0)$

Hence, both of these two statements are not correct

47 **(b)**

Given equation of the curve is

$3x^2 - y^2 - 2x + 4y = 0$ ...(i)

Let the equation of one of the chord be

$y = mx + c \Rightarrow \frac{y - mx}{c} = 1$ ... (ii)

On making Eq. (i) homogeneous, we get

$$3x^2 - y^2 + (-2x + 4y)\left(\frac{y - mx}{c}\right) = 0$$

$$\Rightarrow x^2(3c + 2m) + y^2(-c + 4) - 2xy - 4mxy = 0$$

Which represent a pair of straight lines passing through origin. Since, the angle subtended is a right angle.

$\therefore 3c + 2m - c + 4 = 0$

$\Rightarrow c = -m - 2$

Substituting value of c in $y = mx + c$, we have

$y = mx - m - 2 \Rightarrow y + 2 = m(x - 1)$

$\Rightarrow$ All such chords pass through a fixed point $(1, -2)$

48 **(a)**

Since, $2x + y = 1$ and $2x + y = 7$ are parallel lines. $(2x + y - 1)(2x + y - 7)$ is positive at point $\left(0, \frac{1}{2}\right)$. So, lines are in the same side of a point

49 **(a)**

Here, $a = 2, b = 2, h = 5/2, g = 3/2, f = 3/2, c = 1$

So, the angle θ between the lines is given by

$$\tan\theta = \frac{2\sqrt{25/4 - 4}}{2 + 2}$$

$$\Rightarrow \tan\theta = \frac{3}{4} \Rightarrow \cos\theta = \frac{4}{5} \Rightarrow \theta = \cos^{-1}\left(\frac{4}{5}\right)$$

50 **(a)**

Let the lines represented by the equations

$px^2 - qxy - y^2 = 0$

be $y = m_1x$ and $y = m_2x$

Then, $m_1 = \tan\alpha$ and $m_2 = \tan\beta$

Also, $m_1 + m_2 = -q$ and $m_1m_2 = -p$

$$\text{Now, } \tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta} = \frac{m_1 + m_2}{1 - m_1m_2}$$

$$= \frac{-q}{1 + p}$$

51 **(b)**

$d(x, y) = \max\{|x|, |y|\}$ ...(i)

but $d(x, y) = a$ ...(ii)

From, Eqs. (i) and (ii),

$a = \max\{|x|, |y|\}$

If $|x| > |y|$, then $a = |x|$

$\therefore x = \pm a$

and if $|y| > |x|$, then $a = |y|$

$\therefore y = \pm a$

Therefore, locus represents a straight line

52 **(b)**

The intersection of two curves

$ax^2+2hxy+by^2+2gx+\lambda(a'x^2+2h'xy+b'y^2+2g'x)=0$

$\Rightarrow x^2(a+a'\lambda)+2xy(h+h'\lambda)+y^2(b+\lambda b')+2x(g+\lambda g')=0$

For making homogeneous equating, $g+\lambda g'=0$

$\Rightarrow \lambda=-\frac{g}{g'}$

Since, lines are perpendicular.

$\therefore$ Coefficient of x^2 + Coefficient of $y^2=0$

$\Rightarrow a+a'\lambda+b+b'\lambda=0$

$\Rightarrow a+b=-(a'+b')\left(-\frac{g}{g'}\right)$

$\Rightarrow (a+b)g'=(a'+b')g$

53 **(b)**

Let the coordinates of the third vertex A be (h,k). Then,

$AD\perp BC$

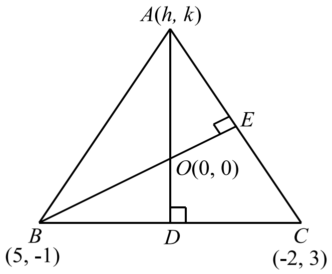
$\Rightarrow OA\perp BC \Rightarrow \frac{k-0}{h-0}\times\frac{4}{-7}=-1 \Rightarrow 7h=4k$ ... (i)

and, $OB\perp AC \Rightarrow \frac{k-3}{h+2}\times\frac{-1}{-5}=-1$

$\Rightarrow 5h-k+13=0$ ... (ii)

Solving (i) and (ii), we get $h=-4, k=-7$

Hence, the coordinates of the third vertex are $(-4,-7)$



54 **(a)**

Required distance $=\frac{|b-a|}{\sqrt{1^2+1^2}}=\frac{|b-a|}{\sqrt{2}}$

55 **(c)**

The given lines are perpendicular to each other.

$\therefore$ Perpendicular distance $=\frac{|r_1-r_2|}{\sqrt{2}}=\sqrt{2}$

$\Rightarrow r_1-r_2=2$

The difference between the y-intercepts = 2

This can happen for five combinations {(0, 2), (1, 3), (2, 4), (3, 5), (4, 6)}.

The difference between the x-intercepts = 2

This can happen for five combinations.

Hence, total number of squares = $5\times5=25$

56 **(d)**

We have,

$(p+2q)x+(p-3q)y-p+q=0$

$\Rightarrow p(x+y-1)+q(2x-3y+1)=0,$

Clearly, it represents a family of lines passing through the intersection of the lines $x+y-1=0$ and $2x-3y+1=0$.

The coordinates of the point of the intersection these two lines are $(2/5, 3/5)$

57 **(d)**

Equation of line perpendicular to $2x+y+6=0$ and passes through origin is $x-2y=0$

Now, point of intersection of $2x+y+6=0$ and $x-2y=0$ is $\left(-\frac{12}{5},-\frac{6}{5}\right)$

Similarly, point of intersection of $x-2y=0$ and $4x+2y-9=0$ is $\left(\frac{9}{5},\frac{9}{10}\right)$

Let the origin divide the line $x-2y=0$ in the ratio $\lambda:1$

$\therefore x=\frac{\frac{9}{5}\lambda-\frac{12}{5}}{\lambda+1}=0 \Rightarrow \frac{9}{5}\lambda=\frac{12}{5}$

$\Rightarrow \lambda=\frac{12}{9}=\frac{4}{3}$

58 **(b)**

Let the straight line meets the x-axis at $A(a,0)$ and the y-axis at $B(0,b)$. The equation of this straight line will be

$\frac{x}{a}+\frac{y}{b}=1$ ...(i)

Since, it passes through $P(1,1)$

$\therefore \frac{1}{a}+\frac{1}{b}=1 \Rightarrow a+b=ab$ ...(ii)

Let the coordinates of the mid point M of AB are (h,k)

$\therefore h=\frac{a+0}{2} \Rightarrow a=2h$

and $k=\frac{0+b}{2}\Rightarrow b=2k$

substitute the values of a and b in Eq. (ii), we get

$2h+2k=2h\times2k$

$\Rightarrow h+k=2hk$

Hence, the equation of the locus of mid point $M(h,k)$ will be

$x+y-2xy=0$

59 **(b)**

Given lines are

$3x+4y=9$ ...(i)

and $6x+8y=15$

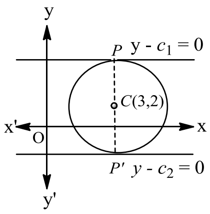
$\Rightarrow 3x+4y=\frac{15}{2}$ ...(ii)

$\because$ Both lines are parallel, therefore the distance between two

lines $=\frac{\left|\frac{15}{2}-9\right|}{\sqrt{3^2+4^2}}=\frac{3}{2\cdot5}=\frac{3}{10}$

60 **(a)**

Let the lines are $y = m_1x + c_1$ and $y = m_2x + c_2$.
Since, pair of straight lines are parallel to x-axis



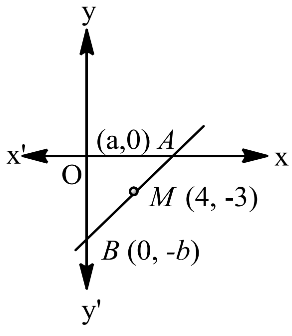
$\therefore m_1 = m_2 = 0$
Hence, the lines will be $y = c_1$ and $y = c_2$. Given circle is $x^2 + y^2 - 6x - 4y - 12 = 0$
$\therefore$ Centre (3, 2) and radius = 5
Here, the perpendicular drawn from centre to the lines are CP and CP''

$$\therefore CP = \frac{2 - c_1}{\sqrt{1}} = \pm 5$$

$\Rightarrow c_1 = 7$ and $c_1 = -3$
Hence, the lines are
$y - 7 = 0, \quad y + 3 = 0$
$ie, (y - 7)(y + 3) = 0$ or $y^2 - 4y - 21 = 0$

62 **(c)**
Let the coordinates of point A and B are $(a, 0)$ and $(0, -b)$

$\therefore \frac{a}{2} = 4 \Rightarrow a = 8$
and $-\frac{b}{2} = -3 \Rightarrow b = 6$
$\therefore$ Equation of line is $\frac{x}{8} + \frac{y}{-6} = 1$
$\Rightarrow 3x - 4y = 24$



63 **(a)**
Given, α be the distance between lines
$x - y + 2 = 0$ and $x - y - 2 = 0$

$$\therefore \alpha = \frac{|2 + 2|}{\sqrt{1 + 1}} = \frac{|4|}{\sqrt{2}} = 2\sqrt{2}$$

and β be the distance between the lines
$4x - 3y - 5 = 0$ and $4x - 3y + \frac{1}{2} = 0$

$$\therefore \beta = \frac{\left|5 + \frac{1}{2}\right|}{\sqrt{(4)^2 + (3)^2}} = \frac{|11|}{2\sqrt{25}} = \frac{11}{10}$$

$$\text{Now, } \frac{\alpha}{\beta} = \frac{2\sqrt{2}}{11/10} = \frac{20\sqrt{2}}{11}$$

$\Rightarrow 20\sqrt{2}\beta = 11\alpha$

64 **(d)**
Given line is
$x^2 + 2xy - 35y^2 - 4x + 44y - 12 = 0$
Here, $a = 1, b = -35, c = -12, h = 1, f = 22$

$$\therefore \text{Point of intersection} = \left(\frac{22 - 70}{-35 - 1}, \frac{-2 - 22}{-35 - 1}\right) = \left(\frac{4}{3}, \frac{2}{3}\right)$$

If the lines are concurrent. The point $\left(\frac{4}{3}, \frac{2}{3}\right)$ will be on the line $5x + \lambda y - 8 = 0$

$$\therefore 5\left(\frac{4}{3}\right) + \lambda\left(\frac{2}{3}\right) - 8 = 0$$

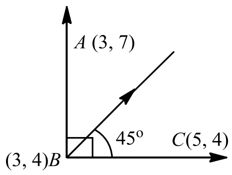
$$\Rightarrow \frac{2}{3}\lambda = 8 - \frac{20}{3} = \frac{4}{3} \Rightarrow \lambda = 2$$

65 **(a)**
The given equation are
$3x + 4y - 5 = 0$ ...(i)
and $4x - 3y - 15 = 0$ ...(ii)
Since, these lines are perpendicular to each other so $\angle QPR$ is right angle and $PQ = PR$. Hence, ΔPQR is a right angle isosceles triangle.
$\angle PQR = \angle PRQ = 45°$
Slope of $PQ = -\frac{3}{4}$ and slope of $PR = \frac{4}{3}$
Let slope of $QR = m$

$$\therefore \tan 45° = \pm \left|\frac{\frac{4}{3} - m}{1 + \frac{4}{3}m}\right|$$

$$\Rightarrow m = \frac{1}{7}, -7$$

66 **(a)**
Required line is passing through (3, 4) and having slope 1.
$\therefore$ Equation of required line is



$y - 4 = 1(x - 3)$
$\Rightarrow x - y + 1 = 0$
$\Rightarrow y = x + 1$

67 **(d)**
Let $Q(x, y)$ be the image of the point $P(4, 1)$ to the line $y - x + 1 = 0$
Then, PQ is perpendicular to $y - x + 1 = 0$

$$\therefore \frac{y + 1}{x - 4} \times 1 = -1$$

$\Rightarrow y + x = 4 + 1 = 5$ ...(i)
Also, mid point of PQ, ie, $\left(\frac{4 + x}{2}, \frac{y + 1}{2}\right)$ lies on $y - x + 1 = 0$

$\therefore \dfrac{y+1}{2} - \dfrac{(4+x)}{2} + 1 = 0$

$\Rightarrow y - x - 1 = 0$ ...(ii)

On solving Eqs. (i) and (ii), we get the required point (2, 3)

68 **(b)**

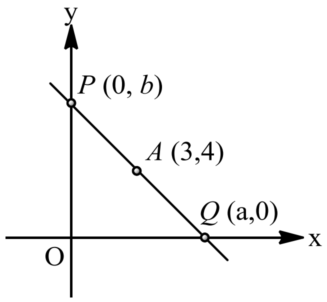
Since, A is mid point of line PQ

$\therefore 3 = \dfrac{a+0}{2} = a = 6$

and $4 = \frac{0+b}{2} \Rightarrow b = 8$

Thus, equation of line is

$\dfrac{x}{6} + \dfrac{y}{8} = 1 \Rightarrow 4x + 3y = 24$



70 **(b)**

The intersection of two curves

$ax^2 + 2hxy + by^2 + 2gx + \lambda(a'x^2 + 2h'xy + b'y^2 + 2g'x) = 0$

$\Rightarrow x^2(a + a'\lambda) + 2xy(h + h'\lambda) + y^2(b + \lambda b') + 2x(g + \lambda g') = 0$

For making homogeneous equating, $g + \lambda g' = 0$

$\Rightarrow \lambda = -\dfrac{g}{g'}$

Since, lines are perpendicular.

$\therefore$ Coefficient of x^2 + Coefficient of $y^2 = 0$

$\Rightarrow a + a'\lambda + b + b'\lambda = 0$

$\Rightarrow a + b = -(a' + b')\left(-\dfrac{g}{g'}\right)$

$\Rightarrow (a+b)g' = (a' + b')g$

71 **(c)**

The equation of line passing through the point of intersection of $x + 2y - 1 = 0$ and $2x - y - 1 = 0$ is

$(x + 2y - 1) + \lambda(2x - y - 1) = 0$

$\Rightarrow x(1 + 2\lambda) + y(2 - \lambda) - 1 - \lambda = 0$

This meets the coordinate axes at $A\left(\frac{1+\lambda}{2\lambda+1}, 0\right)$ and $B\left(0, \frac{\lambda+1}{2-\lambda}\right)$

Let (h, k) be the mid point of AB, then

$h = \dfrac{1}{2}\left(\dfrac{1+\lambda}{2\lambda+1}\right), k = \dfrac{1}{2}\left(\dfrac{\lambda+1}{2-\lambda}\right)$

On eliminating λ from the these equations, we get

$h + 3k = 10hk$

Thus, the locus of (h, k) is $x + 3y = 10xy$

72 **(c)**

On comparing the given lines with

$y = m_1x + c_1$ and $y = m_2x + c_2$, we get

$m_1 = 2$ and $c_1 = 7$

and $m_2 = 2$ and $c_2 = 5$

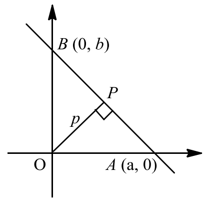
$\therefore$ Required distance $= \dfrac{|c_1 - c_2|}{\sqrt{(m)^2 + 1}}$

$= \dfrac{|7-5|}{\sqrt{(2)^2+1}} = \dfrac{2}{\sqrt{5}}$

73 **(c)**

Here the equation of AB is $\dfrac{x}{a} + \dfrac{y}{b} = 1$

From the figure, $OP \perp AB$,



$\therefore OP = \left|\dfrac{0\left(\frac{1}{a}\right) + 0\left(\frac{1}{b}\right) - 1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}}\right|$

$\Rightarrow p = \dfrac{1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2}}}$

$\Rightarrow p^2 = \dfrac{1}{\frac{1}{a^2} + \frac{1}{b^2}}$ [squaring both sides]

$\Rightarrow \dfrac{1}{p^2} = \dfrac{1}{a^2} + \dfrac{1}{b^2}$

74 **(d)**

Clearly, diagonals are perpendicular

So, $ABCD$ must be a rhombus

75 **(b)**

Given lines are concurrent

$\therefore \begin{vmatrix} 2 & -3 & k \\ 3 & -4 & -13 \\ 8 & -11 & -33 \end{vmatrix} = 0$

$\Rightarrow 2(132 - 143) + 3(-99 + 104) + k(-33 + 32) = 0$

$\Rightarrow -22 + 15 - k = 0 \Rightarrow k = -7$

76 **(a)**

The equations of the sides of the quadrilateral are given by

$l^2x^2 - m^2y^2 - n(lx + my) = 0$

and, $l^2x^2 = m^2y^2 + n(lx + my) = 0$

$\Rightarrow (lx + my)(lx - my - n) = 0$ and $(lx - mylx+my+n=0$

$\Rightarrow lx + my = 0, lx - my - n = 0, lx - my = 0, lx + my + n = 0$

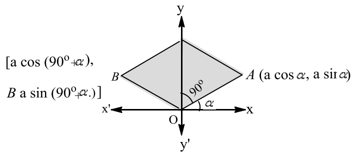
Clearly, the lines form a parallelogram whose are is

$$\left|\frac{\{0-(-n)\}\{0-n\}}{\begin{vmatrix} l & m \\ l & -m \end{vmatrix}}\right| = \frac{n^2}{2|lm|}$$

77 **(d)**

Since, line OA makes an angle α with x-axis and given $OA = a$, then coordinates of A are $(a\cos\alpha, a\sin\alpha)$. Also, $OB \perp OA$, then OB makes an angle $(90° + \alpha)$ with x-axis, then coordinates of B are $[a\cos(90° + \alpha), a\sin(90° + \alpha)]$

ie, $(-a\sin\alpha, a\cos\alpha)$



Equation of the diagonal AB not passing through the origin is

$$(y - a\sin\alpha) = \frac{a\cos\alpha - a\sin\alpha}{-a\sin\alpha - a\cos\alpha}(x - a\cos\alpha)$$

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

$$\Rightarrow y(\sin\alpha + \cos\alpha) + x(\cos\alpha - \sin\alpha)$$

$$= a\sin\alpha(\sin\alpha + \cos\alpha) - a\cos\alpha(\sin\alpha - \cos\alpha)$$

$$= a(\sin^2\alpha + \sin\alpha\cos\alpha - \cos\alpha\sin\alpha + \cos^2\alpha)$$

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

78 **(d)**

Required equation can be $4x - 3y - K = 0$

$$\therefore \left|\frac{4 \times -1 - 3 \times -4 - K}{\sqrt{4^2 + (-3)^2}}\right| = 1$$

$$\Rightarrow \frac{-4 + 12 - K}{5} = \pm 1$$

$$\Rightarrow 8 - K = \pm 5$$

$$\Rightarrow K = 3 \text{ or } K = 13$$

∴ Equation of lines are $4x - 3y - 3 = 0$ and $4x - 3y - 13 = 0$

79 **(b)**

∵ Point $P(a, b)$ lies on $3x + 2y = 13$

∴ $3a + 2b = 13$ ...(i)

and point $Q(b, a)$ is lies on $4x - y = 5$

∴ $4b - a = 5$ ...(ii)

On solving Eqs. (i) and (ii), we get $a = 3, b = 2$

Therefore, the coordinates of P and Q are (3, 2) and (2, 3)

respectively.

Now, equation of PQ is

$$y - 2 = \frac{3-2}{2-3}(x - 3) \Rightarrow x + y = 5$$

80 **(b)**

The given equation

$x^2 + kxy + y^2 - 5x - 7y + 6 = 0$ is compared with

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, we get

$$a = 1, b = 1, h = \frac{k}{2}, g = \frac{-5}{2}, f = \frac{-7}{2}, c = 6$$

This equation represents a pair of straight lines,

$$\text{if } \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} 1 & k/2 & -5/2 \\ k/2 & 1 & -7/2 \\ -5/2 & -7/2 & 6 \end{vmatrix} = 0$$

$$\Rightarrow 1\left(6 - \frac{49}{4}\right) - \frac{k}{2}\left(\frac{6k}{2} - \frac{35}{4}\right) - \frac{5}{2}\left(-\frac{7k}{4} + \frac{5}{2}\right) = 0$$

$$\Rightarrow \left(\frac{24-49}{4}\right) - \frac{k}{2}\left(\frac{12k-35}{4}\right) - \frac{5}{2}\left(\frac{-7k+10}{4}\right) = 0$$

$$\Rightarrow -50 - 12k^2 + 35k + 35k - 50 = 0$$

$$\Rightarrow -12k^2 + 70k - 100 = 0$$

$$\Rightarrow 6k^2 - 35k + 50 = 0$$

$$\Rightarrow k = \frac{10}{3}$$

81 **(b)**

Since, t_1, t_2 are the roots of the equation

$t^2 + \lambda t + 1 = 0$

$\therefore t_1 + t_2 = -\lambda, \quad t_1 t_2 = 1$

The equation of a line passing through $(at_1^2, 2at_1)$ and $(at_2^2, 2at_2)$ is

$$y - 2at_2 = \frac{2}{t_1 + t_2}(x - at_2^2)$$

$$\Rightarrow y - 2at_2 = -\frac{2}{\lambda}(x - at_2^2)$$

$$\Rightarrow \lambda y - 2a\lambda t_2 = -2x + 2at_2^2$$

$$\Rightarrow \lambda y + 2x = 2a(\lambda t_2 + t_2^2)$$

$$\Rightarrow \lambda y + 2x = 2a(-1)$$

$$\Rightarrow 2(x + a) + \lambda y = 0$$

∴ Fixed point is $(-a, 0)$

82 **(b)**

$\sqrt{3}x + y = 0$ makes an angle of 120° with OX and $\sqrt{3}x - y = 0$ makes an angle 60° with OX. So, the required line is $y - 2 = 0$

83 **(c)**

Here, $a = 2, b = 5, c = 7, h = 2, g = -2, f = -11$

To eliminate 1st degree terms origin is to be shifted to the point

$$\left(\frac{hf - bg}{ab - h^2}, \frac{gh - af}{ab - h^2}\right) = \left(\frac{-22 + 10}{10 - 4}, \frac{-4 + 22}{10 - 4}\right)$$

$$= (-2, 3)$$

84 **(a)**

If the lines given by $ax^2 + 2hxy + by^2 = 0$ are equally inclined to the lines given by $ax^2 + 2hxy + by^2 + \lambda(x^2 + y^2) = 0$, then the two pairs have same bisectors. Therefore, equations

$\frac{x^2-y^2}{a-b} = \frac{xy}{h}$ and $\frac{x^2-y^2}{(a+\lambda)-(b+\lambda)} = \frac{xy}{h}$

represent same pair of lines.
Clearly, these two equations are identical for all values of λ

85 **(a)**
Equation of the line passing through $(-4, 6)$ and $(8, 8)$ is
$y - 6 = \left(\frac{8-6}{8+4}\right)(x+4)$
$\Rightarrow y - 6 = \frac{2}{12}(x+4)$
$\Rightarrow 6y - 36 = x + 4 \Rightarrow 6y - x - 40 = 0$ ...(i)
Now, equation of any line perpendicular to the Eq. (i), is
$6x + y + \lambda = 0$ ...(ii)
This line passes through the mid point of $(-4, 6)$ and $(8, 8)$ is
$\left(\frac{-4+8}{2}, \frac{6+8}{2}\right), ie, (2, 7)$
$\therefore 6 \times 2 + 7 + \lambda = 0$
$\Rightarrow 19 + \lambda = 0 \Rightarrow \lambda = -19$
On putting $\lambda = -19$ in Eq. (ii), we get the equation of required line which is
$6x + y - 19 = 0$

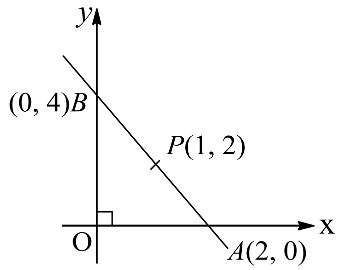
86 **(b)**
Given lines are $3x + 4y = 5, 5x + 4y = 4$ and $\lambda x + 4y = 6$. These three lines meet at point, if the point of intersection of first two lines lies on the third line
Now, point of intersection of line $3x + 4y = 5$ and $5x + 4y = 4$ is $\left(-\frac{1}{2}, \frac{13}{8}\right)$
The line $\lambda x + 4y = 6$ passes through the point $\left(-\frac{1}{2}, \frac{13}{8}\right)$
$\therefore \lambda\left(-\frac{1}{2}\right) + 4\left(\frac{13}{8}\right) = 6$
$\Rightarrow -\lambda + 13 = 12$
$\Rightarrow \lambda = 1$

87 **(c)**
Give lines are $ax + by + c = 0$ ...(i)
$x = \alpha t + \beta$ ...(ii)
and $y = \gamma t + \delta$ ...(iii)
On eliminating t, from Eqs. (ii) and (iii), we get
$\gamma x - \alpha y + \alpha\delta - \beta\gamma = 0$ ...(iv)
For parallelism condition in Eqs. (i) and (iv)
$\frac{a}{\gamma} = \frac{b}{-\alpha}$
$\Rightarrow a\alpha + b\gamma = 0$

89 **(d)**
The point of intersection of the lines given by $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ is given by
$\left(\frac{hf - bg}{ab - h^2}, \frac{gh - af}{ab - h^2}\right)$
Hence, the lines given by $2x^2 - 5xy + 2y^2 - 3x + 3y + 1 = 0$ intersect at $(1/3, -1/3)$

91 **(b)**
Equation belonging to both families will pass through two fixed points. First intersection point of lies $x + 2y = 0$ and
$3x + 2y + 1 = 0$ is $\left(-\frac{1}{2}, \frac{1}{4}\right)$ and second interception point of lines $x - 2y = 0$ and $x - y + 1 = 0$, is $(-2, -1)$
Line passing through $\left(-\frac{1}{2}, \frac{1}{4}\right)$ and $(-2, -1)$ is
$y - \frac{1}{4} = \frac{-1 - \frac{1}{4}}{-2 + \frac{1}{2}}\left(x + \frac{1}{2}\right)$
$\Rightarrow 5x - 6y + 4 = 0$

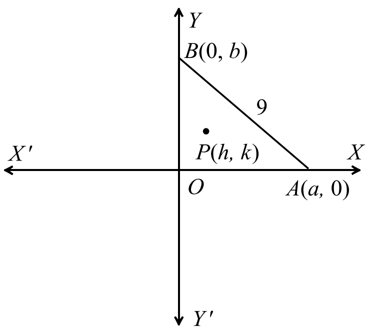
92 **(d)**
Since, $P(1, 2)$ is mid point of AB. Therefore, coordinate of A and B are $(2, 0)$ and $(0, 4)$ respectively



$\therefore$ Equation of line AB is
$y - 0 = \frac{4}{-2}(x - 2)$
$\Rightarrow 2x + y = 4$

93 **(d)**
Here, $h = \sqrt{2}$, $g = 2$, $a = 1, c = 1$, $b = 2$, $f = 2\sqrt{2}$
$\therefore$ Distance $= 2\sqrt{\frac{g^2 - ac}{a(a+b)}} = 2\sqrt{\frac{4-1}{1(1+2)}} = 2$ units

94 **(b)**
Let $P(h, k)$ be the centroid of $\Delta\, OAB$. Let the coordinates of A and B be $(a, 0)$ and $(0, b)$ respectively. then,
$h = \frac{a}{3}, k = \frac{b}{3}$



in $\Delta\, OAB$, we have

$OA^2 + OB^2 = AB^2$

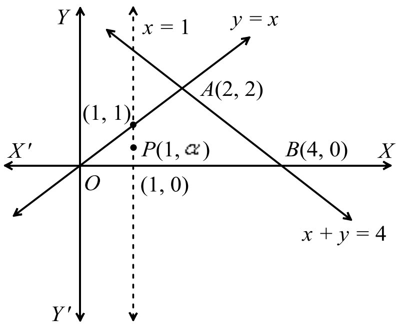
$\Rightarrow a^2 + b^2 = 9^2 \Rightarrow 9h^2 + 9k^2 = 9^2 \Rightarrow h^2 + k^2 = 9$

Hence, the locus of (h, k) is $x^2 + y^2 = 9$

95 **(b)**

It is evident from the figure that P moves on the line $x = 1$. Clearly, y-coordinate of P varies between 0 and 1

$\therefore 0 \le \alpha \le \Rightarrow \alpha \in [0, 1]$



96 **(d)**

The given equation is

$x^2(\cos^2\theta - 1) - xy\sin^2\theta + y^2\sin^2\theta = 0$

Here, $a = \cos^2\theta - 1, h = -\frac{1}{2}\sin^2\theta, b = \sin^2\theta$

$a + b = \cos^2\theta + \sin^2\theta - 1 = 1 - 1 = 0$

$\therefore$ The angle between the pair of straight lines is $\frac{\pi}{2}$.

97 **(a)**

We have,

$\Delta_1 = \frac{1}{2}\begin{vmatrix} 4 & 3 \\ 1 & 6 \end{vmatrix} = \frac{21}{2}, \Delta_2 = \frac{1}{2}\begin{vmatrix} 3 & -5 \\ 6 & 1 \end{vmatrix} = \frac{33}{2}$

$\Delta_3 = \frac{1}{2}\begin{vmatrix} -5 & -3 \\ 1 & -3 \end{vmatrix} = 9, \Delta_4 = \frac{1}{2}\begin{vmatrix} -3 & -3 \\ -3 & 0 \end{vmatrix} = -\frac{9}{2}$

and, $\Delta_5 = \frac{1}{2}\begin{vmatrix} -3 & 4 \\ 0 & 1 \end{vmatrix} = -\frac{3}{2}$

$\therefore$ Area of the pentagon

$= |\Delta_1 + \Delta_2 + \Delta_3 + \Delta_4 + \Delta_5|$

$= \left|\frac{21}{2} + \frac{33}{2} + 9 - \frac{9}{2} - \frac{3}{2}\right| = 30$ sq. units

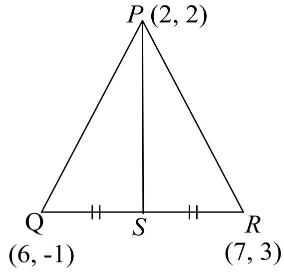
98 **(d)**

Since, S is mid point of QR

$\therefore$ Coordinate of S are

$\left(\frac{6+7}{2}, \frac{-1+3}{2}\right) = \left(\frac{13}{2}, 1\right)$

$\therefore$ Slope of $PS = \frac{2-1}{2-\frac{13}{2}} = -\frac{2}{9}$



The required equation which is

passing throught $(1, -1)$ andslope $-\frac{2}{9}$, is

$y + 1 = -\frac{2}{9}(x - 1)$

$\Rightarrow 9y + 9 = -2x + 2$

$\Rightarrow 2x + 9y + 7 = 0$

99 **(a)**

Let the equation of the line be $\frac{x}{a} + \frac{y}{b} = 1$

It passes through (2,2)

$\therefore \frac{2}{a} + \frac{2}{b} = 1 \Rightarrow 2(a + b) = ab$ ... (i)

The line encloses a triangle of area A square units with the coordinate axes

$\therefore \frac{1}{2}|a||b| = A \Rightarrow |ab| = 2A \Rightarrow ab = \pm 2A$ ... (ii)

From (i) and (ii), we get $a + b = \pm A$

The quadratic equation having a, b as its roots is

$x^2 - x(a + b) + ab = 0$ or, $x^2 \mp Ax \pm 2A = 0$

101 **(c)**

Let p be the length of the perpendicular from the vertex $(2, -1)$ to the base

$x + y = 2$, then

$p = \left|\frac{2 - 1 - 2}{\sqrt{1^2 + 1^2}}\right|$

$= \frac{1}{\sqrt{2}}$

If a be the length of the side of triangle then,

$p = a \sin 60°$

$\Rightarrow \frac{1}{\sqrt{2}} = \frac{a\sqrt{3}}{2}$

$\Rightarrow a = \sqrt{\frac{2}{3}}$

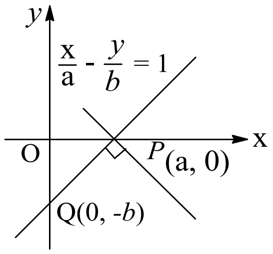
102 **(c)**

Line perpendicular to the given line $\frac{x}{a} - \frac{y}{b} = 1$ is

$\frac{1}{b}x + \frac{1}{a}y + \lambda = 0$ ...(i)

According to the question, line (i) is

Passing through the point $P(a, 0)$



$\therefore \frac{a}{b}+0+\lambda=0$

$\Rightarrow \lambda=-\frac{a}{b}$

On putting the value of λ in Eq. (i), we get

$\frac{x}{b}+\frac{y}{a}-\frac{a}{b}=0$

$\Rightarrow ax+by=a^2$

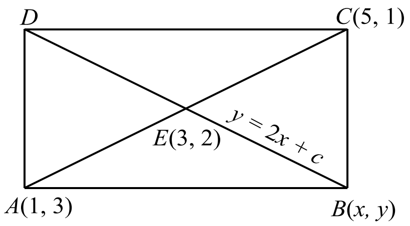
103 **(a)**

Let (x,y) be the coordinates of the vertex B. Then,

$BE=\frac{1}{2}AC$

$\Rightarrow (x-3)^2+(y-2)^2=\frac{(1-5)^2+(3-1)^2}{4}$

$\Rightarrow (x-3)^2+(y-2)^2=5$ ...(i)



Solving (i) with $y=2x-4$, we get coordinates of B and D as $(2,0)$ and $(4,4)$ respectively

104 **(a)**

The equation of a line parallel to $x+2y=4$ is

$x+2y=k$

The distance between these two lines is 3

$\therefore \frac{k}{\sqrt{1+4}}-\frac{4}{\sqrt{1+4}}=3 \Rightarrow k=4+3\sqrt{5}$

This shifted line cuts x-axis at $(k,0)$. After rotation the slope of the line is $\tan(\theta-30°)$, where

$\tan\theta=$ (slope of $x+2y=4$) $=-1/2$

Thus, the equation of the line in the new position is

$y-0=\tan(\theta-30°)(x-k)$, where $k=4+3\sqrt{5}$

106 **(a)**

On solving $3x+4y=9$ and $y=mx+1$, we get

$x=\frac{5}{3+4m}$

$\because x$ is an integer

$\therefore 3+4m=1,-1,5,-5$

$\Rightarrow m=\frac{-2}{4},\frac{-4}{4},\frac{2}{4},\frac{-8}{4}$

So, m has two integral values

108 **(b)**

Now, $h^2-ab=4^2-8(2)=16-16=0$

The required distance between the parallel straight lines

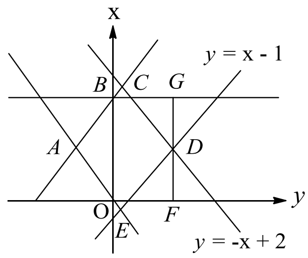
$=2\sqrt{\frac{169-120}{80}}=\frac{2\times 7}{4\sqrt{5}}=\frac{7}{2\sqrt{5}}$

109 **(c)**

Lines are $y=1, y=0$

$y=-x, y=-x+2$

$y=x+1, y=x-1$



Area of $OABCDE=$ area of $OBGF$

$=\frac{3}{2}\times 1=\frac{3}{2}$ sq unit

110 **(c)**

We have,

Coeff. Of x^2 + Coeff. Of $y^2=0$

So, lines represented by $x^2-y^2=0$ are at right angles

112 **(b)**

Since, a,b,c are in HP

$\therefore \frac{2}{b}=\frac{1}{a}+\frac{1}{c} \Rightarrow \frac{1}{a}-\frac{2}{b}+\frac{1}{c}=0$

So, straight line $\frac{x}{a}+\frac{y}{b}+\frac{1}{c}=0$ always passes through a fixed point $(1,-2)$

113 **(d)**

We have,

$x^2+y^2+2xy-8ax-8ay-9a^2=0$

$\Rightarrow (x+y)^2-8a(x+y)-9a^2=0$

$\Rightarrow (x+y-9a)(x+y+a)=0$

$\Rightarrow x+y-9a=0, x+y+a=0$

Clearly, these lines are parallel. The distance d between these lines is

$d=\frac{|a-(-9a)|}{\sqrt{1^2+1^2}}=5\sqrt{2}\,a$

114 **(b)**

Let the image of reflection of the origin with reference to the line $4x+3y-25=0$ is (h,k)

$\therefore \frac{h-0}{4}=\frac{k-0}{3}=\frac{-2(0+0-25)}{16+9}=2$

$\Rightarrow \frac{h}{4}=2 \Rightarrow h=8$

and $\frac{k}{3}=2 \Rightarrow k=6$

$\therefore$ Required point is (8, 6)

115 **(d)**

The equation of a straight line passing through the point of intersection of $x - y + 1 = 0$ and $3x + y - 5 = 0$

$(x - y + 1) + \lambda(3x + y - 5) = 0$

or $x(3\lambda + 1) + y(\lambda - 1) - (5\lambda - 1) = 0$ ...(i)

It is perpendicular to $3x + y - 5 = 0$

$\therefore -3 \times \frac{3\lambda + 1}{\lambda - 1} = -1 \Rightarrow -\frac{1}{5}$

Putting $\lambda = -\frac{1}{5}$ in (i), we get $x - 3y + 5 = 0$ as the equation of the required line

116 **(a)**

Given lines are $kx - 2y - 1 = 0$

and $6x - 4y - m = 0$

Since, these lines are coincident.

$\therefore \frac{k}{6} = \frac{-2}{-4} = \frac{-1}{-m}$

$\Rightarrow \frac{k}{6} = \frac{1}{2}$ and $\frac{1}{m} = \frac{1}{2}$

$\Rightarrow k = 3$ and $m = 2$

117 **(a)**

Clearly, $L = 0$ is the perpendicular bisector of the segment joining (−2,6) and (4,2). The equation of which is

$y - 4 = \frac{3}{2}(x - 1) \Rightarrow 3x - 2y + 5 = 0$

$\therefore L = 3x - 2y + 5$

118 **(b)**

Equation of line perpendicular to $ax + by - a^2 = 0$ is $bx - ay + \lambda = 0$ and line $ax + by - a^2 = 0$ is passes through $\left(-\frac{\lambda}{b}, 0\right)$, then

$\lambda = -ab$

$\therefore bx - ay = ab$

$\Rightarrow \frac{x}{a} - \frac{y}{b} = 1$

119 **(a)**

Let the equation of line be

$ax + by + c = 0$ ...(i)

The perpendicular distance from (1, 1), (2, 0) and (0, 2) to the line $ax + by + c = 0$ are

$p_1 = \frac{a + b + c}{\sqrt{a^2 + b^2}}, p_2 = \frac{2a + c}{\sqrt{a^2 + b^2}}, p_3 = \frac{2b + c}{\sqrt{a^2 + b^2}}$

Since, it is given that $p_1 + p_2 + p_3 = 0$

$\Rightarrow \frac{a + b + c}{\sqrt{a^2 + b^2}} + \frac{2a + c}{\sqrt{a^2 + b^2}} + \frac{2b + c}{a^2 + b^2} = 0$

$\Rightarrow 3a + 3b + 3c = 0$

$\Rightarrow a + b + c$ ...(ii)

From Eq. (ii), it is clear that the line (i) passes through (1, 1)

120 **(c)**

Equation of perpendicular diagonal to $7x - y + 8 = 0$ is $x + 7y = \lambda$, which passes through (−4, 5)

$\therefore \lambda = 31$

So, equation of another diagonal is

$x + 7y = 31$

121 **(b)**

Here, $a = 12, b = 2, h = -5, f = -\frac{5}{2}, g = \frac{11}{2}, c = k$

The given equation represents a pair of straight line, if

$abc + 2fgh - af^2 - bg^2 - ch^2 = 0$

$$\Rightarrow 12 \cdot 2 \cdot k + 2\left(-\frac{5}{2}\right)\left(\frac{11}{2}\right)(-5) - 12\left(-\frac{5}{2}\right)^2 - 2\left(\frac{11}{2}\right)^2 - k(-5)^2 = 0$$

$\Rightarrow 24k + \frac{275}{2} - \frac{150}{2} - \frac{121}{2} - 25k = 0$

$\Rightarrow -k + \frac{4}{2} = 0 \Rightarrow k = 2$

122 **(d)**

The line $x\cos\alpha + y\sin\alpha = p$ meets the coordinate axes at $A\left(\frac{p}{\cos\alpha}, 0\right)$ and $B\left(0, \frac{p}{\sin\alpha}\right)$

Let (h, k) be the coordinates of the mid point of the portion AB intercepted between the axes by the line $x\cos\alpha + y\sin\alpha = p$. Then,

$h. = \frac{\frac{p}{\cos\alpha} + 0}{2}, k = \frac{0 + \frac{p}{\sin\alpha}}{2}$

$\Rightarrow \cos\alpha = \frac{p}{2h}, \sin\alpha = \frac{p}{2k}$

$\Rightarrow \cos^2\alpha + \sin^2\alpha = \frac{p^2}{4h^2} + \frac{p^2}{4k^2}$

$\Rightarrow \frac{p^2}{4h^2} + \frac{p^2}{4k^2} = 1$

Hence, the locus of (h, k) is

$\frac{p^2}{4x^2} + \frac{p^2}{4y^2} = 1$ or, $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$

123 **(a)**

Let the vertices of the triangle be $O(0,0), A(8,0)$ and $B(4,6)$. The equation of an altitude through O and perpendicular to AB is $y = 2/3\, x$ and the equation of an altitude through $A(8,0)$ and perpendicular to OB is $3y = -2x + 16$. These altitudes intersect at (4,8/3)

124 **(b)**

Here, the given triangle is a right angled triangle at the vertex (2, −1/2). Hence, the orthocentre is at (2, −1/2)

125 **(c)**

Let $Q(x, y)$ be the image of the point $P(3,8)$ in the line $x + 3y = 7$. Then, PQ is perpendicular to the given line. So,

$$\frac{y_1-8}{x_1-3}\times-\frac{1}{3}=-1\Rightarrow 3x_1-y_1=1 \quad \dots\text{(i)}$$

Also, the mid-point of PQ i.e. $\left(\frac{x_1+3}{2},\frac{y_1+8}{2}\right)$ lies on $x+3y=7$

$\therefore x_1+3+3y_1+24=14\Rightarrow x_1+3y_1+13=0$ ...(ii)

Solving (i) and (ii), we get $x_1=-1, y_1=-4$

Hence required point is $(-1,-4)$

ALITER The image (α,β) of a point (x_1,y_1) in the $ax+by+x=0$ is given by

$$\frac{\alpha-x_1}{a}=\frac{\beta-y_1}{b}=\frac{-2(ax_1+by_1+c)}{a^2+b^2}$$

So, the image of (3,8) in the line $x+3y-7=0$ is given by

$$\frac{x-3}{1}=\frac{y-8}{3}=\frac{-2(3+24-7)}{(1+9)}$$

$\Rightarrow x-3=-4$ and $y-8=-12\Rightarrow x=-1, y=-4$

126 **(c)**

The given equation of the family of lines is

$x\sec^2\theta+y\tan^2\theta-2=0$

$$\Rightarrow (x+y)\tan^2\theta+(x-2)=0$$

Clearly, it represents a family of lines passing through the intersection of the lines $x-2=0$ and $x+y=0$ i.e. $(2,-2)$

127 **(a)**

There are four possible straight lines which are equally inclined to both the axes *ie*, in Ist, IInd, IIIrd and IVth quadrant

128 **(c)**

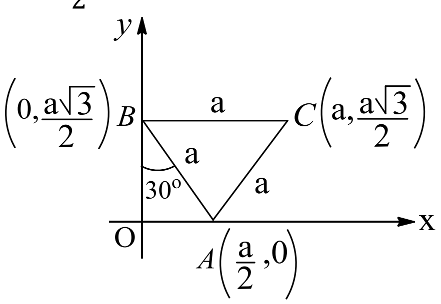
Equation of bisectors of lines $xy=0$ are $y=\pm x$. Put $y=\pm x$ in $my^2+(1-m^2)xy-mx^2=0$, we get

$mx^2\pm(1-m^2)x^2-mx^2=0$

$\Rightarrow (1-m^2)x^2=0 \Rightarrow m=\pm1$

129 **(c)**

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



$$\Rightarrow y-\frac{a\sqrt{3}}{2}=-\sqrt{3}x+a\sqrt{3}$$

$$\Rightarrow y+\sqrt{3}x=\frac{3a\sqrt{3}}{2}$$

130 **(a)**

Given equation

$x^2+pxy+y^2-5x-7y+6=0$

Will represent a pair of straight lines, if

$$1\cdot1\cdot6+2\left(-\frac{7}{2}\right)\left(\frac{-5}{2}\right)\left(\frac{p}{2}\right)-1\left(\frac{-7}{2}\right)^2-1\left(\frac{-5}{2}\right)^2-6\left(\frac{p}{2}\right)^2=0$$

$$\Rightarrow 6+\frac{35p}{4}-\frac{49}{4}-\frac{25}{4}-\frac{6p^2}{4}=0$$

$\Rightarrow 35p-50-6p^2=0$

$\Rightarrow (2p-5)(3p-10)=0$

$\Rightarrow p=\frac{5}{2},\frac{10}{3}$

131 **(a)**

The equation of a line concurrent with the lines $4x+3y-7=0$ and $8x+5y-1=0$

$(4x+3y-7)+\lambda(8x+5y-1)=0$

$\Rightarrow x(4+8\lambda)+y(3+5\lambda)-7-\lambda=0$

The gradient of this line is $-\frac{3}{2}$. Therefore,

$$-\frac{8\lambda+4}{5\lambda+3}=-\frac{3}{2}\Rightarrow 16\lambda+8=15\lambda+9 \Rightarrow \lambda=1$$

So, the required line is $12x+8y-8=0$ or, $3x+2y-2=0$

132 **(b)**

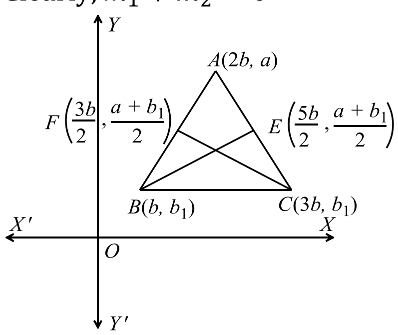
Let $B(b,b_1), C(3b,b_1)$ be coordinates of end-points of base BC of ΔABC and $A(2b,a)$ be the coordinates of the vertex A. BE and CF are two medians

Now,

$$m_1=\text{Slope of } BE=\frac{\frac{a+b_1}{2}-b_1}{\frac{5b}{2}-b}=\frac{a-b_1}{3b}$$

$$\text{and, } m_2=\text{Slope of } CF=\frac{\frac{a+b_1}{2}-b_1}{\frac{5b}{2}-b}=\frac{a-b_1}{3b}$$

Clearly, $m_1+m_2=0$



133 **(d)**

$\because$ Line perpendicular to $3x+y=3$ is $x-3y=\lambda$

Also, it passes through (2, 2)

$\therefore 2-6=\lambda \Rightarrow \lambda=-4$

$\therefore$ Equation of line is

$x-3y=-4$ ...(i)

Hence, y-intercept $= \frac{-4}{-3} = \frac{4}{3}$

134 **(a)**

$\because a_1a_2 + b_1b_2 = 3 \times (-12) + (-4)(-5)$

$= -36 + 20 = -16 \leq 0$

$\therefore$ Obtuse angle bisector is

$$\frac{3x-4y+7}{\sqrt{3^2+(-4)^2}} = -\frac{-12x-5y+2}{\sqrt{(-12)^2+(-5)^2}}$$

$\Rightarrow 13(3x-4y+7) = -5(-12x-5y+2)$

$\Rightarrow 21x + 77y - 101 = 0$

135 **(c)**

Since, the lines $2x + 3y + 5 = 0$ and $2x + 3y - \frac{11}{2} = 0$ are parallel

Let required line is $2x + 3y + \lambda = 0$

$$\therefore \lambda = \frac{5 - \frac{11}{2}}{2} = -\frac{1}{4}$$

So, $8x + 12y - 1 = 0$ is the required line

136 **(a)**

Points (3,5) and $(\sin\theta, \cos\theta)$ will lie on the same side of $x + y - 1 = 0$, if

$(\sin\theta + \cos\theta - 1)(3 + 5 - 1) > 0$

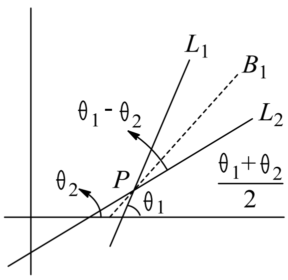
$\Rightarrow \sin\theta + \cos\theta > 1$

$\Rightarrow \sin(\frac{\pi}{4} + \theta) > \frac{1}{\sqrt{2}} \Rightarrow \frac{\pi}{4} < \frac{\pi}{4} + \theta < \frac{3\pi}{4} \Rightarrow 0 < \theta < \frac{\pi}{2}$

137 **(d)**

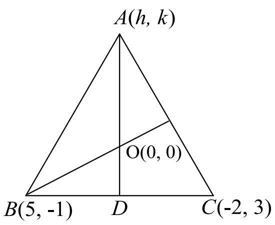
$$y - y_1 = \tan\left(\frac{\theta_1 + \theta_2}{2}\right)(x - x_1)$$

and $y - y_1 = -\cot\left(\frac{\theta_1 + \theta_2}{2}\right)(x - x_1)$



138 **(b)**

Let the coordinates of the third vertex A be (h, k)



Also, $AD \perp BC$

$$\therefore \frac{k-0}{h-0} \times \left(\frac{4}{-7}\right) = -1$$

$\Rightarrow 7h = 4k$ ...(i)

and $OB \perp AC$

$$\Rightarrow \frac{k-3}{h+2} \times \left(-\frac{1}{5}\right) = -1$$

$\Rightarrow 5h - k + 13 = 0$ ...(ii)

On solving Eqs. (i) and (ii), we get

Hence, the coordinates of third vertex are $(-4, -7)$

139 **(b)**

Here, $a = 12, b = 12, c = 2, g = 5, f = \frac{11}{2}, h = \frac{25}{2}$

Now, product of perpendicular distance from the origin

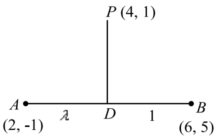
$$= \frac{c}{\sqrt{(a+b)^2 + 4h^2}} = \frac{2}{\sqrt{0 + 4\left(\frac{25}{2}\right)^2}} = \frac{2}{25}$$

140 **(b)**

Let $P(4, 1)$and $PD \perp AB$.

Equation of AB is $3x - 2y - 8 = 0$

$\therefore$ Equation of PD is $2x + 3y - 11 = 0$



Let line AB is divided by PD in the ratio λ:1, then intersecting point

$D\left(\frac{6\lambda+2}{\lambda+1}, \frac{5\lambda-1}{\lambda+1}\right)$ lies on $2x + 3y - 11 = 0$

$$\Rightarrow 2\left(\frac{6\lambda+2}{\lambda+1}\right) + 3\left(\frac{5\lambda-1}{\lambda+1}\right) - 11 = 0$$

$\Rightarrow 16\lambda - 10 = 0$

$\Rightarrow \lambda : 1 = 5 : 8$

141 **(a)**

Let $A(x_1, y_1), B(x_2, y_2)$ be two fixed points and let $P(h, k)$ be a variable point such that $\angle APB = \frac{\pi}{2}$.

Then,

Slope of AP $\times$ Slope of $BP = -1$

$$\Rightarrow \frac{k-y_1}{h-x_1} \times \frac{k-y_2}{h-x_2} = -1$$

$\Rightarrow (h-x_1)(h-x_2) + (k-y_1)(k-y_2) = 0$

Hence, the locus of (h, k) is

$(x-x_1)(x-x_2) + (y-y_1)(y-y_2) = 0$, which is circle having AB as diameter

143 **(a)**

Given lines are concurrent, then

$$\begin{vmatrix} 1 & 3 & -9 \\ 4 & b & -2 \\ 2 & -1 & -4 \end{vmatrix} = 0$$

$\Rightarrow 1(-4b-2) - 3(-16+4) - 9(-4-2b) = 0$

$\Rightarrow 14b + 70 = 0 \Rightarrow b = -5$

144 **(b)**

Lines $x + 2y - 1 = 0$ and $2x - y + 3 = 0$ intersect at $(-1,1)$. Since the given lines are concurrent. Therefore, $(-1,1)$ lies on $y = mx$, which implies that $m=-1$

145 **(d)**

Given equation of line is

$kx^2-2xy-y^2-2x+2y=0$

On comparing with standard equation, we get

$a=k\,,b=-1,h=-1,g=-1,f=1,c=0$

It represent a pair of lines, if

$$k(-1)(0)+2(1)(-1)(-1)-k(1)^2-(-1)(-1)^2 -0(-1)^2=0$$

$\Rightarrow\ 0+2-k+1=0\ \Rightarrow\ k=3$

146 **(d)**

Let the required line be

$y-2=m(x-1)$

This line meets the lines $3x+4y-12=0$ and $3x+4y-24=0$ at $A\left(\frac{4+4\,m}{3+4\,m},\frac{6+9\,m}{3+4\,m}\right)$ and $B\left(\frac{16+4\,m}{3+4\,m},\frac{6+21\,m}{3+4\,m}\right)$ respectively.

It is given that $AB=3$

$\therefore\left(\frac{12}{3+4\,m}\right)^2+\left(\frac{12}{3+4\,m}\right)^2m^2=9\ \Rightarrow m=\frac{7}{24}$

So, the required line is

$y-2=\frac{7}{24}(x-1)\ \Rightarrow 7\,x-24\,y+41=0$

148 **(c)**

Given line AB makes 0 intercepts on x-axis and y-aixs or $(x_1,y_1)\equiv(0,0)$ and the line is perpendicular to line $CD, 3x+4y+6=0$

$\therefore$ Slope of required line which is perpendicular $3x+4y+6=0$ is $4/3$

$\therefore$ Required line which is passing through origin and having slope $4/3$, is

$y-0=\frac{4}{3}(x-0)$

$\Rightarrow\ 4x-3y=0$

150 **(a)**

$\because$ The slope of line $x+y=1$ is -1

$\therefore$ It makes an angle of $135°$ with x-axis

The equation of line passing through (1, 1) and making an angle of $135°$ is

$\frac{x-1}{\cos 135°}=\frac{y-1}{\sin 135°}=r$

$\Rightarrow\frac{x-1}{-\frac{1}{\sqrt{2}}}=\frac{y-1}{\frac{1}{\sqrt{2}}}=r$

Coordinates of any point on this line are

$\left(1-\frac{r}{\sqrt{2}},1+\frac{r}{\sqrt{2}}\right)$

If this point lies on $2x-3y=4$, then

$2\left(1-\frac{r}{\sqrt{2}}\right)-3\left(1+\frac{r}{\sqrt{2}}\right)=4$

$\Rightarrow 2-\frac{2r}{\sqrt{2}}-3-\frac{3r}{\sqrt{2}}=4$

$\Rightarrow\frac{5r}{\sqrt{2}}=-5$

$\Rightarrow r=\sqrt{2}$ (neglect negative sign)

151 **(c)**

Given equation of lines are

$5x+3y-7=0$ ...(i)

and $15x+9y+14=0$ or $5x+3y+\frac{14}{3}=0$ ...(ii)

$\because$ Lines (i) and (ii) are parallel and c_1 and c_2 are of opposite signs, therefore these lines are on opposite sides of the origin

So, the distance between them is

$$\left|\frac{c_1}{\sqrt{a_1^2+b_1^2}}\right|+\left|\frac{c_2}{\sqrt{a_2^2+b_2^2}}\right|$$

$$=\left|-\frac{7}{\sqrt{5^2+3^2}}\right|+\left|\frac{14}{3\sqrt{5^2+3^2}}\right|$$

$$=\left|-\frac{7}{\sqrt{34}}\right|+\left|\frac{14}{3\sqrt{34}}\right|=\frac{35}{3\sqrt{34}}$$

152 **(a)**

Angle between the lines $ax^2+2hxy+by^2=0$ is

$\tan\theta=\left|\frac{2\sqrt{h^2-ab}}{a+b}\right|$

For $x^2+2xy\sec\theta+y^2=0$

$h=\sec\theta\,,a=b=1$

$\therefore\ \tan\phi=\left|\frac{2\sqrt{\sec^2\theta-1}}{1+1}\right|$

$=\frac{2\tan\theta}{2}=\tan\theta$

$\therefore$ Angle between $x^2+2xy\sec\theta+y^2=0$ is θ

153 **(b)**

Lines $3\,x+4\,y+2=0$ and $3\,x+4\,y+5=0$ are on the same side of the origin. The distance d_1 between these lines is given by

$d_1=\left|\frac{2-5}{\sqrt{3^2+4^2}}\right|=\frac{3}{5}$

Lines $3\,x+4\,y+2=0$ and $3\,x+4\,y-5=0$ are on the opposite sides of the origin. The distance d_2 between these lines is given by

$d_2=\left|\frac{2+5}{\sqrt{3^2+4^2}}\right|=\frac{7}{5}$

Thus, $3\,x+4\,y=0$ divides the distance between $3x+4y+5=0$ and $3\,x+4\,y-5=0$ in the ratio $d_1:d_2$ i.e. $3:7$

155 **(c)**

Equation of lines which make equal intercept on axes, is

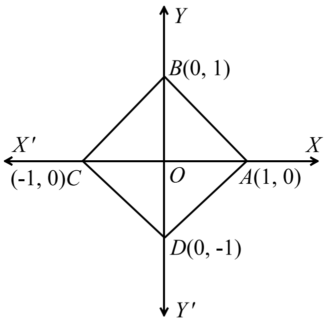
$x\pm y=a$ ...(i)

Since, it passes through (2, 4).

$\therefore\ 2\pm4=a\ \Rightarrow\ a=-2,6$

$\therefore$ Equation of the required lines are
$x - y = -2$ or $x + y = 6$

156 **(b)**
The given curve is
$|x| + |y| = 1$
$\Rightarrow x + y = 1$ for $x \geq 0, y \geq 0$
$-x - y = 1$ for $x < 0, y < 0$
$x - y = 1$ for $x \geq 0, y < 0$
$-x + y = 1$ for $x \leq 0, y \geq 0$
These lines represent a square as shown in Fig.S.5 such that the length of each side is $\sqrt{2}$ units
$\therefore$ Area enclosed $= \sqrt{2} \times \sqrt{2} = 2$ sq. units



157 **(a)**
The bisectors of the angles between the lines in new position are same as the bisectors of the angles between their old positions. Therefore, the required equation is
$$\frac{x^2 - y^2}{1 - (-1)} = \frac{xy}{-p}$$
$\Rightarrow px^2 - py^2 = -2\,xy$
$\Rightarrow px^2 + 2\,xy - py^2 = 0$

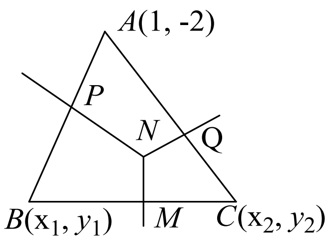
158 **(a)**
The equation of a line passing through the intersection of the lines $x - \sqrt{3}\,y + \sqrt{3} - 1 = 0$ and $x + y - 2 = 0$, is
$\left(x - \sqrt{3}\,y + \sqrt{3} - 1\right) + \lambda(x + y - 2) = 0$
$\Rightarrow x(1 + \lambda + y\left(\lambda - \sqrt{3}\right) + \sqrt{3} - 1 - 2\,\lambda = 0$ ...(i)
The line $x - \sqrt{3}\,y + \sqrt{3} - 1 = 0$ makes 30° angle with x-axis. Therefore, the line making an angle of 15° with this line will make 45° angle with x-axis. Therefore, Its slope is 1
$$\Rightarrow -\left(\frac{1 + \lambda}{\lambda - \sqrt{3}}\right) = 1 \Rightarrow \lambda = \frac{\sqrt{3} - 1}{2}$$
Putting the value of λ in (i), we get $x - y = 0$

159 **(c)**
The equation of straight line equally inclined to the axes is $\frac{x}{a} + \frac{y}{a} = 1 \Rightarrow x + y = a$. Since, it is equidistant from the points $(1, -2)$ and $(3, 4)$, so perpendicular distances from these points on the line will be equal.
$$\Rightarrow \left|\frac{1 - 2 - a}{\sqrt{1^2 + 1^2}}\right| = \left|\frac{3 + 4 - a}{\sqrt{1^2 + 1^2}}\right|$$
$$\Rightarrow \frac{1 + a}{\sqrt{2}} = \frac{7 - a}{\sqrt{2}}$$
$\Rightarrow 2a = 6 \Rightarrow a = 3$
$\therefore$ Equation is $x + y - 3 = 0$
But, given equation is $ax + by + c = 0$
$\therefore a = 1, b = 1, c = -3$

160 **(d)**
Given equation can be rewritten as
$x^2 + 4xy - 3xy - 12y^2 = 0$
Factorising the above equation, we get
$(x + 4y)(x - 3y) = 0$
Therefore, separate equations for the lines are
$x + 4y = 0$ and $x - 3y = 0$

161 **(b)**
The desired point is the foot of the perpendicular from the origin on the line $3x - 4y = 25$. The equation of a line passing through the origin and perpendicular to $3x - 4y = 25$ is $4x + 3y = 0$. Solving these two equations we get $x = 3, y = -4$. Hence, the nearest point on the line from the origin is $(3, -4)$.
ALITER The desired point is the foot of the perpendicular drawn from the origin $(0, 0)$ on the line $3x - 4y = 25$ and its coordinates are given by
$$\frac{x - 0}{3} = \frac{y - 0}{-4} = -\frac{(3 \times 0 - 4 \times 0 - 25)}{3^2 + (-4)^2} \Rightarrow x = 3, y = -4$$

162 **(d)**
Let $B(x_1, y_1)$ and $C(x_2, y_2)$ are the vertices of a triangle
$P\left(\frac{x_1 + 1}{2}, \frac{y_1 - 2}{2}\right)$ lies on the line $x - y + 5 = 0$
$$\therefore \frac{x_1 + 1}{2} - \frac{y_1 - 2}{2} = -5$$
$\Rightarrow x_1 - y_1 = -13$ ...(i)



Also, $PN \perp AB$
$$\therefore \frac{y_1 + 2}{x_1 - 1} = -1$$
$\Rightarrow y_1 + 2 = -x_1 + 1$
$\Rightarrow x_1 + y_1 = -1$ ...(ii)
On solving Eqs. (i) and (ii), we get
$x_1 = -7$ and $y_1 = 6$
$\therefore$ Coordinates of B are $(-7, 6)$

Similarly, the coordinates of C are $\left(\frac{11}{5}, \frac{2}{5}\right)$

$\therefore$ Equation of BC is

$$(y-6) = \frac{\frac{2}{5}-6}{\frac{11}{5}+7}(x+7)$$

$\Rightarrow 14x + 23y - 40 = 0$

163 **(c)**

$\because a_1a_2 + b_1b_2 = 3(12) + (-4)(5) = 16 > 0$

$\therefore$ The equation of bisector of the acute angle between these lines are

$$\frac{3x-4y+7}{\sqrt{3^2+4^2}} = \frac{12x+5y-2}{\sqrt{12^2+5^2}}$$

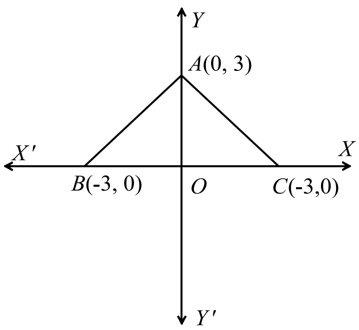
$\Rightarrow\ 13(3x-4y+7) = 5(12x+5y-2)$

$\Rightarrow\ 21x + 77y - 101 = 0$

164 **(c)**

In $\Delta\, OAC$, we have

$OA = OC \Rightarrow \angle OAC = \frac{\pi}{4}$



In $\Delta\, OAB$, we have

$OA = OB \Rightarrow \angle OAB = \frac{\pi}{4}$

Thus, we have $\angle BAC = \frac{\pi}{4} + \frac{\pi}{4} = \frac{\pi}{2}$

Hence, $\Delta\, BAC$ is a right angled triangle.

Consequently its orthocentre is at $A(0,3)$

165 **(b)**

We know that the coordinates of the foot of the perpendicular drawn from (x_1, y_1) on the line $ax + by + c = 0$ are given by

$$\frac{x-x_1}{a} = \frac{y-y_1}{b} = -\frac{ax_1+by_1+c}{a^2+b^2}$$

So, the required coordinates are given by

$$\frac{x-2}{1} = \frac{y-4}{1} = -\frac{2+4-1}{1+1} \Rightarrow x = -\frac{1}{2}, y = \frac{3}{2}$$

166 **(a)**

Given points $(\sin\theta, \cos\theta)$ and $(3, 2)$ and a line $x + y - 1 = 0$ ..(i)

Since, (3,2) lies on Eq. (i)

$3 + 2 - 1 > 0$

And $(\sin\theta, \cos\theta)$ lies in Eq. (i)

$\therefore \sin\theta + \cos\theta - 1 > 0$

$\Rightarrow\ \sin\theta + \cos\theta > 1$

$\Rightarrow\ \sqrt{2}\left[\sin\left(\theta + \frac{\pi}{4}\right)\right] > 1$

$\Rightarrow\ \sin\left(\theta + \frac{\pi}{4}\right) > \frac{1}{\sqrt{2}} = \sin\left(\frac{\pi}{4}\right)$

$\Rightarrow\ 0 < \theta < \frac{\pi}{2}$

167 **(d)**

Let the equation of line is

$y = mx + c$

$\because m = \tan 30° = \frac{1}{\sqrt{3}}$ and $c = -2$

($\because$ It is intercepted in negative axis of y with an angle 30°)

$\therefore$ The equation of required line is

$y = \frac{x}{\sqrt{3}} - 2$

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

168 **(a)**

It is given that the lines represented by the given equation are equidistant from the origin

$\therefore \left|\frac{n_1}{\sqrt{l_1^2+m_1^2}}\right| = \left|\frac{n_2}{\sqrt{l_2^2+m_2^2}}\right|$ [See Example 45]

$\Rightarrow n_1^2(l_2^2+m_2^2) = n_2^2(l_1^2+m_1^2)$

$\Rightarrow (n_1l_2+n_2l_1)(n_1l_2-n_2l_1)$

$= (n_2m_1+n_1m_2)(n_2m_1-n_1 - m_2)$

$\Rightarrow 4g^2(n_1l_2-n_2l_1) = 4f^2(n_2m_1-n_1m_2)^2$ [See Example 45]

$\Rightarrow g^2[(n_1l_2+n_2l_1)^2 - 4\, l_1l_2n_1n_2]$

$= f^2[(n_1m_2+n_2m_1)^2 - 4m_1m_2n_1n_2]$

$\Rightarrow g^2[4g^2-4ac] = f^2[4f^2-4bc]$

$\Rightarrow f^4 - g^4 = c(bf^2 - ag^2)$

169 **(a)**

Given equation of the line is $x^2 - 4xy + 3y^2 = 0$

$\therefore\ \ m_1 + m_2 = \frac{4}{3}$ and $m_1m_2 = \frac{1}{3}$

On solving these equations, we get

$m_1 = 1, m_2 = \frac{1}{3}$

Let the lines parallel to given line are

$y = m_1x + c_1$ and $y = m_2x + c_2$

$\therefore y = \frac{1}{3}x + c_1$ and $y = x + c_2$

Also, these lines passes through the point $(3, -2)$

$\therefore\ -2 = \frac{1}{3} \times 3 + c_1$

$\Rightarrow c_1 = -3$

and $-2 = 1 \times 3 + c_2$

$\Rightarrow c_2 = -5$

$\therefore$ Required equation of pair of lines is

$(3y - x + 9)(y - x + 5) = 0$

$\Rightarrow\ x^2 + 3y^2 - 4xy - 14x + 24y + 45 = 0$

170 **(c)**

The point of intersection of lines $x - 2y$ and

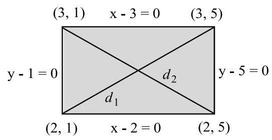
$x + 3y = 2$ is
$\left(\frac{7}{5}, \frac{1}{5}\right)$
Since, required line is parallel to $3x + 4y = 0$.
Therefore, the slope of required line $= -\frac{3}{4}$
$\therefore$ Equation of required line whose slope is $\frac{-3}{4}$ and passes through $\left(\frac{7}{5}, \frac{1}{5}\right)$ is
$$y - \frac{1}{5} = -\frac{3}{4}\left(x - \frac{7}{5}\right)$$
$\Rightarrow 20y - 4 = -15x + 21 \Rightarrow 3x + 4y - 5 = 0$

171 **(b)**
The equation of lines are
$$y - y_1 = \frac{m_1 \pm m_2}{1 \mp m_1 m_2}(x - x_1)$$
Since, $m_1 = 1$, $m_2 = 1$
$$\therefore y - 4 = \frac{1 \pm 1}{1 \mp 1}(x - 3)$$
$\Rightarrow y = 4$ or $x = 3$
Hence, the lines which make the triangle are
$x - y = 2, x = 3$ and $y = 4$
The intersection points of these lines are (6, 4), (3, 1) and (3, 4)
$\therefore$ Area of triangle
$$= \frac{1}{2}|6(1-4) + 3(4-4) + 3(4-1)|$$
$$= \frac{1}{2}|6(-3) + 3(0) + 3(3)|$$
$$= \frac{1}{2}|-18 + 0 + 9| = \frac{9}{2} \text{ sq unit}$$

172 **(c)**
Given, $x^2 - 2xy - xy + 2y^2 = 0$
$\Rightarrow (x - 2y)(x - y) = 0$
$\Rightarrow x = 2y$ ...(i)
$x = y$ ...(ii)
Also, $x + y + 1 = 0$ ...(iii)
On solving Eq. (i) and (ii) and (iii), we get
$A\left(-\frac{2}{3}, -\frac{1}{3}\right), B\left(-\frac{1}{2}, -\frac{1}{2}\right), C(0, 0)$
$$\therefore \text{Area of } \Delta ABC = \frac{1}{2}\begin{vmatrix} -\frac{2}{3} & -\frac{1}{3} & 1 \\ -\frac{1}{2} & -\frac{1}{2} & 1 \\ 0 & 0 & 1 \end{vmatrix}$$
$$= \frac{1}{2}\left[\frac{1}{3} - \frac{1}{6}\right]$$
$$= \frac{1}{2}\left[\frac{1}{6}\right] = \frac{1}{12}$$

173 **(c)**
The given line is $x \tan \alpha - y + c = 0$
or $x \sin \alpha - y \cos \alpha + c \cos \alpha = 0$
$\therefore$ Length of perpendicular from $(a \cos \alpha, a \sin \alpha)$
$$= \frac{a \cos \alpha \sin \alpha - a \sin \alpha \cos \alpha + c \cos \alpha}{\sqrt{\sin^2 \alpha + \cos^2 \alpha}}$$
$$= \frac{c \cos \alpha}{1} = c \cos \alpha$$

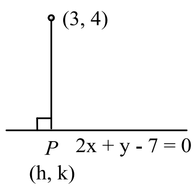
174 **(c)**
Equation of diagonal d_1 is $y - 1 = \frac{5-1}{3-2}(x - 2)$
$\Rightarrow y = 4x - 7$



Equation of diagonal d_2 is $y - 1 = \frac{5-2}{2-3}(x - 3)$
$\Rightarrow 4x + y = 13$
So, equations are, $4x + y = 13$ and $y = 4x - 7$

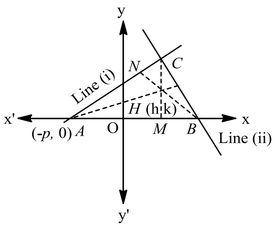
175 **(d)**
Let the line passing through the intersection of two lines is
$(x + y - 2) + \lambda(x - y) = 0$
or $(1 + \lambda)x + (1 - \lambda)y - 2 = 0$ ...(i)
Which is parallel to $x + 2y = 5$
$$\therefore -\frac{(1+\lambda)}{(1-\lambda)} = -\frac{1}{2}$$
$$\Rightarrow 2 + 2\lambda = 1 - \lambda \Rightarrow \lambda = -\frac{1}{3}$$
On putting $\lambda = -\frac{1}{3}$ in Eq. (i), we get
$$\frac{2}{3}x + \frac{4}{3}y - 2 = 0 \Rightarrow x + 2y = 3$$

176 **(a)**
Here, $(x_1, y_1) = (3, 4)$ and $ax + by + c = 2x + y - 7 = 0$
$\therefore a = 2, \quad b = 1, \quad c = -7$
Let, (h, k) be the coordinates of the foot.
Then,
$$\frac{h-3}{2} = \frac{k-4}{1} = \frac{-(2 \times 3 + 1 \times 4 - 7)}{2^2 + 1^2} = \frac{-3}{5}$$
$$\Rightarrow \frac{h-3}{2} = \frac{-3}{5} \text{ and } \frac{k-4}{1} = \frac{-3}{5}$$
$$\Rightarrow h = \frac{-6}{5} + 3 \text{ and } k = \frac{-3}{5} + 4$$
$$\Rightarrow h = \frac{9}{5} \text{ and } k = \frac{17}{5}$$



177 **(c)**
Each side of square is 5 unit, distance between given lines is 5 unit,
$$ie, \left|\frac{k_1 - k_2}{5}\right| = 5 \Rightarrow |k_1 - k_2| = 25$$

178 **(d)**
Given, lines are $(1+p)x-py+p(1+p)=0$ ...(i)
and $(1+q)x-qy+q(1+q)=0$....(ii)
and $y=0$
on solving Eqs. (i) and (ii), we get
$C\{pq,(1+p)(1+q)\}$
∴ Equation of altitude CM passing through C and perpendicular to AB is
$x=pq$ ...(iii)
∵ Slope of line (ii)is $\left(\frac{1+q}{q}\right)$
∵ Slope of altitude BN (as shown in figure)is $\frac{-q}{1+q}$



∴ Equation of BN is $y-0=\frac{-q}{1+q}(x+p)$
$\Rightarrow\ y=\frac{-q}{(1+q)}(x+p)$ ... (iv)
Let orthocentre of triangle be $H(h,k)$, which is the point of intersection of Eqs. (iii) and (iv).
∴ On solving Eqs. (iii) and (iv), we get
$x=pq$ and $y=-pq$
$\Rightarrow h=pq$ and $k=-pq$
∴ $h+k=0$
∴ Locus of $H(h,k)$ is $x+y=0$.

179 **(b)**
Let the coordinates of the point P which divides the line joining (1,0) and $(2\cos\theta, 2\sin\theta)$ in the ratio 2 : 3 be (h,k). Then,
$h=\frac{4\cos\theta+3}{5}$ and $k=\frac{4\sin\theta}{5}$
$\Rightarrow \cos\theta=\frac{5h-3}{4}$ and $\sin\theta=\frac{5k}{4}$
$\Rightarrow \left(\frac{5h-3}{4}\right)^2+\left(\frac{5k}{4}\right)^2=1$
$\Rightarrow (5h-3)^2+(5k)^2=16$
Hence, the locus of (h, k) is
$(5x-3)^2+(5y)^2=16$, which is a circle

180 **(b)**
$\sqrt{3}x+y=0$ makes an angle of 120° with OX and $\sqrt{3}x-y=0$ makes an angle 60° with OX. So, the required line is $y-2=0$

181 **(b)**
∵ Slope of given line $y=x$ is 1
∴ Slope of required line which is perpendicular to given line is -1
Thus, the equation of required line passing through (3, 2) and slope -1, is
$y-2=-1(x-3)$
$\Rightarrow\ x+y=5$

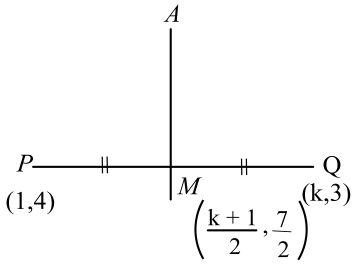
182 **(a)**
Here, $a=2, b=3, h=5/2, g=0, f=7/2, c=4$
$$\therefore \tan(\tan^{-1}m)=\frac{2\sqrt{h^2-ab}}{a+b}=\frac{2\sqrt{\sqrt{25/4}-6}}{5}$$
$=1/5$
$\Rightarrow m=1/5$

183 **(d)**
Given, $Ax^2+2Hxy+By^2=0$ ...(i)
and $ax+by+c=0$ ...(ii)
Since, triangle is equilateral, then angle between the two lines is 60°
Angle between pair of lines is given by
$$\cos 60°=\frac{A+B}{\sqrt{(A-B)^2+4H^2}}$$
$$\Rightarrow\ \frac{A+B}{\sqrt{(A-B)^2+4H^2}}=\frac{1}{2}$$
$\Rightarrow\ (A-B)^2+4H^2=4(A+B)^2$
$\Rightarrow\ 4(A^2+B^2+2AB)-(A^2+B^2-2AB)=4H^2$
$\Rightarrow\ 3A^2+10AB+3B^2=4H^2$
$\Rightarrow\ (3A+B)(A+3B)=4H^2$

184 **(b)**
Required equation of line is
$y-a\sin^3\theta=\frac{\mathrm{cosec}\theta}{\sec\theta}(x-a\cos^3\theta)$
$\Rightarrow y-a\sin^3\theta=\frac{\cos\theta}{\sin\theta}(x-a\cos^3\theta)$
$\Rightarrow y\sin\theta-a\sin^4\theta=x\cos\theta-a\cos^4\theta$
$\Rightarrow x\cos\theta-y\sin\theta+a\sin^4\theta-a\cos^4\theta=0$
$\Rightarrow x\cos\theta-\ y\sin\theta+a\cos 2\theta=0$

185 **(d)**
Required distance
$=\left|\frac{65+39}{\sqrt{25+144}}\right|$ $\left[\because d=\left|\frac{|c_1-c_2|}{\sqrt{a^2+b^2}}\right|\right]$
$=\left|\frac{104}{13}\right|=8$ unit

186 **(a)**
Since, slope of $PQ=\frac{4-3}{1-k}=\frac{1}{1-k}$
∴ Slope of $AM=(k-1)$



$\therefore$ Equation of AM is

$y-\frac{7}{2}=(k-1)\left[x-\left(\frac{k+1}{2}\right)\right]$

For y-intercept, $x=0, y=-4$

$-4-\frac{7}{2}=-(k-1)\left(\frac{k+1}{2}\right)$

$\Rightarrow \frac{15}{2}=\frac{k^2-1}{2} \Rightarrow k^2-1=15 \Rightarrow k=\pm 4$

187 **(d)**

The equation of a line passing though (2,2) and perpendicular to $3x+y=3$ is

$y-2=1/3\,(x-2) \Rightarrow x-3y+4=0$

Putting $x=0$ in this equation, we obtain $y=4/3$

Hence, y-intercet $=4/3$

188 **(a)**

Since the diagonals of a rectangle bisect each other.

Therefore, BD passes through $\left(\frac{1+5}{2},\frac{3+1}{2}\right)$ i.e. (3,2)

The slope of BD is 2. So, its equation is

$y-2=2(x-3) \Rightarrow 2x-y-4=0$

189 **(c)**

The given equation of pair of lines is $2x^2-xy-y^2=0$

This can be rewritten as $(2x+y)(x-y)=0$

So, the equation of required pair is

$(2x+y+\lambda_1)(x-y+\lambda_2)=0$

Where, $2x+y+\lambda_1=0$ and $x-y+\lambda_2=0$

These passes through (1, 0)

$\therefore\ \lambda_1=-2, \lambda_2=-1$

Thus, the required equation of pair of line is

$(2x+y-2)(x-y-1)=0$

$\Rightarrow\ 2x^2-xy-y^2-4x+y+2=0$

190 **(c)**

On adding the given three equations, we get

$ax+by+bx+cy+cx+ay=a+b+c$

$\Rightarrow\ (a+b+c)x+(a+b+c)y=(a+b+c)$

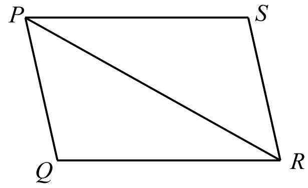
On comparing with $0x+0y=0$ for collinearity, we get

$a+b+c=0$

191 **(b)**

Since $PQRS$ is a parallelogram with an area which is twice the area of $\Delta\, PQR$

$\therefore$ Area $PQRS = 2\times\frac{1}{2}\begin{vmatrix}2 & 1 & 1\\ 4 & -1 & 1\\ 3 & 2 & 1\end{vmatrix}=4$



192 **(a)**

Let $P(3,-4)$ be the foot of the perpendicular from the origin O on the required line.

Then, the slope of $OP=\frac{-4-0}{3-0}=\frac{-4}{3}$

Therefore, the slope of the required line is $\frac{3}{4}$

Hence, its equation is $y+4=\frac{3}{4}(x-3)$

$\Rightarrow\ 3x-4y-9-16=0$

$\Rightarrow\ 3x-4y=25$

193 **(a)**

Le the equation of the pair of perpendicular lines be $x^2+\lambda\,xy-y^2=0$. Then,

$ay^4+b\,xy^3+cx^2\,y^2+dx^3\,y+ex^4$

$=(x^2+\lambda\,xy-y^2)(ex^2+\mu\,xy-ay^2)$

On equating the coefficients of like terms, we get

$b=-a\,\lambda-\mu, c=-\alpha-e+\lambda\,\mu$ and $d=\mu+e\,\lambda$

Now, $a\,\lambda+\mu+b=0$

and, $e\,\lambda+\mu-d=0$

$\Rightarrow \frac{\lambda}{-(b+d)}=\frac{\mu}{ad+be}=\frac{1}{a-e}$

$\Rightarrow \lambda=-\frac{b+d}{a-e}$ and $\mu=\frac{ad+be}{a-e}$

Substituting these values in $c=-a-e+\lambda\,\mu$, we get

$c+a+e=-\frac{(b+d)(ad+be)}{(a-e)^2}$

$\Rightarrow (c+a+e)(a-e)^2+(b+d)(ad+be)=0$

194 **(c)**

Let $A(a,0)$ and $B(0,b)$ be variable points on x and y-axes respectively such that

$AB=\lambda \Rightarrow a^2+b^2=\lambda^2$

Let $P(h,k)$ be the mid-point of AB. Then,

$a=2h, b=2k \Rightarrow 4h^2+4k^2=\lambda^2$

Hence, the locus of (h,k) is $4x^2+4y^2=\lambda^2$, which represents a circle

195 **(d)**

Let $C(2a,\lambda)$ be the third vertex,

Clearly, $AC=\lambda$

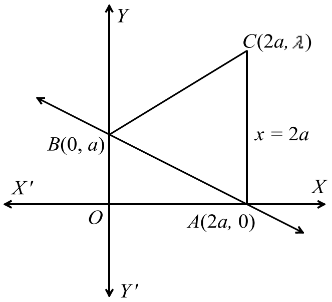
$\therefore BC=AC \Rightarrow \sqrt{4a^2+(\lambda-a)^2}=\lambda \Rightarrow \lambda=\frac{5a}{2}$

Thus, the coordinates of C are $(2a, 5a/2)$

Hence, the equation of BC is

$$y - a = \frac{5a/2 - a}{2a - 0}(x - 0)$$

$$\Rightarrow y - a = \frac{3}{4}x \Rightarrow 3x - 4y + 4a = 0$$



196 **(b)**

We know that equation of pair of straight line passing through the origin and perpendicular to $ax^2 + 2hxy + by^2 = 0$ is

$bx^2 - 2hxy + ay^2 = 0$

∴ Required equation of pair of straight line is

$2x^2 - 3xy + 2y^2 = 0$

197 **(b)**

The mid point of (1,3) and (5,1) i.e. (3,2) lies on

$y = 2x + c$

$\therefore 2 = 6 + c \Rightarrow c = 4$

198 **(c)**

For the greatest distance, both points lie on a straight line.

∴ Required equation of line is

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

$\Rightarrow x + 2y = 5$

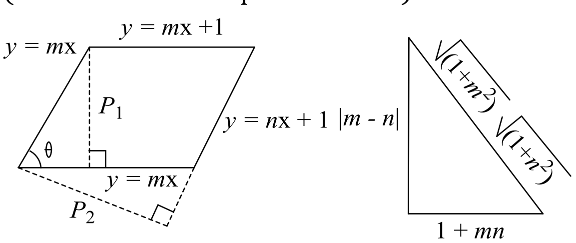
200 **(d)**

If p_1 and p_2 be the distance between parallel sides and θ be the angle between adjacent sides, then

Required area $= p_1 p_2$ cosec θ

Where, $p_1 = \frac{1}{\sqrt{(1 + m^2)}}, p_2 = \frac{1}{\sqrt{(1 + n^2)}}$

(distance between parallel lines)



and $\tan\theta = \frac{|m - n|}{|1 + mn|}$

∴ Required area

$$= \frac{1}{\sqrt{(1 + m^2)\sqrt{(1 + n^2)}}} \cdot \frac{\sqrt{(1 + m^2)}\sqrt{(1 + n^2)}}{|m - n|}$$

$$= \frac{1}{|m - n|}$$

201 **(a)**

The equation of the family of lines is

$(\lambda + \mu)x + (2\lambda + \mu)y = \lambda + 2\mu$

$\Rightarrow \lambda(x + 2y - 1) + \mu(x + y - 2) = 0$

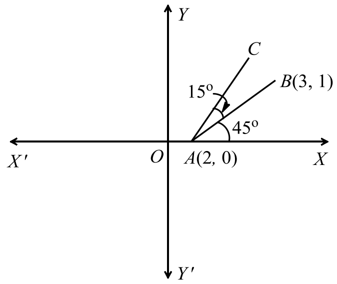
Clearly, it represents a family of lines passing through the intersection of the lines $x + 2y - 1 = 0$ and $x + y - 2 = 0$ i.e. $(3, -1)$

202 **(a)**

We have,

Slope of $AB = \frac{1-0}{3-2} = 1 \Rightarrow \angle BAX = \frac{\pi}{4}$

But, $\angle BAC = 15°$. Therefore, $\angle CAX = 60°$



So, the equation of AC is

$y - 0 = \tan 60°(x - 2)$

$\Rightarrow y = \sqrt{3}x - 2\sqrt{3} \Rightarrow \sqrt{3}x - y = 2\sqrt{3}$

203 **(c)**

The sides of the triangle are $y = 1$ and the pair of lines $x^2 + 7xy + 2y^2 = 0$

Clearly, one vertex is (0, 0) and the y-coordinates of each of the other two vertices is 1.

On putting $y = 1$ in the second equation, we get

$x^2 + 7x + 2 = 0$

If x_1 and x_2 are the roots of this equation, then

$x_1 + x_2 = -7$

$$\therefore \text{Centroid}, G = \left(\frac{0 + x_1 + x_2}{3}, \frac{0 + 1 + 1}{3}\right)$$

$$= \left(-\frac{7}{3}, \frac{2}{3}\right)$$

204 **(c)**

Let equation of line parallel to $3x - y = 7$ be $3x - y = \lambda$.

The passes through (1, 2)

$\therefore 3 - 2 = \lambda \Rightarrow \lambda = 1$

∴ Line is $3x - y = 1$

The point of intersection of $x + y + 5 = 0$ and $3x - y = 1$ is $(-1, -4)$

∴ Distance between (1, 2) and $(-1, -4)$

$= \sqrt{(2)^2 + (6)^2} = \sqrt{40}$

206 **(a)**

Here, $a = 1, b = 4, g = \frac{3}{2}, f = 3, h = 2$ and $c = -4$

Then, required distance $= 2\sqrt{\frac{\frac{9}{4} + 4}{5}}$

$= \frac{2\sqrt{25}}{2\sqrt{5}} = \frac{5}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \sqrt{5}$

207 **(d)**

Equation of pair straight lines is $xy - x - y + 1 = 0$

$\Rightarrow (x-1)(y-1) = 0$

$\Rightarrow x - 1 = 0$ or $y - 1 = 0$

The intersection points of $x - 1, y - 1 = 0$ is (1, 1)

$\because$ Lines $x - 1 = 0, y - 1 = 0$ and $ax + 2y - 3 = 0$ are concurrent

$\therefore$ The intersecting points of first two lines lies on the third line $ax + 2y - 3 = 0$

$\therefore a + 2 - 3 = 0 \Rightarrow a = 1$

208 **(a)**

Any point on $x + y = 4$ is $(t, 4 - t)$. It is at a unit distance from the line $4x + 3y - 10 = 0$

$\therefore \left|\frac{4\,t + 3(4 - t) - 10}{\sqrt{4^2 + 3^2}}\right| = 1 \Rightarrow t = 3, -7$

Hence, the required points are (3, 1) and $(-7, 11)$

209 **(c)**

The equation of bisector of acute angle formed between the lines $4x - 3y + 7 = 0$ at $3x - 4y + 14 = 0$, is

$\frac{4x - 3y + 7}{\sqrt{16 + 9}}$

$= -\frac{3x - 4y + 14}{\sqrt{16 + 9}}$

$\Rightarrow \ 7x - 7y + 21 = 0$

$\Rightarrow \ x - y + 3 = 0$

210 **(d)**

The equations will represent the same line if

$\frac{b^3 - c^3}{b - c} = \frac{c^3 - a^3}{c - a} = \frac{a^3 - b^3}{a - b}$

$\Rightarrow b^2 + bc + c^2 = c^2 + ca + a^2 = a^2 + ab + b^2$

$\Rightarrow b^2 + bc + c^2 = c^2 + ca + a^2$ and $b^2 + bc + c^2 = a^2 + ab + b^2$

$\Rightarrow b^2 - a^2 + bc - ca = 0$ and $c^2 - a^2 + bc - ab = 0$

$\Rightarrow (b - a)(b + a + c) = 0$ and $(c - a)(c + a + b = 0$

$\Rightarrow a + b + c = 0$

211 **(a)**

Given lines are $x + y = 4$ and $2x + 2y = 5$ or $x + y = \frac{5}{2}$

The distance between two parallel lines,

$d = \frac{4 - \frac{5}{2}}{\sqrt{1^2 + 1^2}} = \frac{3}{2\sqrt{2}} = \frac{3\sqrt{2}}{4} > 1$

Hence, no point lies in it.

213 **(a)**

Given lines are concurrent, if

$\begin{vmatrix} 2 & 1 & -1 \\ a & 3 & -3 \\ 3 & 2 & -2 \end{vmatrix} = 0$

This is true for all values of a, because C_2 and C_3 are identical

214 **(b)**

Let (h, k) be the centroid of the triangle having vertices $A(\cos\alpha, -\cos\alpha)$ and $C(1,2)$. Then,

$h = \frac{\cos\alpha + \sin\alpha + 1}{3}$ and $k = \frac{\sin\alpha - \cos\alpha + 2}{3}$

$\Rightarrow 3\,h - 1 = \cos\alpha + \sin\alpha$ and $3\,k - 2 = \sin\alpha - \cos\alpha$

$\Rightarrow (3\,h - 1)^2 + (3\,k - 2)^2 = 2$ [Squaring and adding]

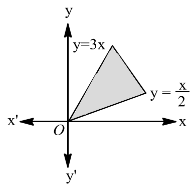
$\Rightarrow 9(h^2 + k^2) - 6\,h - 12\,k + 3 = 0$

$\Rightarrow 3(h^2 + k^2) - 2\,h - 4k + 1 = 0$

Hence, the locus of (h, k) is $3(x^2 + y^2) - 2\,x - 4\,y + 1 = 0$

215 **(b)**

The graph of equations $x - 2y = 0$ and $3x - y = 0$ is as shown in the figure. Since, given point (a, a^2) lies in the shaded region.



Then, $a^2 - \frac{a}{2} > 0$

and $a^2 - 3a < 0$

$\Rightarrow \ a \in (-\infty, 0) \cup \left(\frac{1}{2}, \infty\right)$

and $a \in (0, 3)$

$\Rightarrow \ a \in \left(\frac{1}{2}, 3\right)$

216 **(d)**

The two pairs of lines are

$ax^2 + 2hxy - ay^2 = 0$ ...(i)

$hx^2 - 2axy - hy^2 = 0$ ...(ii)

Clearly, these two equations represent two pairs of lines such that the lines in each pair are mutually perpendicular.

The combined equation of the bisectors of the angles between the lines given in (i) is

$\frac{x^2 - y^2}{a + a} = \frac{xy}{h} \Rightarrow hx^2 - 2axy - hy^2 = 0$

Clearly it is same as (ii).

Thus, each pair bisects the angle between the other pair.

Also, lines of one pair are equally inclined to the lines of the other pair

217 **(a)**

$\because$ Line $ax+by+c=0$ passes through $(1,-2)$

$\therefore\ a-2b+c=0$

$\Rightarrow\ 2b=a+c$

$\Rightarrow\ a,b,c$ are in AP.

218 **(d)**

The diagonal through B passes through the mid-point of AC. The coordinates of the mid point of AC are

$$\left(\frac{\sqrt{3}+1}{2},\frac{\sqrt{3}+3}{2}\right)$$

$\therefore$ equation of the diagonal through B is

$$y-2=\frac{\left(\frac{\sqrt{3}+3}{2}\right)-2}{\left(\frac{\sqrt{3}+1}{2}\right)-(\sqrt{3}+1)}(x-\sqrt{3}-1)$$

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

219 **(c)**

Since, the given three lines are concurrent, then

$$\begin{vmatrix}4 & 3 & -1\\ 1 & -1 & 5\\ k & 5 & -3\end{vmatrix}=0$$

$\Rightarrow\ 4(3-25)-3(-3-5k)-1(5+k)=0$

$\Rightarrow\ -88+9+15k-5-k=0$

$\Rightarrow\ 14k=84\ \Rightarrow\ k=6$

220 **(b)**

On comparing the given equation with

$ax^2+2hxy+by^2=0$, we get

$a=1, 2h=2h$ and $b=2$

Let the slope of the lines are m_1 and m_2.

$\therefore m_1:m_2=1:2$

Let $m_1=m$ and $m_2=2m$

$\therefore m_1+m_2=-\frac{2h}{2}\Rightarrow m+2m=-h\ \Rightarrow\ h=-3m$ ...(i)

and $m_1m_2=\frac{a}{b}\ \Rightarrow\ m\cdot 2m=\frac{1}{2}\Rightarrow m=\pm\frac{1}{2}$ ...(ii)

From Eqs. (i) and (ii), we get

$$h=\pm\frac{3}{2}$$

221 **(c)**

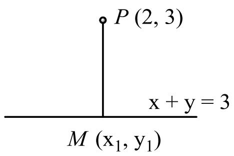
Let the coordinate of M are (x_1,y_1)

Since, the line PM is perpendicular to the given line $x+y=3$

$$\therefore\ \frac{y_1-3}{x_1-2}\times(-1)=-1$$

$\Rightarrow\ y_1-3=x_1-2$

$\Rightarrow\ x_1-y_1+1=0$ ...(i)



and also the point lies on the given line.

$\therefore\ x_1+y_1-3=0$ ...(ii)

On solving Eqs. (i) and (ii), we get

$x_1=1,\qquad y_1=2$

$\therefore$ The coordinates of M are (1, 2).

222 **(b)**

The equation of line in new position is

$y-0=\tan 15°\,(x-2)$

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

$\Rightarrow\ (2-\sqrt{3})x-y-4+2\sqrt{3}=0$

223 **(d)**

Here $a=1, h=1, f=-4a,\ g=-4a, c=-9a$

Now, required distance

$$=\left|2\sqrt{\frac{f^2-bc}{b(b+a)}}\right|$$

$$=\left|2\sqrt{\frac{16a^2+9a^2}{1(1+1)}}\right|$$

$$=\left|2\sqrt{\frac{25a^2}{2}}\right|=\frac{5a}{\sqrt{2}}\cdot 2$$

$=5\sqrt{2}a$

224 **(c)**

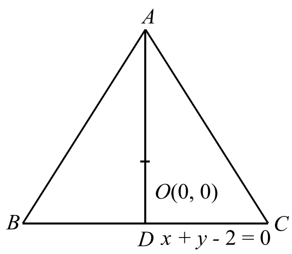
Let ABC be the equilateral triangle with centroid $O(0,0)$ and sides BC as $x+y-2=0$.

$$\therefore OD=\left|\frac{0+0-2}{\sqrt{1^2+1^2}}\right|=\sqrt{2}\Rightarrow OA=2\sqrt{2}$$

Since AD is perpendicular to BC. Therefore,

Slope of $AD=1$

$\Rightarrow AD$ makes 45° with X-axis



Clearly, A lies on OA at a distance of $2\sqrt{2}$ units from O. So, its coordinates are given by

$$\frac{x-0}{\cos\pi/4}=\frac{y-0}{\sin\pi/4}=\pm 2\sqrt{2}\ \Rightarrow x=\pm 2, y=\pm 2$$

But, O and A lie on the same side of $x+y-2=0$

Hence, the coordinates of A are $(-2,-2)$

225 **(c)**

The intersection point of lines $x-2y=1$ and $x+3y=2$ is

$$\left(\frac{7}{5},\frac{1}{5}\right)$$

Since, required is parallel to $3x+4y=0$

Therefore, the slope of required line $= -\frac{3}{4}$

$\therefore$ Equation of required line which passes through $\left(\frac{7}{5}, \frac{1}{5}\right)$

and having slope $-\frac{3}{4}$, is

$$y - \frac{1}{5} = \frac{-3}{4}\left(x - \frac{7}{5}\right)$$

$$\Rightarrow \frac{3x}{4} + y = \frac{21}{20} + \frac{1}{5}$$

$$\Rightarrow \frac{3x+4y}{4} = \frac{21+4}{20}$$

$$\Rightarrow 3x + 4y = 5$$

$$\Rightarrow 3x + 4y - 5 = 0$$

226 **(b)**

Required ratio is given by

$$-\frac{3 \times 1 + 3 - 9}{3 \times 2 + 7 - 9}$$

$$= \frac{3}{4}\ ie, 3:4 \text{ internally}$$

227 **(d)**

The lines $4x - 7y + 10 = 0$ and $7x + 4y - 15 = 0$ are perpendicular and their point of intersection is (1,2).

Hence, the orthocentre is at (1,2)

228 **(b)**

Since the distance between the parallel lines $lx + my + n = 0$ and $lx + my + n' = 0$ is same as the distance between parallel lines $mx + ly + n = 0$ and $mx + ly + n' = 0$.

Therefore, the parallelogram is a rhombus.

Also, the diagonals of a rhombus are at right angles. Therefore, the required angle is a right angle.

229 **(a)**

Vertices are interception points of line

$x + y = 2\sqrt{2}$ ...(i)

with $y = x\tan(105°)$ or $y = x\tan(165°)$

(lines through centroid)

$y = -x\tan 75°$ ...(ii)

$y = -x\tan 15°$ ...(iii)

For the interception point of Eqs. (i) and (ii)

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

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

$$\Rightarrow x = -\frac{2\sqrt{2}(1-\sqrt{3})}{(1+\sqrt{3})(1-\sqrt{3})}$$

$$\Rightarrow x = \sqrt{2} - \sqrt{6}$$

$$\therefore y = -(\sqrt{2}-\sqrt{6})(2+\sqrt{3})$$

$$= -(2\sqrt{2} + \sqrt{6} - 2\sqrt{6} - 3\sqrt{2}$$

$$= \sqrt{2} + \sqrt{6}$$

and its image about $y = x$ is $(\sqrt{2}+\sqrt{6}, \sqrt{2}-\sqrt{6})$

230 **(a)**

It is given that the lines $ax + 2y + 1 = 0, bx + 3y + 1 = 0$ and $cx + 4y + 1 = 0$ are concurrent

$$\therefore \begin{vmatrix} a & 2 & 1 \\ b & 3 & 1 \\ c & 4 & 1 \end{vmatrix} = 0$$

$\Rightarrow -a + 2b - c = 0 \Rightarrow 2b = a + c \Rightarrow a, b, c$ are in A.P.

231 **(b)**

Let (h, k) be the centroid of the triangle whose vertices are $(a\cos t, a\sin t), (b\sin t, -b\cos t)$ and $(1,0)$. Then,

$3h = a\cos\ t + b\sin t + 1$ and $3k = a\sin t - b\cos t$

$$\Rightarrow (3h-1)^2 + (3k)^2 = a^2 + b^2$$

Hence, the locus of (h, k) is $(3x-1)^2 + (3y)^2 = a^2 + b^2$

234 **(c)**

The equation representing the bisectors of the angles between the lines given by $ax^2 + 2hxy + by^2 = 0$ is

$$\frac{x^2 - y^2}{a-b} = \frac{xy}{h}$$

$\Rightarrow hx^2 - (a-b)xy - hy^2 = 0$ ...(i)

The combined equation of the bisectors of the angles between these lines is

$$\frac{x^2 - y^2}{h+h} = \frac{xy}{-\frac{(a-b)}{2}} \Rightarrow (a-b)(x^2-y^2) + 4hxy = 0$$

235 **(a)**

Given, $\sqrt{3}\sin\theta + 2\cos\theta = \frac{4}{r}$ ... (i)

Any line perpendicular to Eq.(i) is

$$\Rightarrow \sqrt{3}\cos\theta - 2\sin\theta = \frac{k}{r}$$

It passes through $\left(-1, \frac{\pi}{2}\right)$, then

$$\sqrt{3}\cos\frac{\pi}{2} - 2\sin\frac{\pi}{2} = \frac{k}{-1}$$

$$-2 = \frac{k}{-1} \Rightarrow k = 2$$

Thus, the equation is

$$\sqrt{3}\cos\theta - 2\sin\theta = \frac{2}{r}$$

$$\Rightarrow \sqrt{3}r\cos\theta - 2r\sin\theta = 2$$

236 **(b)**

$$P = \left|\frac{a(4-3+4) + b(2+6-3)}{\sqrt{(2a+b)^2 + (a-2b)^2}}\right| = \sqrt{10}$$

$$\Rightarrow 25(a+b)^2 = 10(5a^2 + 5b^2)$$

$$\Rightarrow 25(a-b)^2 = 0 \Rightarrow a = b$$

Only one line which is $3x - y + 1 = 0$

237 **(b)**

Let $\left(t, \frac{5-2t}{11}\right)$ be a point on the line $2x + 11y = 5$

Then,

$$p_1 = \left|\frac{24t + 7\left(\frac{5-2t}{11}\right) - 20}{\sqrt{24^2 + 7^2}}\right| = \frac{|50t - 37|}{55}$$

and,

$$p_2 = \left|\frac{4t - 3\left(\frac{5-2t}{11}\right) - 2}{\sqrt{4^2 + (-3)^2}}\right| = \frac{|50t - 37|}{55}$$

Clearly, we have $p_1 = p_2$

ALITER Clearly, $2x + 11y = 5$ is the angle bisector of the two lines. Therefore, $p_1 = p_2$

238 **(c)**

The equation of lines are $\pm x \pm y = 0$. Now, we take the lines $x + y = 0$ and $x - y = 0$.

$\therefore$ The equation of bisector of the angles between these lines are

$$\frac{x + y}{\sqrt{1 + 1}} = \pm \frac{x - y}{\sqrt{1 + 1}}$$

$\Rightarrow x + y = \pm(x - y)$

Taking positive sign, $x + y = x - y \Rightarrow y = 0$

Taking negative sign, $x + y = -(x - y) \Rightarrow x = 0$

239 **(c)**

Given pair of lines are

$x^2 - 3xy + 2y^2 = 0$

and $x^2 - 3xy + 2y^2 + x - 2 = 0$

$\therefore\ (x - 2y)(x - y) = 0$

and $(x - 2y + 2)(x - y - 1) = 0$

$\Rightarrow x - 2y = 0, x - y = 0$ and $x - 2y + 2 = 0, x - y - 1 = 0$

Since, the lines $x - 2y = 0, x - 2y + 2 = 0$ and $x - y = 0\ , x - y - 1 = 0$ are parallel.

Also, angle between $x - 2y = 0$ and $x - y = 0$ is not $90°$

$\therefore$ It is a parallelogram.

240 **(b)**

Let a and b the intercepts made by the straight line on the axes

Given that, $a + b = \frac{ab}{2}$

$\Rightarrow \frac{2a + 2b}{ab} = 1 \Rightarrow \frac{2}{a} + \frac{2}{b} = 1$

On comparing with $\frac{x}{a} + \frac{y}{b} = 1$, we get

$x = 2, y = 2$

$\therefore$ Required point is (2, 2)

So, the straight line passes through the point (2, 2)

241 **(d)**

Let the equation of the line be $\frac{x}{a} + \frac{y}{b} = 1$. This cuts the coordinates axes at $A(a, 0)$ and $B(0, b)$

The coordinates of the mid-point of the intercept AB between the axes are $(a/2, b/2)$

$\therefore \frac{a}{2} = 1, \frac{b}{2} = 2 \Rightarrow a = 2, b = 4$

Hence, the equation of the line is $\frac{x}{2} + \frac{y}{4} = 1$ or,

$2x + y = 4$

242 **(b)**

We know that the coordinates of the incentre of triangle formed by the points

$O(0,0)$ $A(a, 0)$ and $B(0, b)$ are

$$\left(\frac{ab}{a + b + \sqrt{a^2 + b^2}}, \frac{ab}{a + b + \sqrt{a^2 + b^2}}\right)$$

Here, $a = 4$ and $b = 3$

So, the Coordinates are $(12/12, 12/12) = (1,1)$

243 **(a)**

To make the given curves $x^2 + y^2 = 4$ and $x + y = a$ homogeneous.

$$x^2 + y^2 - 4\left(\frac{x + y}{a}\right)^2 = 0$$

$\Rightarrow\ a^2(x^2 + y^2) - 4(x^2 + y^2 + 2xy) = 0$

$\Rightarrow\ x^2(a^2 - 4) + y^2(a^2 - 4) - 8xy = 0$

Since, this is a perpendicular pair of straight lines.

$\therefore\ a^2 - 4 + a^2 - 4 = 0$

$\Rightarrow\ a^2 = 4\ \Rightarrow\ a = \pm 2$

Hence, required set of a is $\{-2, 2\}$.

244 **(b)**

Equation of bisector between the lines

$x^2 - 2pxy - y^2 = 0$ is

$$\frac{x^2 - y^2}{1 - (-1)} = \frac{xy}{-p}$$

$$\Rightarrow\ x^2 + \frac{2xy}{p} - y^2 = 0$$

Above lines will be same as the $x^2 - 2qxy - y^2 = 0$.

$\therefore\ \frac{1}{p} = -q$

$\Rightarrow\ pq = -1$

245 **(d)**

Since the diagonals of a rhombus bisect each other at right angle. Therefore, BD passes through (3,4) and is perpendicular to AC. So, its equation is

$y - 4 = -1(x - 3) \Rightarrow x + y - 7 = 0$

247 **(c)**

Slope of given line is $\frac{1}{\sqrt{3}}$, it's angle from positive x-axis is $30°$. Now, lines making an angle $30°$ from it are either x-axis ($ie, y = 0$) or makes and angle $60°$ with positive x-axis $\left(ie, y = \sqrt{3}x + \lambda\right)$

248 **(d)**

Let the slopes be m, m^2

$\therefore m + m^2 = \frac{-2h}{b}$ and $mm^2 = \frac{a}{b}$

$\Rightarrow m^3 = \left(\frac{a}{b}\right)$

Now, $\quad m(1+m) = \frac{-2h}{b}$

On cubing both sides, we get

$m^3[1 + m^3 + 3m(1+m)] = -\frac{8h^3}{b^3}$

$\Rightarrow \frac{a}{b}\left[1 + \frac{a}{b} + 3\left(\frac{-2h}{b}\right)\right] = \frac{-8h^3}{b^3}$

$\Rightarrow \frac{b+a}{b} - \frac{6h}{b} = \frac{-8h^3}{ab^2}$

$\Rightarrow b + a + \frac{8h^3}{ab} = 6h$

$\Rightarrow \frac{b+a}{h} + \frac{8h^2}{ab} = 6$

250 **(d)**

The equation of line BC is $x + y + 4 = 0$. Therefore, equation of a line parallel to BC is $x + y + k = 0$. This is at a distance $1/2$ from the origin

$\therefore \left|\frac{k}{\sqrt{2}}\right| = \frac{1}{2} \Rightarrow k = \pm\frac{1}{\sqrt{2}}$

Since BC and the required line are on the same side of the origin. Therefore, $k = \pm\frac{1}{\sqrt{2}}$

Hence, the equation of the required lines is

$x + y + \frac{1}{\sqrt{2}} = 0$

251 **(b)**

Slope of the given lines are

$m_1 = \frac{2+2}{3-1} = 2$ and $m_2 = -\frac{1}{2}$

Now, $\quad m_1 \times m_2 = 2 \times \frac{-1}{2} = -1$

$\therefore$ Lines are perpendicular, so angle is $\frac{\pi}{2}$

252 **(c)**

Given equation of curve is

$y^2 - x^2 + 2x - 1 = 0$

Here, $a = -1, b = 1, c = -1, h = 0, g = 1, f = 0$

$\therefore \; \Delta = abc + 2fgh - af^2 - bg^2 - ch^2$

$= (-1)(1)(-1) + 2(0)1(0) - 0 - 1 - 0$

$= 1 - 1 = 0$

$\therefore$ Given equation is equation of pair of straight lines.

253 **(c)**

Let the points be $A(3,-4)$ and $B(5,2)$ and mid point of $AB = (4,-1)$

It is given that the bisecting line intersect the coordinate axes in the ratio $2:1$

$\therefore$ Point of coordinate axes are $(2k, 0)$ and $(0, k)$.

The equation of line passing through the above point is

$y - 0 = \frac{k-0}{0-2k}(x - 2k)$

$\Rightarrow \; y = -\frac{1}{2}(x - 2k) \quad$ ...(i)

Since, it passing through the mid point of AB ie, $(4,-1)$

$\therefore \; -1 = -\frac{1}{2}(4 - 2k) \; \Rightarrow \; k = 1$

On putting the value of k in Eq. (i), we get

$y = -\frac{1}{2}(x - 2) \; \Rightarrow \; x + 2y = 2$

254 **(d)**

Let the coordinates of the third vertex C be (h, k).

Then, Area of $ABC = 20$ sq. units

$\Rightarrow \frac{1}{2}\begin{vmatrix} h & k & 1 \\ -5 & 0 & 1 \\ 3 & 0 & 1 \end{vmatrix} = \pm 20 \Rightarrow k = \pm 5 \quad$ ... (i)

Since, (h, k) lies on $x - y = 2$ Therefore,

$h - k = 2 \quad$ ... (ii)

Solving (i) and (ii), we find that the coordinates of the third vertex are $(-3,-5)$ or, $(7,5)$

255 **(c)**

Given lines are $ax + by + c = 0$ ...(i)

and a, b, c satisfy the relation

$3a + 2b + 4c = 0$ ...(ii)

Only option (c) satisfy both condition.

$\because a \cdot \frac{3}{4} + b \cdot \frac{1}{2} + c = 0$

$\Rightarrow 3a + 2b + 4c = 0$

256 **(a)**

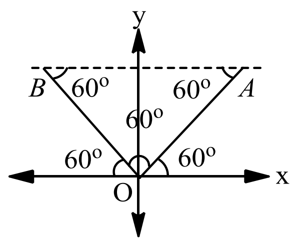
Here, $a_1 = 1, b_1 = -\sqrt{3}, a_2 = \sqrt{3}, b_2 = 1$

Now, $a_1a_2 + b_1b_2 = 1 \cdot \sqrt{3} + (-\sqrt{3}) \cdot 1 = 0$

$\therefore$ Lines are perpendicular, ie, $\theta = 90°$

257 **(a)**

Equation of OA is $y = \sqrt{3}x$. Equation of OB is $y = -\sqrt{3}x$ and equation of AB is $y = 1$



Clearly, from figure ΔOAB is an equilateral triangle.

258 **(a)**

The point of intersection of the lines $3x + y + 1 = 0$ and $2x - y + 3 = 0$ $\left(-\frac{4}{5}, \frac{7}{5}\right)$. The equation of line which makes equal intercepts with axes is

$x+y=a$

$\therefore\ -\dfrac{4}{5}+\dfrac{7}{5}=a \Rightarrow a=\dfrac{3}{5}$

$\therefore$ Equation of line is $x+y-\frac{3}{5}=0$

or $5x+5y-3=0$

259 **(c)**

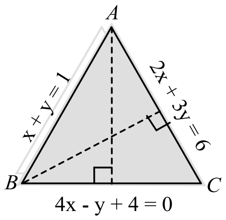
Let the line be $x/a+y/a=1$. It passes through $(1,-2)$

$\therefore 1/a-2/a=1 \Rightarrow a=-1$

Hence, the equation of the line is $x+y=-1$

260 **(a)**

On solving line Ist and IInd, and Ist and IIIrd, we get $A(-3,4)$ and $B\left(-\frac{3}{5},\frac{8}{5}\right)$.



The equation of perpendicular line to the line $4x-y+4=0$ and passes through the point $A(-3,4)$ is

$x+4y-13=0$ ...(i)

Also, the equation of perpendicular line to the line $2x+3y=6$ and passes through a point $B\left(-\frac{3}{5},\frac{8}{5}\right)$ is

$3x-2y+5=0$ ...(ii)

On solving Eq. (i) and (ii), we get the orthocentre $\left(\frac{3}{7},\frac{22}{7}\right)$

Which is lies in Ist quadrant.

261 **(d)**

Let the equation of line is $y=mx+c$

Given, $m=\tan 30°=\dfrac{1}{\sqrt{3}}$ and $c=-2$

$\therefore y=\dfrac{x}{\sqrt{3}}-2 \Rightarrow \sqrt{3}y-x+2\sqrt{3}=0$

262 **(c)**

Here, $a=1, b=9, c=-4, h=-3, g=\frac{3}{2}$ and $f=-\frac{9}{2}$

$\therefore$ Required distance $=2\sqrt{\dfrac{g^2-ac}{a(a+b)}}=2\sqrt{\dfrac{9/4+4}{10}}$

$=\sqrt{\dfrac{5}{2}}$

263 **(b)**

The coordinates of A and B are (0,12) and (8,0) respectively. The equation of the perpendicular bisectors of AB is

$y-6=\frac{2}{3}(x-4) \Rightarrow 2x-3y+10=0$ ....(i)

Equation of a line passing through $(0,-1)$ and parallel to x-axis is $y=-1$. This line meets line (i) at C. Therefore, the coordinates of C are $(-13/2,-1)$. Hence, the area A of the triangle ABC is given by

$$\Delta=\frac{1}{2}\begin{vmatrix}0 & 12 & 1\\ 8 & 0 & 1\\ -13/2 & -1 & 1\end{vmatrix}=91 \text{ sq. units}$$

264 **(c)**

Let (h,k) be the coordinates of the fourth vertex. Then,

$\Delta_1=\dfrac{1}{2}\begin{vmatrix}6 & 7\\ 1 & 2\end{vmatrix}=\dfrac{5}{2}, \Delta_2=\dfrac{1}{2}\begin{vmatrix}7 & -1\\ 2 & 0\end{vmatrix}=1,$

$\Delta_3=\dfrac{1}{2}\begin{vmatrix}-1 & h\\ 0 & k\end{vmatrix}=-\dfrac{k}{2}$ and $\Delta_4=\dfrac{1}{2}\begin{vmatrix}h & 6\\ k & 1\end{vmatrix}$

$=\dfrac{1}{2}(h-6k)$

We have,

$|\Delta_1+\Delta_2+\Delta_3+\Delta_4|=4$

$\Rightarrow \left|\dfrac{5}{2}+1-\dfrac{k}{2}+\dfrac{h-6k}{2}\right|=4$

$\Rightarrow |7+h-7k|=8$

$\Rightarrow 7+h-7k=\pm 8$

$\Rightarrow h-7k-1=0, h-7k+15=0$

$\Rightarrow (h-7k-1)(h-7k+15)=0$

$\Rightarrow (h-7k)^2+14(h-7k)-15=0$

Hence, the locus of (h,k) is $(x-7y)^2+14(x-7y)-15=0$

265 **(a)**

The equation of the line joining $A(a,0)$ and $B(0,b)$ is $\frac{x}{a}+\frac{y}{b}=1$. Clearly, point $(3a,-2b)$ lies on this line

266 **(c)**

Lines are $\left[(l+\sqrt{3}m)x+(m-\sqrt{3}l)y\right]\left[(l-\right.$ *3mx+m+3ly=0*

and $lx+my+n=0$

$\therefore m_1=-\dfrac{(l+\sqrt{3}m)}{(m-\sqrt{3}l)}, m_2=-\dfrac{(l-\sqrt{3}m)}{(m+\sqrt{3}l)}$

and $m_3=-\dfrac{l}{m}$

$\therefore\ \theta_1=\tan^{-1}\left[\dfrac{-\left(\frac{l+\sqrt{3}m}{m-\sqrt{3}l}\right)+\frac{l}{m}}{1+\left(\frac{l+\sqrt{3}m}{m-\sqrt{3}l}\right)\cdot\frac{l}{m}}\right]=60°$

and $\theta_2=\tan^{-1}\left[\dfrac{-\left(\frac{l-\sqrt{3}m}{m+\sqrt{3}l}\right)+\frac{l}{m}}{1+\left(\frac{l-\sqrt{3}m}{m+\sqrt{3}l}\right)\left(\frac{l}{m}\right)}\right]=60°$

Hence, triangle is equilateral.

267 **(c)**

Here, $a = 1,\quad h = -3,\quad b = 9,\quad g = \frac{3}{2},$

$$f = -\frac{9}{2} \text{ and } c = -4$$

$\therefore$ Required distance $= \left| 2\sqrt{\frac{f^2 - bc}{b(a+b)}} \right|$

$$= \left| 2\sqrt{\frac{\left(-\frac{9}{2}\right)^2 + (9)(4)}{9(9+1)}} \right|$$

$$= \left| 2\sqrt{\frac{225}{4 \times 90}} \right| = \left| \frac{2\sqrt{5}}{2\sqrt{2}} \right| = \sqrt{\frac{5}{2}}$$

268 **(c)**

We have,

$\angle PRQ = \pi/2$

$\therefore$ Slope of $RP \times$ Slope of $RQ = -1$

$\Rightarrow \frac{y-1}{x-3} \times \frac{5-1}{6-3} = -1 \Rightarrow 3x + 4y = 13 \quad \ldots$(i)

Now, Area of $\Delta RPQ = 7$

$\Rightarrow \frac{1}{2}\begin{vmatrix} x & y & 1 \\ 3 & 1 & 1 \\ 6 & 5 & 1 \end{vmatrix} = \pm 7 \Rightarrow 3y - 4x = 5 \Rightarrow 3y - 4x$

$= -23 \quad \ldots$(ii)

Solving, (i) and (ii), we get two points

269 **(c)**

We have,

$x^3 - 6x^2y + 11xy^2 - 6y^3 = 0$

$\Rightarrow (x-y)(x-2y)(x-3y) = 0$

$\Rightarrow x - y = 0, x - 2y = 0, x - 3y = 0$

Thus, the slopes of the lines represented by the given equation are $1, \frac{1}{2}, \frac{1}{3}$ which are in H.P.

270 **(a)**

Equation of the line passing through $(-4, 6)$ and $(8, 8)$ is

$(y - 6) = \left(\frac{8-6}{8+4}\right)(x + 4)$

$\Rightarrow 6y - x - 40 = 0 \ldots$(i)

Now, equation of any line perpendicular to Eq. (i), is

$6x + y + \lambda = 0 \ldots$(ii)

This line passes through the mid point of $(-4, 6)$ and $(8, 8)$, which is

$\left(\frac{-4+8}{2}, \frac{6+8}{2}\right)$ *ie*, $(2, 7)$

$\therefore 6 \times 2 + 7 + \lambda = 0 \Rightarrow \lambda = -19$

On putting $\lambda = -19$ in Eq. (ii), we get the required line which is $6x + y - 19 = 0$.

271 **(c)**

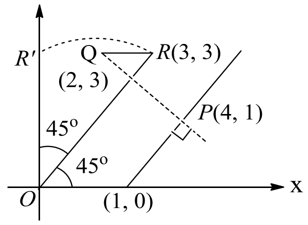
Given sides of a triangle are $x - 3y = 0, 4x + 3y = 5$ and $3x + y = 0$

Since, the lines $x - 3y = 0$ and $3x + y = 0$ are perpendicular to each other, therefore it is right angled triangle and the point of intersection $(0, 0)$ is the orthocentre of a triangle.

$\therefore$ The line $3x - 4y = 0$ is passes through origin $(0, 0)$ *ie*, it is passes through orthocentre.

273 **(c)**

If (α, β) be the image of $(4, 1)$ w.r.t. $y = x - 1$, then $(\alpha, \beta) = (2, 3)$ say point Q



After translation through a distance 1 unit along the positive direction of x-axis at the point whose coordinate are $R \equiv (3, 3)$. After rotation through are angle $\pi/4$ about the origin in the anti-clockwise direction, then R goes to R'' such that $OR = OR'' = 3\sqrt{2}$

$\therefore$ The coordinates of the final point are $(0, 3\sqrt{2})$

275 **(d)**

The point of intersection of $x + 2y - 3 = 0$ and $2x + 3y - 4 = 0$ is $(-1, 2)$ which satisfies $4x + 5y - 6 = 0$. But, it does not satisfy $3x + 4y - 7 = 0$

Hence, only three lines are concurrent

277 **(d)**

$\because P(1, 2)$ is mid point of AB, therefore coordinate of A and B respectively $(2, 0)$ and $(0, 4)$.

$\therefore$ Equation of line AB is

$y - 0 = \frac{4}{-2}(x - 2) \Rightarrow 2x + y = 4$

278 **(c)**

On comparing the given line with

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$

we get,

$a = \lambda,\quad h = -5,$

$$b = 12, g = \frac{5}{2}, f = -8, c = -3$$

It represents a pair of line, if

$$\lambda \times 12 \times (-3) + 2(-8)\left(\frac{5}{2}\right)(-5) - \lambda(-8)^2 - 12\left(\frac{5}{2}\right)^2 + 3(-5)^2 = 0$$

$\Rightarrow -36\lambda + 200 - 64\lambda - 75 + 75 = 0$

$\Rightarrow 100\lambda = 200 \Rightarrow \lambda = 2$

279 **(d)**

Equation of a line perpendicular to $5x - y + 1 =$

0 is $x+5y+c=0$. This meets the axes at $A(-c,0)$ and $B(0,-c/5)$.
Now,
Area of $\Delta OAB=5 \Rightarrow \frac{1}{2}(-c)\left(-\frac{c}{5}\right)=5 \Rightarrow c$
$=\pm 5\sqrt{2}$
Hence, the required line is $x+5\,y\pm 5\sqrt{2}=0$

280 **(b)**
Let $h=u\cos\alpha\cdot t, k=u\sin\alpha\cdot t-\frac{1}{2}\,gt^2$
On eliminating t, we get
$k=h\tan\alpha-\frac{1}{2}g\frac{h^2}{u^2\cos^2\alpha}$
Hence, locus of (h,k) is
$y=x\tan\alpha-\frac{1}{2}g\frac{x^2}{u^2\cos^2\alpha}$, which is a parabola

281 **(c)**
The given lines are
$4x+3y-11=0$ and $4x+3y-\frac{15}{2}=0$
$\therefore$ Required distance $=\frac{\left|-11+\frac{15}{2}\right|}{\sqrt{4^2+3^2}}=\frac{7}{10}$

282 **(d)**
These lines cannot be the sides of a rectangle as none of these are parallel nor they are perpendicular.
Now, for concurrent $\begin{vmatrix}1 & 2 & -3\\ 3 & 4 & -7\\ 2 & 3 & -4\end{vmatrix}$
$=1(-16+21)-2(2)-3(1)$
$\neq 0$
Hence, these are not concurrent.
Opposite side of the parallelogram are
$x^2-5x+6=0$ and $y^2-6y+5=0$
$\Rightarrow (x-2)(x-3)=0$ and $(y-1)(y-5)=0$
$\Rightarrow x-2=0, x-3=0$ and $y-1=0, y-5=0$
$\therefore$ Vertices are $(3,5),(2,5),(2,1)$ and $(3,1)$

283 **(b)**
The perpendicular distance of $(1,3)$ from the line $3x+4y=5$ is 2 units while,
$\sec^2\theta+2\,\mathrm{cosec}^2\theta\geq 3$ [as $\sec^2\theta, \mathrm{cosec}^2\theta\geq 1$]
So, there will be two such points on the line

284 **(b)**
The equation of line passing through the point of intersection of
$\frac{x}{\alpha}+\frac{y}{\beta}=1$ and $\frac{x}{\beta}+\frac{y}{\alpha}=1$ is
$\left(\frac{x}{\alpha}+\frac{\lambda}{\beta}-1\right)+\lambda\left(\frac{x}{\beta}+\frac{\lambda}{\alpha}-1\right)=0$
$\Rightarrow\ x\left(\frac{1}{\alpha}+\frac{\lambda}{\beta}\right)+\lambda\left(\frac{1}{\beta}+\frac{\lambda}{\alpha}\right)-\lambda-1=0$
This meets the coordinate axes at
$A\left(\frac{\lambda+1}{\frac{1}{\alpha}+\frac{\lambda}{\beta}},0\right)$ and $B\left(0,\frac{\lambda+1}{\frac{1}{\beta}+\frac{\lambda}{\alpha}}\right)$
Let (h,k) be the mid point of AB. Then,
$h=\frac{1}{2}\left(\frac{\lambda+1}{\frac{1}{\beta}+\frac{\lambda}{\alpha}}\right)$ and $k=\frac{1}{2}\left(\frac{\lambda+1}{\frac{1}{\beta}+\frac{\lambda}{\alpha}}\right)$
On eliminating λ from these two equations, we get
$2hk(\alpha+\beta)=\alpha\beta(h+k)$
Hence, the locus of (h,k) is $2xy(\alpha+\beta)=\alpha\beta(x+y)$

285 **(a)**
The coordinates of a point of intersection of given lines are $(1, 1)$
The equation of the perpendicular to the line $3x+2y+5=0$ is $2x-3y+\lambda=0$. It is also passes through $(1, 1)$.
$\therefore\ 2-3+\lambda=0\ \Rightarrow\ \lambda=1$
$\therefore$ Required equation of line is $2x-3y+1=0$

286 **(a)**
Let line be $x+2y+\lambda=0$
$\therefore\ \lambda=\frac{-5\times 6+1\times 9}{7}=-3\quad\left(\lambda=\frac{mc_2+nc_1}{m+n}\right)$
So, required line is $x+2y-3=0$

287 **(c)**
The equation of line perpendicular to line $3x-y+5=0$ is $x+3y+\lambda=0$ ...(i)
Also it passes through $(-2,-4)$.
$\therefore\ -2-12+\lambda=0$
$\Rightarrow\ \lambda=14$
$\therefore$ Required equation of line is
$x+3y+14=0$[from Eq. (i)]

288 **(c)**
We have,
$3x^2+xy-y^2-3x+6y+k=0$ ...(i)
Comparing this equation with
$ax^2+2hxy+by^2+2gx+2fy+c=0$, we have
$a=3, b=-1, h=1/2, c=k, f=3$ and
$g=-3/2$
Equation (i) will represent a pair of straight lines if
$abc+2fgh-af^2-bg^2-ch^2=0$
$\Rightarrow -3k-\frac{9}{2}-27+\frac{9}{4}-\frac{k}{2}=0$
$\Rightarrow -\frac{13k}{3}-\frac{117}{4}=0\Rightarrow k=-9$

289 **(b)**

Since, the required lines make an angle 45° either above the line or below the line

∴ Required slopes are

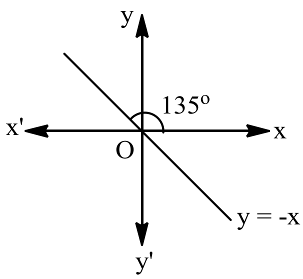
$m = 90°, 180°$

$\therefore y - 1 = \tan 90° \, (x - 1)$

$\Rightarrow x = 1$

and $y - 1 = \tan 180° \, (x - 1)$

$\Rightarrow y = 1$



290 **(b)**

Slope of the line segment joining $(-4,6)$ and $(8, 8)$ is given by

$= \frac{8-6}{8+4} = \frac{1}{6}$

∴ Slope of line perpendicular to it is

$m = -\frac{1}{1/6} = -6$

As the line bisecting it.

∴ Mid point of this line is $\left(\frac{8-4}{2}, \frac{8+6}{2}\right) = (2,7)$

∴ Required equation is

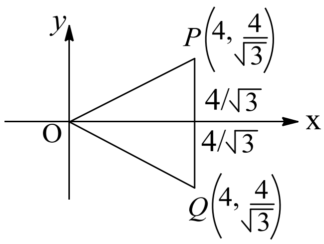
$y - 7 = -6(x - 2)$

$\Rightarrow \; y + 6x - 19 = 0$

291 **(b)**

We have, $x^2 - 3y^2 = 0$...(i)

and $x = 4$ ...(ii)



From Eqs. (i) and (ii), we get

$y^2 = \frac{16}{3}$

$\Rightarrow y = \pm \frac{4}{\sqrt{3}}$

∴ Three sides of triangle are $x - \sqrt{3}y = 0, x + \sqrt{3}y = 0$ and

$x - 4 = 0 ie, OP = OQ = PQ = \frac{8}{\sqrt{3}}$

∴ Triangle is an equilateral triangle

292 **(a)**

We observe that none of the vertices $A(-2,1)$ and $B(2, 4)$ lie on the side $3x - 4y - 10 = 0$.

Therefore,

Length of one side of the rectangle is

$AB = \sqrt{(-2-2)^2 + (1-4)^2} = 5$

Also,

Length of the other side

= Length of the perpendicular drawn from $A(-2,1)$ on $3x - 4y - 10 = 0$

$= \left|\frac{-6-4-10}{\sqrt{9+16}}\right| = 4$

∴ Area of the rectangle $= 5 \times 4 = 20$ sq. units

293 **(b)**

Let a and b be the intercepts made by the straight line on the axes. Then, according to questions

$a + b = \frac{ab}{2}$

$\Rightarrow \frac{2}{a} + \frac{2}{b} = 1$

On comparing with $\frac{x}{a} + \frac{y}{b} = 1$, we get

$\Rightarrow x = 2, y = 2$

Hence, straight line passes through the point $(2, 2)$

294 **(c)**

Two sides $x - 3y = 0$ and $3x + y = 0$ are perpendicular to each other. Therefore, its orthocentre is the point of intersection of $x - 3y = 0$ and $3x + y = 0$ ie, $(0,0)$.

So, the line $3x - 4y = 0$ passes through the orthocentre of triangle

295 **(b)**

Let the coordinates of C be (x, y). Then,

$BC = 5 \Rightarrow x^2 + (y+1)^2 = 5^2$ ...(i)

Now, $AB \perp AC$

$\Rightarrow \frac{y-3}{x-2} \times \frac{4}{2} = -1$

$\Rightarrow 2y - 6 = -x + 2 \Rightarrow x = -2y + 8$ ...(ii)

From (i) and (ii), we have,

$(-2y + 8)^2 + (y+1)^2 = 5^2$

$\Rightarrow 5y^2 - 30y + 40 = 0$

$\Rightarrow y^2 - 6y + 8 = 0 \Rightarrow y = 2,4$

Putting $y = 2$ and $y = 4$ in (ii), we get $x = 4, x = 0$ respectively. Hence, the coordinates of C are $(4,2)$ or $(0,4)$

296 **(c)**

On comparing the given equation with standard equation, we get

$a = \cos\theta - \sin\theta$, $b = \cos\theta + \sin\theta$, $h = \cos\theta$

$$\tan\phi = \frac{2\sqrt{\cos^2\theta - (\cos^2\theta - \sin^2\theta)}}{\cos\theta - \sin\theta + \cos\theta + \sin\theta} = \frac{2\sin\theta}{2\cos\theta}$$

$\Rightarrow \tan\phi = \tan\theta \Rightarrow \phi = \theta$

297 **(d)**

Let m be the required slope

$$\therefore \left|\frac{m-3}{1+3m}\right| = 1$$

$$\Rightarrow \frac{m-3}{1+3m} = \pm 1$$

$\Rightarrow m - 3 = 1 + 3m$

and $m - 3 = -1 - 3m$

$$\Rightarrow m = -2, m = \frac{1}{2}$$

298 **(a)**

Given equation of line are

$x + 2y - 3 = 0$ ...(i)

$2x + 3y - 4 = 0$ ...(ii)

$3x + 4y - 5 = 0$ ...(iii)

and $4x + 5y - 6 = 0$ ...(iv)

On solving Eqs. (i) and (ii), we get

$x = -1, y = 2$

From, Eq. (iii),

$3(-1) + 4(2) - 5 = 0 \Rightarrow 0 = 0$

From Eq. (iv),

$4(-1) + 5(2) - 6 = 0 \Rightarrow 0 = 0$

Hence, given lines are concurrent.

299 **(a)**

The equation of a line passing through $P(4,1)$ and slope -2 is

$$\frac{x-4}{-\frac{1}{\sqrt{5}}} = \frac{y-1}{\frac{2}{\sqrt{5}}} \left[\because \tan\theta = -2 \Rightarrow \cos\theta = -\frac{1}{\sqrt{5}}, \sin\theta = \frac{2}{\sqrt{5}}\right]$$

Suppose it cuts $x + y - 8 = 0$ at Q such that $PQ = r$. Then, the coordinates of Q are given by

$$\frac{x-4}{-\frac{1}{\sqrt{5}}} = \frac{y-1}{\frac{2}{\sqrt{5}}} = r \Rightarrow x = 4 - \frac{r}{\sqrt{5}}, y = 1 + \frac{2r}{\sqrt{5}}$$

Since Q lies on the line $x + y - 8 = 0$

$$\therefore 4 - \frac{r}{\sqrt{5}} + 1 + \frac{2r}{\sqrt{5}} - 8 = 0 \Rightarrow r = 3\sqrt{5}$$

Hence, required distance $= 3\sqrt{5}$ units

300 **(d)**

Let $P(x_1, y_1)$ be the image of point $Q(4, -3)$

Mid point of PQ is $\left(\frac{x_1+4}{2}, \frac{y_1-3}{2}\right)$. This point lies $= x$

$$\therefore \frac{x_1+4}{2} = \frac{y_1-3}{2} \Rightarrow x_1 - y_1 = -7 \text{ ... (i)}$$

Slope of $PQ = \frac{-3-y_1}{4-x_1}$ and slope of $y = x$ is 1

$\because$ PQ is perpendicular to $y = x$

$$\therefore \left(\frac{-3-y_1}{4-x_1}\right)(1) = -1$$

$\Rightarrow y_1 + x_1 = 1$ ...(ii)

On solving Eqs. (i) and (ii), we get $x_1 = -3, y_1 = 4$

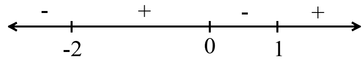
301 **(b)**

If the points $(\alpha, 2+\alpha)$ and $\left(\frac{3\alpha}{2}, \alpha^2\right)$ are on the opposite sides of $2x + 3y - 6 = 0$, then

$(2\alpha + 6 + 3\alpha - 6)(3\alpha + 3\alpha^2 - 6) < 0$

$\Rightarrow 15\alpha(\alpha^2 + \alpha - 2) < 0$

$\Rightarrow \alpha(\alpha + 2)(\alpha - 1) < 0 \Rightarrow \alpha \in (-\infty, -2) \cup (0,1)$



302 **(c)**

Let $y = m_1x, y = m_2x$ be the lines represented by $ax^2 + 2hxy + by^2 = 0$. Then,

$$m_1 + m_2 = \frac{-2h}{b} \text{ and } m_1m_2 = \frac{a}{b}$$

Let $y = m_1'x$ and $y = m_2'x$ be new positions of $y = m_1x$ and $y = m_2x$ respectively. Then,

$y = m_1x$ is perpendicular to $y = m_1'x$

$$\therefore m_1m_1' = -1 \Rightarrow m_1' = -\frac{1}{m_1}$$

Similarly, we have $m_2' = -\frac{1}{m_2}$

So, the new lines are $y = -\frac{1}{m_1}x$ and $y = -\frac{1}{m_2}x$

and their combined equation is

$(m_1y + x)(m_2y + x) = 0$

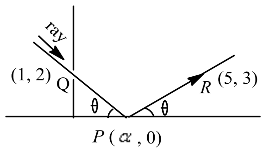
$\Rightarrow m_1m_2y^2 + x^2 + xy(m_1 + m_2) = 0$

$$\Rightarrow \frac{a}{b}y^2 + x^2 + xy\left(\frac{-2h}{b}\right) = 0$$

$\Rightarrow bx^2 - 2hxy + ay^2 = 0$

303 **(c)**

Here, in the figure it is shown that a ray of light passing through the point $Q(1, 2)$ and reflected from a point $P(\alpha, 0)$ on x-axis towards point $R(5, 3)$.



$\therefore$ slope of incident ray (*ie*, before reflection) is given by

$$\tan(\pi - \theta) = \frac{0-2}{\alpha - 1}$$

$$\Rightarrow \tan\theta = \frac{2}{\alpha - 1} \text{ ... (i)}$$

Similarly, slope of reflected ray (*ie*, after reflection) is given by

$\Rightarrow \tan\theta = \frac{3}{5-\alpha}$ ... (ii)

From Eq. (i) and (ii),

$\frac{2}{\alpha - 1} = \frac{3}{5-\alpha}$

$\Rightarrow 10 - 2\alpha = 3\alpha - 3 \Rightarrow \alpha = \frac{13}{5}$

304 **(c)**

The equation of any line passing through $(1, -10)$ is $y + 10 = m(x-1)$. Since makes equal angles, say θ, with the given lines. Therefore,

$\tan\theta = \frac{m-7}{1+7m} = -\frac{m-(-1)}{1+m(-1)} \Rightarrow m = \frac{1}{3}$ or, -3

Hence, the equations of third side are

$y + 10 = \frac{1}{3}(x-1)$ and $y + 10 = -3(x-1)$

i.e. $x - 3y - 31 = 0$ and $3x + y + 7 = 0$

ALITER Required lines are parallel to the angle bisectors

305 **(c)**

The line L is $x + y = 2$. The line perpendicular to L and passing through $(1/2, 0)$ is $x - y = 1$ and the equation of y-axis is $x = 0$. Solving these three equations in pairs we get the points as $(0,2), (0, -1/2)$ and $(5/4, 3/4)$. Therefore, the area Δ of the given triangle is given by

$$\Delta = \frac{1}{2}\begin{vmatrix} 0 & 2 & 1 \\ 0 & -\frac{1}{2} & 1 \\ \frac{5}{4} & \frac{3}{4} & 1 \end{vmatrix} = \frac{25}{16} \text{ sq. units}$$

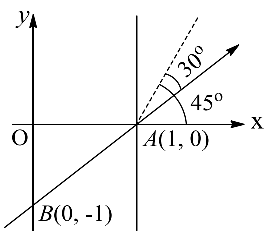
306 **(c)**

On comparing the given equation with standard equation, we get $a = 12$ and $b = a$, for perpendicular lines coefficient of x^2 + coefficient of $y^2 = 0$

$\therefore 12 + a = 0 \Rightarrow a = -12$

307 **(d)**

From figure refracted ray makes an angle of 75° with positive direction of x-axis and passes through the point (1, 0)



$\therefore$ Its equation is

$(y - 0) = \tan(45° - 30°)(x-1)$

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

308 **(a)**

The equation $12x^2 + 7xy - py^2 - 18x + qy + 6 = 0$ will represent a pair of perpendicular lines

$-72p - \frac{63}{2}q - 3q^2 + 81p - \frac{147}{2} = 0$ and $12 - p = 0$

$\Rightarrow 2q^2 + 21q - 23 = 0$ and $p = 12$

$\Rightarrow q = 1$and $p = 12$

309 **(a)**

Given, $|x + y| = 4$

If point (a, a) lies between the lines, then

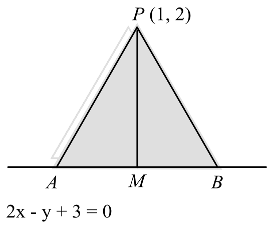
$|a + a| = 4 \Rightarrow |a| = 2$

310 **(a)**

Since, $AP = BP$ and PM is perpendicular to the line

$2x - y + 3 = 0$ ...(i)

Where, M is the mid point AB



Therefore, its slope is $\left(-\frac{1}{2}\right)$

$\therefore$ Equation of line PM is $y - 2 = -\frac{1}{2}(x-1)$

$\Rightarrow 2y + x - 5 = 0$ ....(ii)

Solving Eqs. (i) and (ii), we get the mid point of AB is

$M\left(-\frac{1}{5}, \frac{13}{5}\right)$

311 **(b)**

Since, a, b, c are in HP

$\therefore \frac{2}{b} = \frac{1}{a} + \frac{1}{c}$

$\Rightarrow \frac{1}{a} - \frac{2}{b} + \frac{1}{c} = 0$

So, straight line $\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes throught a fixed point $(1, -2)$

312 **(c)**

From the given equations, we get

$m^2 + am + 2 = 0$

Since, m is real, $a^2 \geq 8 \Rightarrow |a| \geq 2\sqrt{2}$

So, least value of $|a|$ is $2\sqrt{2}$

313 **(c)**

We have,

$a^2x^2 + 2h(a+b)xy + b^2y^2 = 0$ ...(i)

$ax^2 + 2hxy + by^2 = 0$ ...(ii)

The equation of the bisectors of the angles between the pair of lines given in (i) is

$$\frac{x^2-y^2}{a^2-b^2}=\frac{xy}{h(a+b)}\Rightarrow\frac{x^2-y^2}{a-b}=\frac{xy}{h}$$

This is same as the equation of the bisectors of the angles between the lines given in (ii). Thus, two pairs of straight lines are equally inclined to each other

316 **(c)**

We have,

$xy+2x+2y+4=0$

$\Rightarrow (x+2)(y+2)=0\Rightarrow x+2=0, y+2=0$

Solving the equations of the sides of the triangle we obtain the coordinates of the vertices as $A(-2,0), B(0,-2) C(-2,-2)$. Clearly, $\Delta\, ABC$ is a right angled triangle with right angle at C.

Therefore, the centre of the circumcircle is the mid-point of AB whose coordinates are $(-1,-1)$

317 **(d)**

Focus is $|x|+|y|=1$ which separately represents equation of straight lines.

318 **(c)**

Equation of line is

$y=mx+4$

$\therefore$ Required distance $=\frac{4}{\sqrt{1+m^2}}$

320 **(d)**

Let $x_1=x, x_2=xr, x_3=xr^2$

and $y_1=y, y_2=yr, y_3=yr^2$

$\because x_1, x_2, x_3$ and y_1, y_2, y_3 are in GP.

$\because \frac{y_2-y_1}{x_2-x_1}=\frac{y_3-y_2}{x_3-x_2}=\frac{y_1-y_3}{x_1-x_3}$

$\therefore$ The points $(x_1,y_1),(x_2,y_2)$and (x_3,y_3) lies on a straight line.

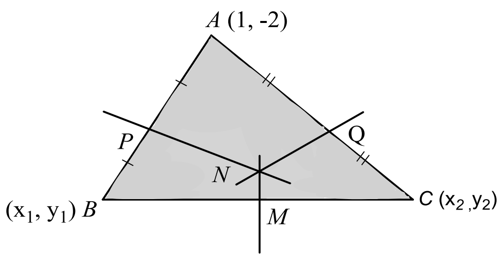
321 **(a)**

Let $B(x_1,x_1)$ and $C(x_2,y_2)$ be two vertices and $P\left(\frac{x_1+1}{2},\frac{y_1-2}{2}\right)$ lies on perpendicular bisector

$x-y+5=0$

$\therefore \frac{x_1+1}{2}-\frac{y_1-2}{2}=-5$

$\Rightarrow\ x_1-y_1=-13$ ...(i)



Also, PN is perpendicular to AB.

$\therefore\ \frac{y_1+2}{x_1-1}\times 1=-1$

$\Rightarrow\ x_1+y_1=-1$ ...(ii)

On solving Eqs. (i) and (ii), we get

$x_1=-7,\qquad y_1=6$

$\therefore$ The coordinates of B are $(-7,6)$ Similarly, the coordinates of C are $\left(\frac{11}{5},\frac{2}{5}\right)$

Hence, the equation of BC is

$$y-6=\frac{\frac{2}{5}-6}{\frac{11}{5}+7}(x+7)$$

$$\Rightarrow\ y-6=\frac{-14}{23}(x+7)$$

$\Rightarrow\ 14x+23y-40=0$

322 **(b)**

Points $(a,0)$ and $(0,b)$ will satisfy the equation of line $px-qy=r$

$\Rightarrow ap=r, -bq=r$

$\therefore a+b=\frac{r}{p}-\frac{r}{q}=r\left(\frac{q-p}{pq}\right)$

323 **(d)**

We have,

$2x-y+4=0$ and $6x-3y-5=0$

$\Rightarrow 2x-y+4=0$ and $2x-y-5/3=0$

This distance between these two parallel lines is given by

$$d=\left|\frac{4+5/3}{\sqrt{2^2+(-1)^2}}\right|=\frac{17\sqrt{5}}{15}$$

324 **(b)**

If the lines given by $ax^2+5\,xy+2\,y^2=0$ arte mutually perpendicular, then

$a+2=0\ \Rightarrow a=-2$

326 **(b)**

Since, the coordinates of three vertices A, B and C are $\left(\frac{5}{3},-\frac{4}{3}\right)$, $(0,0)$ and $\left(-\frac{2}{3},\frac{7}{3}\right)$ respectively, also the mid point of AC is $\left(\frac{1}{2},\frac{1}{2}\right)$, therefore the equation of line passing through $\left(\frac{1}{2},\frac{1}{2}\right)$ and $(0, 0)$ is given by $x-y=0$, which is the required equation of another diagonal, so

$a=1, b=-1,$ and $c=0$

327 **(d)**

Let m be the slope of required line

$$\therefore\left|\frac{m-(-1)}{1+m(-1)}\right|=1$$

$$\Rightarrow\frac{m+1}{1-m}=\pm 1$$

$\Rightarrow m+1=1-m, m+1=-1+m$

$\Rightarrow m=0, m=\infty$

$\therefore$ Equation of the line through (1, 1)is

$y-1=0, x-1=0$

328 **(a)**

Let the equation of line which is perpendicular to $5x-2y=7$, is

$2x + 5y = \lambda$ ...(i)
The point of intersection of given lines is $(14, -9)$
Since, the Eq. (i) is passing through the point $(14, -9)$
$\therefore\ 2(14) + 5(-9) = \lambda \Rightarrow \lambda = -17$
$\therefore$ Eq. (i) becomes
$2x + 5y + 17 = 0$

329 **(a)**
Let the vertices of the triangle be
$A(5, -2), B(-1, 2)$ and $C(1, 4)$
The equation of the altitude through $B(-1, 2)$ is
$y + 2 = -(x - 5) \Rightarrow x + y - 3 = 0$ ...(i)
The equation of the altitude through $B(-1, 2)$
$y - 2 = \frac{2}{3}(x + 1) \Rightarrow 2x - 3y + 8 = 0$ ...(ii)
Solving (i) and (ii), we obtain that the coordinates of the orthocentre are $(1/5, 14/15)$

330 **(a)**
Since the origin and the point $(1, -3)$ lie on the same side of $x + 2y - 11 = 0$ and on the opposite side of $3x - 6y - 5 = 0$. Therefore, the bisector of the angle containing $(1, -3)$ is the bisector of that angle which does not contain the origin and is given by

$$\frac{-x - 2y + 11}{\sqrt{5}} = -\left(\frac{-3x + 6y + 5}{\sqrt{45}}\right) \Rightarrow 3x = 19$$

ALITER Re-write the two equations in such a way that the values of the expressions on the left hand side of the equality for $x = 1, y = -3$ become positive. Now, find the bisector corresponding to positive sign

331 **(c)**
For the two lines $24x + 7y - 20 = 0$ and $4x - 3y - 2 = 0$, the angle bisectors are given by $\frac{24x + 7y - 20}{25} = \pm \frac{4x - 3y - 2}{5}$
Talking positive sign, we get
$2x + 11y - 5 = 0$
$\therefore$ The given three lines are concurrent with one line bisecting the angle between the other two.

332 **(b)**
Let a and b be non-zero real numbers.
Therefore, the given equation
$(ax^2 + by^2 + c)(x^2 - 5xy + 6y^2) = 0$ implies either
$x^2 - 5xy + 6y^2 = 0$
$\Rightarrow (x - 2y)(x - 3y) = 0$
$\Rightarrow x = 2y$ and $x = 3y$
Represent two straight lines passing through origin.
or $ax^2 + by^2 + c = 0$
When $c = 0$ and a and b are of same signs, then
$ax^2 + by^2 + c = 0$
$\Rightarrow x = 0$ and $y = 0$
Which is a point specified as the origin.
When $a = b$ and c is of sign opposite to that of a, then
$ax^2 + by^2 + c = 0$ represents a circle.
Hence, the given equation,
$(ax^2 + by^2 + c)(x^2 - 5xy + 6y^2) = 0$
may represents two straight lines and a circle.

333 **(c)**
Equation of intersection of line is
$(100x + 50y - 1) + \lambda(75x + 25y + 3) = 0$
$\Rightarrow (100 + 75\lambda)x + (50 + 25\lambda)y = -3\lambda$ ...(i)

$$\Rightarrow \frac{x}{\frac{1-3\lambda}{100+75\lambda}} + \frac{y}{\frac{1-3\lambda}{50+25\lambda}} = 1$$

According to the given condition

$$\frac{1 - 3\lambda}{100 + 75\lambda} = \frac{1 - 3\lambda}{50 + 25\lambda}$$

$\Rightarrow\ 50 = -50\lambda \Rightarrow \lambda = -1$
$\therefore$ From Eq. (i), we get
$25x + 25y - 4 = 0$

334 **(a)**
The coordinates of the point dividing the line segment joining $(2,3)$ and $(-1,2)$ internally in the ratio $3 : 4$ are

$$\left(\frac{3 \times -1 + 4 \times 2}{3 + 4}, \frac{3 \times 2 + 4 \times 3}{3 + 4}\right) = \left(\frac{5}{7}, \frac{18}{7}\right)$$

This point lies on the line $x + 2y = \lambda$

$$\therefore \frac{5}{7} + \frac{36}{7} = \lambda \Rightarrow \lambda = \frac{41}{7}$$

335 **(d)**
Slopes of given lines are $m_1 = \sqrt{3}$ and $m_2 = \frac{1}{\sqrt{3}}$

$$\therefore\ \tan\theta = \left|\frac{\sqrt{3} - \frac{1}{\sqrt{3}}}{1 + 1}\right| = \left|\frac{3 - 1}{2\sqrt{3}}\right| = \frac{1}{\sqrt{3}}$$

$\Rightarrow\ \theta = 30°$

336 **(c)**
The coordinates of the vertices of the rectangle are $A(1,4), B(6,4), C(6,10), D(1,10)$. The equation of diagonal AC is

$$y - 4 = \frac{10 - 4}{6 - 1}(x - 1) \Rightarrow 6x - 5y + 14 = 0$$

337 **(d)**
Let the equation of perpendicular line to the line $3x - 2y = 6$ is $3y + 2x = c$ ...(i)
Since, it passes through (0, 2)
$\therefore c = 6$
On putting the value of c in Eq. (i) we get
$3y + 2x = 6$

$\Rightarrow \frac{x}{3}+\frac{y}{2}=1$

Hence, x-intercept is 3.

338 **(a)**

Given equation is $x^2-1005x+2006=0$

$\Rightarrow (x-2)(x-1003)=0$

$\Rightarrow x=2, \quad x=1003$

$\therefore$ Required distance between the lines

$=1003-2=1001$

339 **(a)**

We have,

$\sqrt{3}\,x^2-4xy+\sqrt{3}\,y^2=0$

$\Rightarrow (\sqrt{3}\,x-y)(x-\sqrt{3}\,y)=0$

$\Rightarrow \sqrt{3}\,x-y=0, x-\sqrt{3}\,y=0$

$\Rightarrow y=\sqrt{3}\,x, y=\frac{1}{\sqrt{3}}x$

These lines make 60° and 30° angles respectively with x-axis. If they are rotated about the origin by $\pi/6$ i.e. 30° in anticlockwise direction, then they make 90° and 60° angles respectively with x-axis. So, their equations in new position are $x=0$ and $y=\sqrt{3}\,x$. The combined equation of these two lines is

$x(\sqrt{3}\,x-y)=0$ or, $\sqrt{3}\,x^2-xy=0$

340 **(b)**

Le the equations of the sides AB, BC, CD and DA of the parallelogram $ABCD$ be respectively

$3x-4y+1=0$ ... (i) $4x-3y-2=0$ ... (ii)

$3x-4y+3=0$ ... (iii) $4x-3y-1=0$ ... (iv)

We know that the area of the parallelogram formed by the lines

$a_1x+b_1y+c_1=0, a_2x+b_2y+c_2=0, a_1x+b_1y+d_1=0$ and $a_2x+b_2y+d_2=0$ is given by

$$\left|\frac{(c_1d_1)(c_2-d_2)}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}}\right|$$

Hence, are Δ of the given parallelogram is given by

$$\Delta=\left|\frac{(3-1)\times(-1+2)}{\begin{vmatrix} 3 & -4 \\ 4 & -3 \end{vmatrix}}\right|=\frac{2}{7} \text{ sq. units}$$

341 **(b)**

The equation of a line passing through $P(1,1)$ and parallel to $2x-y=0$ is

$\frac{x-1}{\cos\theta}=\frac{y-1}{\sin\theta}$, where $\tan\theta=2$

i. e. $\frac{x-1}{1/\sqrt{5}}=\frac{y-1}{2/\sqrt{5}}$

Since P is translated in the first quadrant through a unit distance, therefore the coordinates of P are given by

$\frac{x-1}{1/\sqrt{5}}=\frac{y-1}{2\sqrt{2}}=\pm 1$

$\Rightarrow x=1\pm\frac{1}{\sqrt{5}}, y=1\pm\frac{2}{\sqrt{5}}$

Hence, the coordinates of P are $\left(1\pm\frac{1}{\sqrt{5}}, 1\pm\frac{2}{\sqrt{5}}\right)$

342 **(a)**

Given, $\frac{1}{a}x^2+\frac{1}{b}y^2+2\frac{1}{h}xy=0$

$\therefore m_1+m_2=-\frac{\frac{2}{h}}{\frac{1}{b}}=\frac{-2b}{h}$ ... (i)

and $m_1m_2=\frac{\frac{1}{a}}{\frac{1}{b}}=\frac{b}{a}$ ... (ii)

Also given $m_2=2m_1$

$\Rightarrow 3m_1=\frac{-2b}{h}$ [from Eq. (i)] .... (iii)

and $2m_1^2=\frac{b}{a}$ [from Eq. (ii)] .... (iv)

From Eqs. (iii) and (iv),

$\frac{9m_1^2}{2m_1^2}=\frac{4b^2}{h^2}\times\frac{a}{b}$

$\Rightarrow \frac{9}{8}=\frac{ba}{h^2}$ or $ab:h^2=9:8$

344 **(a)**

Clearly the point (3,0) does not lie on the diagonal $x=2y$. Let m be the slope of a side passing through (3,0). Then, its equation is

$y-0=m(x-3)$ ...(i)

Since the angle between a diagonal and a side of a square is $\pi/4$. Therefore, angle between $x=2y$ and $y-0=m(x-3)$ is also $\pi/4$. Consequently, we have

$\tan\frac{\pi}{4}=\pm\frac{m-1/2}{1+m/2}\Rightarrow m=3,-\frac{1}{3}$

Substituting the values of m in (i), we obtain $y-3x+9=0$ and $3y+x-3=0$ as the required sides

345 **(a)**

Any line which is perpendicular to $\sqrt{3}\sin\theta+2\cos\theta=\frac{4}{r}$ is

$\sqrt{3}\sin\left(\frac{\pi}{2}+\theta\right)+2\cos\left(\frac{\pi}{2}+\theta\right)=\frac{k}{r}$ ...(i)

Since, it is passing through $\left(-1,\frac{\pi}{2}\right)$

$\therefore \sqrt{3}\sin\pi+2\cos\pi=\frac{k}{-1}\Rightarrow k=2$

On putting $k=2$ n Eq. (i), we get

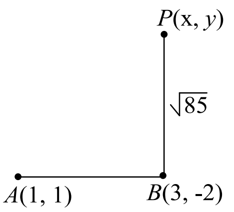
$\sqrt{3}\cos\theta-2\sin\theta=\frac{2}{r}$

$\Rightarrow 2=\sqrt{3}r\cos\theta-2r\sin\theta$

346 **(c)**

Slope of refracted ray is
$-\tan 60° = -\sqrt{3}$
It passes through (1, 0)
$\therefore\ y = -\sqrt{3}(x-1)$
$\Rightarrow\ \sqrt{3}x + y - \sqrt{3} = 0$

347 **(c)**
It is simple way to take a point from the option and finding the distance, which is equal to $\sqrt{85}$
Taking point $P(5,7)$
$BP = \sqrt{(5-3)^2 + (7+2)^2}$
$= \sqrt{4+81} = \sqrt{85}$
Hence, option (c) is correct



348 **(b)**
Equation of the line $\frac{ax}{c-1} + \frac{by}{c-1} + 1 = 0$ has two independent parameters. It can
pass through a fixed point if it contains only one independent parameter. Now , there must be one relation between $\frac{a}{c-1}$ and $\frac{b}{c-1}$ independent of a, b and c so that $\frac{a}{c-1}$ can be expressed in terms of $\frac{b}{c-1}$ and straight line contains only one independent parameter. Now, that given relation can be expressed as $\frac{5a}{c-1} + \frac{4b}{c-1} = \frac{t-20c}{c-1}$ RHS in independent of c if $t = 20$

349 **(c)**
On comparing given equation with standard equation, we get
$a = 1, b = -1, c = -2, h = 0, g = -1/2\ , f = \lambda/2$
Given equation represent a pair of straight line,
$\therefore abc + 2\,fgh - af^2 - bg^2 - ch^2 = 0$
$\Rightarrow\ 2 + 0 - \frac{\lambda^2}{4} + \frac{1}{4} = 0$
$\Rightarrow\ \frac{\lambda^2}{4} = \frac{9}{4}\ \ \Rightarrow\ \ \lambda = \pm 3$

350 **(b)**
The equation of given curve is
$y = \sqrt{x}$ ...(i)
$\Rightarrow \frac{dy}{dx} = \frac{1}{2\sqrt{x}}$
Slope of line at $(x_1, y_1), m_1 = \frac{1}{2\sqrt{x_1}}$
and let line parallel to x-axis is $y = k$ ...(ii)
Whose slope, $m_2 = 0$
Since, 45° is the angle between the line and the curve.
$\therefore \tan 45° = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right| \Rightarrow\ 1 = \left|\frac{\frac{1}{2\sqrt{x_1}} - 0}{1}\right| \Rightarrow\ x_1$
$= \frac{1}{4}$
$\therefore y_1 = \frac{1}{2}$ [from Eq.(i)]
$\therefore$ Required line is $y = \frac{1}{2}$ [from Eq.(ii)]

351 **(c)**
(1)Let A and B be the points where the lines $2x + 3y + 19 = 0$ meets the coordinates axes and let C and O be the points where the line $9x + 6y - 17 = 0$ meet the coordinate axes

Then, $OA = \frac{19}{2}, OB = \frac{19}{2}$,

$OC = \frac{17}{9}$ and $OD = \frac{17}{6}$

Thus, the segments AOC and BOD intersect at such that $OA \cdot OC = OB \cdot OD$. Hence, A, B, C, D are concyclic

(2) Distance of $(2, -5)$ from the line $3x + y + 5 - 0$ is

$\frac{2 \times 3 - 5 + 5}{\sqrt{3^2 + 1^2}} = \frac{6}{\sqrt{10}}$

and distance of $(-1, 4)$ from the line $3x + y + 5 = 0$ is

$\frac{3(-1) + 4 + 5}{\sqrt{10}} = \frac{6}{\sqrt{10}}$

Thus, the points are equidistant from the given line

Hence, both of these statements are correct

352 **(a)**
On comparing the given equation with the standard form of equation, we get $a = 1, h = 2$ and $b = 1$
Let θ is the angle between them, then
$\tan\theta = \frac{2\sqrt{h^2 - ab}}{a+b}$
$\therefore \tan\theta = \frac{2\sqrt{2^2 - 1}}{1+1} = \frac{2\sqrt{4-1}}{2} = \sqrt{3}$
$\Rightarrow\ \theta = \tan^{-1}(\sqrt{3}) = 60°$

354 **(d)**
Here, $a = 6, 2h = -1, b = 4c$

$\therefore m_1 + m_2 = \frac{1}{4c}, m_1 m_2 = \frac{6}{4c}$

One line of given pair of line is $3x + 4y = 0$

Slope of line $= -\frac{3}{4} = m_1$(say)

$\therefore\ -\frac{3}{4} + m_2 = \frac{1}{4c}$

$\Rightarrow\ m_2 = \frac{1}{4c} + \frac{3}{4}$

$\therefore\ \left(-\frac{3}{4}\right)\left(\frac{1}{4c} + \frac{3}{4}\right) = \frac{6}{4c}$

$\Rightarrow\ 1 + 3c = \frac{-6 \times 4}{3}$

$\Rightarrow\ 3c = -9\ \Rightarrow\ c = -3$

355 **(b)**

The equation $4x^2 + 8xy + ky^2 - 9 = 0$ represents a pair of straight lines, if

$(4)(k)(-9) - (-9)(4)^2 = 0 \Rightarrow k = 4$

356 **(b)**

Slope of the line segment joining $(-4, 6)$ and $(8, 8)$ is

$\frac{8-6}{8+4} = \frac{2}{12} = \frac{1}{6}$

$\therefore$ Slope of line perpendicular to it.

$m = -\frac{1}{1/6} = -6$

As the line bisecting it.

$\therefore$ Mid point of this line is $\left(\frac{8-4}{2}, \frac{8+6}{2}\right) = (2, 7)$

$\therefore$ Required equation is

$y - 7 = -6(x - 2)$

$\Rightarrow\ y + 6x - 19 = 0$

357 **(c)**

Let (h, k) be the point of intersection of the line $x\cos\alpha + y\sin\alpha = a$ and $x\sin\alpha - y\cos\alpha = b$. Then,

$h\cos\alpha + k\sin\alpha = a$ ...(i)

$h\sin\alpha - k\cos\alpha = b$ ...(ii)

Squaring and adding (i) and (ii), we get

$(h\cos\alpha + k\sin\alpha)^2 + (h\sin\alpha - k\cos\alpha)^2 = a^2 + b^2$

$\Rightarrow h^2 + k^2 = a^2 + b^2$

Hence, locus of (h, k) is $x^2 + y^2 = a^2 + b^2$

358 **(a)**

Equations of the bisectors of the angles between the lines $x^2 - 2mxy - y^2 = 0$ are given by

$\frac{x^2 - y^2}{1-(-1)} = \frac{xy}{-m} \Rightarrow x^2 + \frac{2}{m}xy - y^2 = 0$ ... (i)

Since (i) and $x^2 - 2nxy - y^2 = 0$ represent the same pair of lines.

$\therefore \frac{1}{1} = \frac{2/m}{-2n} = \frac{-1}{-1} \Rightarrow mn = -1 \Rightarrow mn + 1 = 0$

359 **(d)**

Point of intersection of $\frac{x}{a} + \frac{y}{b} = 1$ and $\frac{x}{b} + \frac{y}{a} = 1$ is $\left(\frac{ab}{a+b}, \frac{ab}{a+b}\right)$

$\therefore$ Equation of line joining $(0, 0)$ and $\left(\frac{ab}{a+b}, \frac{ab}{a+b}\right)$ is $x = y$ $ie, x - y = 0$

360 **(c)**

Here, $a = 4, b = 11$ and $h = -12$

$\therefore\ h^2 - ab = (-12)^2 - 4 \times 11 = 100$

$\therefore$ The two lines represented by given equation will be real and distinct which represent a pair of straight lines passing through the origin.

361 **(a)**

Let the slope of first line be m, then slope of second line is $5m$.

Then, $m + 5m = -\frac{2h}{b}$ and $m \cdot 5m = \frac{a}{b}$

$\Rightarrow\ m = -\frac{2h}{6b} = \frac{-h}{3b}$

$\therefore\ 5m^2 = \frac{a}{b}\ \Rightarrow\ 5\left(-\frac{h}{3b}\right)^2 = \frac{a}{b}$

$\Rightarrow\ \frac{5h^2}{9b^2} = \frac{a}{b}\ \Rightarrow\ 5h^2 = 9ab$

362 **(a)**

We have,

$|x| = |y| x = \pm y \Rightarrow x + y = 0, x - y = 0$

Let $(t, 4-t)$ be the required point. It is equidistant from the lines $|x| = |y|$

$\therefore \left|\frac{t + 4 - t}{\sqrt{2}}\right| = \left|\frac{t - (4-t)}{\sqrt{2}}\right|$

$\Rightarrow 4 = |2t - 4| \Rightarrow t - 2 = \pm 2 \Rightarrow t = 0,4$

Hence, required points are (0,4) and (4,0)

363 **(d)**

Equation of line is $\frac{x}{3} + \frac{y}{4} = 1$

$\Rightarrow\ 4x + 3y - 12 = 0$

Now, distance from origin $= \left|\frac{4 \times 0 + 3 \times 0 - 12}{\sqrt{3^2 + 4^2}}\right|$

$= \frac{12}{5}$ units

364 **(c)**

As $m \in \left(\frac{1}{2}, 3\right)$

$\therefore$ Line $y = mx + 4$ lies between

$y = 3x + 1$ and $2y = x + 3$

Slope of given lines are $m_2 = 3, m = m$ and $m_1 = \frac{1}{2}$

$\therefore \tan\theta = \frac{3 - m}{1 + 3m}$

and $\tan\theta = \frac{m-\frac{1}{2}}{1+\frac{m}{2}}$

$\Rightarrow \frac{3-m}{1+3m} = \frac{2m-1}{2+m}$

$\Rightarrow 7m^2 - 2m - 7 = 0$

$\therefore m = \frac{2 \pm \sqrt{4+196}}{2 \times 7} = \frac{1}{7}(1 \pm 5\sqrt{2})$

365 **(d)**

The point of intersection of the given lines is $\left(\frac{ab}{a+b}, \frac{ab}{a+b}\right)$

Clearly, it satisfies equation of options (a),(b) and (c)

366 **(c)**

Equation of the straight lines are

$3x - 4y + 7 = 0$ ...(i)

and $12x + 5y - 2 = 0$ ...(ii)

The equation of bisectors of the angles between these lines are

$\frac{3x-4y+7}{\sqrt{3^2+4^2}} = \frac{12x+5y-2}{\sqrt{12^2+5^2}}$

$\Rightarrow \frac{3x-4y+7}{5} = \frac{12x+5y-2}{13}$

$\Rightarrow 39x - 52y + 91 = 60x + 25y - 10$

$\Rightarrow 21x + 77y - 101 = 0$

367 **(b)**

Given equation of pair of lines can be written as

$(3x - y)(x + 2y) = 0$

Slope of separate equations of line $3x - y = 0$ is 3 and $x + 2y = 0$ is $-\frac{1}{2}$

Thus, required sum $= 3 - \frac{1}{2} = \frac{5}{2}$

Alternate

Sum of slope of the lines $3x^2 + 5xy - 2y^2 = 0$ is

$m_1 + m_2 = -\frac{h}{b} = \frac{5}{2}$

368 **(b)**

Let the another equation of line is

$x - 2y + 1 = 0$

$\therefore$ Equation of bisector of angle between two lines is

$\frac{2x-y-1}{\sqrt{4+1}} = \pm\frac{x-2y+1}{\sqrt{1+4}}$

$\Rightarrow x + y - 2 = 0$ and $x = y$

369 **(d)**

Given equation can be rewritten as

$a(x + y - 1) + b(2x - 3y + 1) = 0$

This is the form of intersection of two lines.

$\therefore x + y - 1 = 0$ ...(i)

and $2x - 3y + 1 = 0$ ....(ii)

On solving Eqs. (i) and (ii), we get

$x = \frac{2}{5}$ and $y = \frac{3}{5}$

Hence, coordinates of required point are $\left(\frac{2}{5}, \frac{3}{5}\right)$

370 **(a)**

Since, $ax + by + c = 0$ is always passes through $(1, -2)$

$\therefore a - 2b + c = 0$

$\Rightarrow 2b = a + c$

Therefore, a, b and c are in AP

371 **(a)**

Let the locus of point be (x, y)

Area of triangle with points (x, y), $(1, 5)$ and $(3, -7)$ is 21 sq unit

$\therefore \frac{1}{2}\begin{vmatrix} x & y & 1 \\ 1 & 5 & 1 \\ 3 & -7 & 1 \end{vmatrix} = 21$

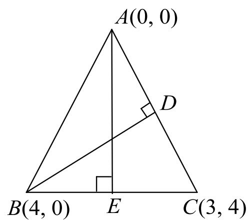
$\Rightarrow \frac{1}{2}[x(5+7) - y(1-3) + 1(-7-15] = 21$

$\Rightarrow \frac{1}{2}[12x + 2y - 22] = 21$

$\Rightarrow 6x + y - 32 = 0$

372 **(c)**

Now, we take $BD \perp AC$ and $AE \perp BC$



Slope of $BD = -\frac{3}{4}$

Equation of BD, $y - 0 = \frac{-3}{4}(x - 4)$

$\Rightarrow 4y = -3x + 12$

$\Rightarrow 3x + 4y - 12 = 0$ ...(i)

and slope of $AE = \frac{1}{4}$

$\therefore$ Equation of AE, $y - 0 = \frac{1}{4}(x - 0)$

$\Rightarrow x - 4y = 0$ ...(ii)

On solving Eqs. (i) and (ii), we get

$x = 3, \quad y = \frac{3}{4}$

$\therefore$ Orthocentre of the traingle is $\left(3, \frac{3}{4}\right)$

373 **(b)**

Let $A(2, -1)$ be one vertex of an equilateral triangle ABC. Then, its altitude is the length of the perpendicular from $A(2, -1)$ on $c + y - 2 = 0$ i.e.

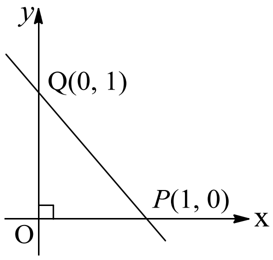
$AD = \left|\frac{2-1-2}{\sqrt{1+1}}\right| = \frac{1}{\sqrt{2}}$

$\Rightarrow \frac{\sqrt{3}}{2}(\text{Side}) = \frac{1}{\sqrt{2}} \Rightarrow \text{side} = \sqrt{\frac{2}{3}}$

374 **(a)**

We have, $x + y = 1$ ...(i)

and $xy = 0$ ...(ii)



On putting $x = 1 - y$ from Eq. (i) into Eq. (ii), we get

$(1 - y)y = 0$

$\Rightarrow y = 0, 1$

At $y = 0 \Rightarrow x = 1$

and at $y = 1 \Rightarrow x = 0$

∴ Coordinates of the vertices of a triangle are (0, 0), (1, 0) and (0, 1)

∴ Point (0, 0) is its orthocentre

375 **(a)**

The equation of required line is

$3x^2 + 4xy - 4x(2x + y) + (2x + y)^2 = 0$

$\Rightarrow 3x^2 + 4xy - 8x^2 - 4xy + 4x^2 + y^2 + 4xy = 0$

$\Rightarrow -x^2 + y^2 + 4xy = 0$

(Coefficient of x^2) +(Coefficient of y^2) $= -1 + 1 = 0$

∴ Lines are mutually perpendicular.

ie, Angle between lines is $\frac{\pi}{2}$.

376 **(a)**

The equation of given line is

$y = mx + \frac{a}{m}$ ... (i)

The equation of line perpendicular to Eq. (i) is

$my + x + \lambda = 0$ ... (ii)

This line passing through $(a, 0)$.

$0 + a + \lambda = 0 \Rightarrow \lambda = -a$

On putting this value on λ in Eq. (ii) and solving with Eq. (i), we get

$x = 0$ and $y = \frac{a}{m}$

Coordinates of the foot of perpendicular are $\left(0, \frac{a}{m}\right)$.

377 **(b)**

∵ Slope of perpendicular $= -\left[\frac{\cos\alpha - \cos\beta}{\sin\alpha - \sin\beta}\right]$

$= \tan\frac{\alpha + \beta}{2}$

∴ Equation of perpendicular is

$y = \tan\left(\frac{\alpha + \beta}{2}\right)x$ ... (i)

On solving the Eq. (i) with the line, we get

$\left[\frac{a}{2}(\cos\alpha + \cos\beta), \frac{a}{2}(\sin\alpha + \sin\beta)\right]$

378 **(d)**

Mid point of the line joining the points (4, −5) and (−2, 9) is

$\left(\frac{4 - 2}{2}, \frac{-5 + 9}{2}\right)$ *ie*, (1, 2)

∴ Inclination of straight line passing through point (−3, 6) and mid point (1, 2) is

$m = \frac{2 - 6}{1 + 3} = \frac{-4}{4} = -1$

$\therefore \tan\theta = -1 \Rightarrow \theta = \frac{3\pi}{4}$

379 **(d)**

Given pair of line is

$x^2\sin^2\alpha + y^2\sin^2\alpha$

$= x^2\cos^2\theta + y^2\sin^2\theta - 2xy\sin\theta\cos\theta$

$\Rightarrow x^2(\sin^2\alpha - \cos^2\theta) + y^2(\sin^2\alpha - \sin^2\theta) + 2(\sin\theta\cos\theta)xy = 0$

On comparing with $ax^2 + by^2 + 2hxy = 0$

We get, $a = \sin^2\alpha - \cos^2\theta$,

$b = \sin^2\alpha - \sin^2\theta$ and $h = \sin\theta\cos\theta$

Let θ be the angle between the pair of lines.

∴ tan θ

$= \left|\frac{2\sqrt{\sin^2\theta\cos^2\theta - (\sin^2\alpha - \cos^2\theta) \times (\sin^2\alpha - \sin}}{\sin^2\alpha - \cos^2\theta + \sin^2\alpha - \sin^2\theta}\right.$

$= \left|\frac{2\sqrt{\sin^2\theta\cos^2\theta - (\sin^2\alpha)^2 + \sin^2\alpha\sin^2\theta + \sin^2\alpha}}{-(1 - 2\sin^2\alpha)}\right.$

$= \left|\frac{2\sqrt{\sin^2\alpha(\sin^2\theta + \cos^2\theta) - (\sin^2\alpha)^2}}{-\cos 2\alpha}\right|$

$= \left|\frac{2\sqrt{\sin^2\alpha(1 - \sin^2\alpha)}}{-\cos 2\alpha}\right|$

$\Rightarrow \tan\theta = \left|\frac{\sin 2\alpha}{\cos 2\alpha}\right| = \tan 2\alpha$

$\Rightarrow \theta = 2\alpha$

380 **(b)**

Given equations of line and circle are respectively

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

and $x^2 + y^2 = 4$ ...(ii)

From Eqs. (i) and (ii), we get

$x^2 + (2 - \sqrt{3}x)^2 = 4$

$\Rightarrow 4x^2 - 4\sqrt{3}x = 0$

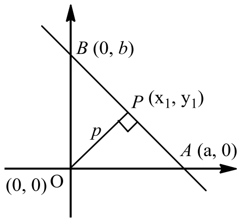
$\Rightarrow x(x - \sqrt{3}) = 0 \Rightarrow x = 0, \sqrt{3}$

∴ Points of intersection of line and circle are (0, 2)

and $(\sqrt{3}, -1)$.
Slope, of line joining (0, 0) and (0, 2)
$= \frac{2-0}{0-0} = \infty \Rightarrow \theta_1 = \frac{\pi}{2}$
Also, slope of line joining (0, 0) and $(\sqrt{3}, -1)$
$= \frac{-1}{\sqrt{3}} \Rightarrow \theta_2 = \frac{\pi}{6}$
$\therefore$ Required angle $= \frac{\pi}{2} - \frac{\pi}{6} = \frac{\pi}{3}$

381 **(b)**

Equation of line is $\frac{x}{a} + \frac{y}{b} = 1$ ... (i)
Let P be the foot of perpendicular from the origin to the whose coordinate is (x_1, y_1).



Since, $OP \perp AB$
$\therefore$ Slope of $OP \times$ Slope of $AB = -1$
$\Rightarrow \left(\frac{y_1}{x_1}\right)\left(\frac{b}{-a}\right) = -1,$
$by_1 = ax_1$ ... (ii)
Since, P lies on the line AB, then
$\frac{x_1}{a} + \frac{y_1}{b} = 1 \Rightarrow bx_1 + ay_1 = ab$ ... (iii)
From Eqs. (ii) and (iii), we get
$x_1 = \frac{ab^2}{a^2+b^2}$ and $y_1 = \frac{a^2b}{a^2+b^2}$
Now, $x_1^2 + y_1^2 = \left(\frac{ab^2}{a^2+b^2}\right)^2 + \left(\frac{a^2b}{a^2+b^2}\right)^2$
$\Rightarrow x_1^2 + y_1^2 = \frac{a^2b^2(a^2+b^2)}{(a^2+b^2)^2}$
$\Rightarrow x_1^2 + y_1^2 = \frac{a^2b^2}{(a^2+b^2)}$
$= \frac{1}{\frac{1}{a^2} + \frac{1}{b^2}}$
But $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$
$\therefore x_1^2 + y_1^2 = c^2$
Thus, the locus of $P(x_1, y_1)$ is
$x^2 + y^2 = c^2$
Which is the equation of circle.

382 **(a)**

Any line through A is given by
$(px + qy - 1) + \lambda(qx + py - 1) = 0$
Which is passing through (p, q)
Hence, $\lambda = -\frac{(p^2 + q^y - 1)}{2pq - 1}$
Thus, the required line is
$(px + qy - 1) - \frac{(p^2+q^2-1)}{(2pq-1)} \cdot (qx + py - 1) = 0$
$\Rightarrow (2pq - 1)(px + qy - 1) - (p^2 + q^2 - 1)(qx + py - 1) = 0$

383 **(a)**

Solving the given equations, we obtain that the vertices of the triangle formed by them are $A(0,4), B(1,1)$ and $C(4,0)$
Now, $AB = \sqrt{10} = BC, CA = 4\sqrt{2}$
Hence, triangle is isosceles

384 **(a)**

Image of (1,3) in the line $x + y - 6 = 0$ is given by
$\frac{x-1}{1} = \frac{y-3}{1} = -2\left(\frac{1+3-6}{1^2+1^2}\right) \Rightarrow x = 3, y = 5$
Hence, the image of the given point has coordinates (3,5)

385 **(c)**

Given lines
$x\cos\alpha + \gamma\sin\alpha = p_1$ and, $x\cos\beta + \gamma\sin\beta = p_2$
Will be perpendicular, if the lines perpendicular to them are also perpendicular.
Clearly, perpendiculars drawn from the origin to the given lines make angles α and β respectively with x-axis. Therefore, angle between them is $|\alpha - \beta|$
Thus, the given lines will be perpendicular, if $|\alpha - \beta| = \frac{\pi}{2}$

387 **(c)**

Since, the given lines are concurrent.
$\therefore \begin{vmatrix} a & k & 10 \\ b & k+1 & 10 \\ c & k+2 & 10 \end{vmatrix} = 0 \Rightarrow 10\begin{vmatrix} a & k & 1 \\ b & k+1 & 1 \\ c & k+2 & 1 \end{vmatrix} = 0$
Applying $R_2 \to R_2 - R_1$ and $R_3 \to R_3 - R_1$
$\Rightarrow 10\begin{vmatrix} a & k & 1 \\ b-a & 1 & 0 \\ c-a & 2 & 0 \end{vmatrix} = 0$
$\Rightarrow 10[1(2b - 2a - c + a)] = 0$
$\Rightarrow 2b = a + c$
Hence, a, b and c are in AP

388 **(b)**

We have,
Required distance $= 2\sqrt{\frac{g^2 - ac}{a(a+b)}} = \frac{2}{\sqrt{10}}$

389 **(c)**

Let $y = mx$ be a line represented by $ax^3 + bx^2y + cxy^2 + dy^3 = 0$. Then,

$dm^3 + cm^2 + bm + a$

$= 0 \quad \begin{bmatrix} \text{Putting } y = mx \text{ in } ax^3 + bx^2y \\ +cxy^2 + dy^3 = 0 \end{bmatrix}$

Let m_1, m_2, m_3 be the roots of this equation. Then,

$m_1 + m_2 + m_3 = -\frac{c}{d}$

$m_1m_2 + m_2m_3 + m_3m_1 = \frac{b}{d}$

$m_1m_2m_3 = -\frac{a}{d}$

Thus, there are three lines viz. $y = m_1x, y = m_2x, y = m_3x$ represented by the given equation.

Suppose $y = m_1x$ and $y = m_2x$ make complementary angles with x-axis. Then,

$m_1m_2 = 1$

Putting $m_1m_2 = 1$ in $m_1m_2m_3 = -\frac{a}{d}$, we get

$m_3 = -\frac{a}{d}$

Since m_3 is a root of the equation $dm^3 + cm^2 + bm + a = 0$

$\therefore d\left(-\frac{a}{d}\right)^3 + c\left(-\frac{a}{d}\right)^2 + b\left(-\frac{a}{d}\right) + a = 0$

$\Rightarrow -a^3d + a^2cd - abd^2 + ad^3 = 0$

$\Rightarrow -a^2 + ac - bd + d^2 = 0$

$\Rightarrow a(c - a) = d(b - d) \Rightarrow a(a - c) = d(d - b)$

390 **(a)**

Let the lines are $y = m_1x + c_1$ and $y = m_2x + c_2$

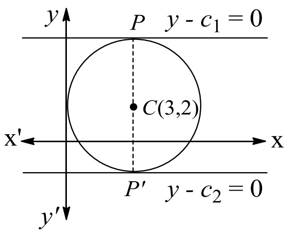
Since, pair of straight lines are parallel to x-axis

$\therefore m_1 = m_2 = 0$

and the lines will be $y = c_1$ and $y = c_2$

Given circle is $x^2 + y^2 - 6x - 4y - 12 = 0$

Centre (3, 2) and radius = 5



Here, the perpendicular drawn from centre to the lines are CP and CP''

$\therefore CP = \frac{2 - c_1}{\sqrt{1}} = \pm 5$

$\Rightarrow 2 - c_1 = \pm 5$

$\Rightarrow \quad c_1 = 7$ and $c_1 = -3$

Hence, the lines are

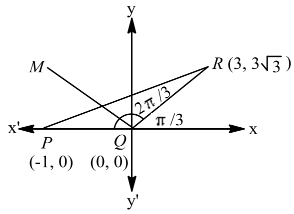
$y - 7 = 0, y + 3 = 0, ie, (y - 7)(y + 3) = 0$

$\therefore$ Pair of straight lines is $y^2 - 4y - 21 = 0$

391 **(a)**

Now, slope of $QR = \frac{3\sqrt{3} - 0}{3 - 0} = \sqrt{3} = \tan\theta$

$\Rightarrow \quad \theta = \frac{\pi}{3}$



$\therefore$ The angle between PQR is $\frac{2\pi}{3}$, so the line QM m

direction of x-axis.

Slope of the line $QM = \tan\frac{2\pi}{3} = -\sqrt{3}$

Hence, equation of line QM is $y = -\sqrt{3}x$

or $\sqrt{3}x + y = 0$

392 **(a)**

Let $ay^4 + bxy^3 + cx^2y^2 + dx^3y + ex^4 = (ax^2 + pxy - ay^2)(x^2 + qxy + y^2)$

On comparing the coefficient of similar terms, we get

$b = aq - p, c = -pq, d = aq + p, e = -a$

Now, $b + d = 2aq, \; e - a = -2a$

$ad + be = 2ap, a + c + e = -pq$

$\therefore \; (b + d)(ad + be) = -(e - a)^2(a + c + e)$

$\Rightarrow \; (b + d)(ad + eb) + (e - a)^2(a + c + e) = 0$

393 **(d)**

Given equation is

$3x^2 + xy - y^2 - 3x + 6y + k = 0$

Here, $a = 3, b = -1, h = \frac{1}{2}, g = -\frac{3}{2}\; f = 3, c = k,$

Given equation represents a pair of straight line, if

$abc + 2fgh - af^2 - bg^2 - ch^2 = 0$

$$\therefore 3(-1)(k) + 2 \times 3 \times \left(-\frac{3}{2}\right) \times \frac{1}{2} - 3(3)^2 + 1\left(\frac{-3}{2}\right)^2 - k\left(\frac{1}{2}\right)^2 = 0$$

$\Rightarrow \; -3k - \frac{9}{2} - 27 + \frac{9}{4} - \frac{k}{4} = 0 \; \Rightarrow \; k = -9$

394 **(b)**

Let (h, k) be the coordinates of the vertex. Then, the height of the triangle is the length of the perpendicular from (h, k) on $x = a$ i.e. $|h - a|$

Since the area of the triangle is a^2

$\therefore \frac{1}{2}(2\,a)|h - a| = a^2$

$\Rightarrow |h - a| = a$

$\Rightarrow h - a = \pm a \; \Rightarrow h = 0, h = 2\,a$

Hence, the vertex lies on $x = 0$ or, $x = 2a$

395 **(a)**

The distance of the point $(-2, 3)$ from the line $x - y = 5$ is

$p = \left|\frac{-2 - 3 - 5}{\sqrt{(1)^2 + (-1)^2}}\right|$

$= \left|\frac{-10}{\sqrt{2}}\right| = \frac{10}{\sqrt{2}} = 5\sqrt{2}$

396 **(b)**

Here, $h = -\frac{1}{2}, a = 1, b = -6$

$$\therefore \tan = \left|2\frac{\sqrt{\frac{1}{4}+6}}{1-6}\right| = \frac{2\sqrt{\frac{25}{4}}}{-5} = |-1|$$

$\therefore\ \theta = \tan^{-1}(1) = 45°$

397 **(c)**

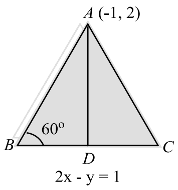
On comparing the given equation with standard equation, we get $a = 12$ and $b = a$. We also know, if pair of straight lines is perpendicular, then coefficient of x^2 + coefficient of $y^2 = 0$ or $a + b = 0$

$\therefore 12 + a = 0 \Rightarrow a = -12$

398 **(a)**

$$\because AD = \left|\frac{-2-2-1}{\sqrt{(2)^2+(-1)^2}}\right| = \left|\frac{-5}{\sqrt{5}}\right| = \sqrt{5}$$

and in ΔABD $\tan 60° = \frac{AD}{BD}$



$$\Rightarrow \sqrt{3} = \frac{\sqrt{5}}{BD} \Rightarrow BD = \sqrt{\frac{5}{3}}$$

$$\therefore\ BC = 2BD = 2\sqrt{\frac{5}{3}} = \sqrt{\frac{20}{3}}$$

399 **(b)**

The equation of any line parallel to $2x + 6y + 7 = 0$ is $2x + 6y + k = 0$. This meets the axes at $A(-k/2, 0)$ and $B(0, -k/6)$

Now,

$AB = 10$

$$\Rightarrow \sqrt{\frac{k^2}{4} + \frac{k^2}{36}} = 10$$

$$\Rightarrow \sqrt{\frac{10\,k^2}{36}} = 10$$

$\Rightarrow 10\,k^2 = 3600 \Rightarrow k = \pm 6\sqrt{10}$

Hence, there are two lines given by $2x + 6y \pm 6\sqrt{10} = 0$s

401 **(d)**

Equation of a line passing through the intersection of lines $ax + 2by + 3b = 0$ and $bx - 2ay - 3a = 0$ is

$(ax + 2by + 3b) + \lambda(bx - 2ay - 3a) = 0$ ...(i)

Now, this line is parallel to x-axis, so coefficient of x should be zero.

$ie, a + \lambda b = 0$

$\Rightarrow\ \lambda = -\frac{a}{b}$

On putting this value in Eq. (i), we get

$b(ax + 2by + 3b) - a(bx - 2ay - 3a) = 0$

$\Rightarrow 2(b^2 + a^2)y + 3(b^2 + a^2) = 0$

$\Rightarrow y = -\frac{3}{2}$

The negative sign shows that the line is below x-axis, at a distance $\frac{3}{2}$ from it.

402 **(a)**

Since the area of the square is 25 sq. units

$\therefore$ Length of each side = 5 units

Let the equations of the other sides be

$3\,x - 4\,y + k_1 = 0$ and $4\,x + 3\,y + k_2 = 0$

The distance between $3\,x - 4\,y = 0$ and $3\,x - 4\,y + k_1 = 0$ is

$$\frac{k_1}{\sqrt{3^2 + (-4)^2}} = \frac{k_1}{5}$$

$\therefore$ Area of the square $= \frac{k_1^2}{25}$

$\Rightarrow \frac{k_1^2}{25} = 25 \Rightarrow k_1 = \pm 25$

Similarly, we have $k_2 = \pm 25$

Hence, the equations of the other two sides of the square are $3\,x - 4\,y \pm 25 = 0$ and $4\,x + 3\,y \pm 25 = 0$

403 **(c)**

Given polar equation is

$r\cos\theta + 7r\sin\theta + 1$

Put $x = r\cos\theta, y = r\sin\theta$, we get

$\Rightarrow x + 7y = 1$

This is the equation of straight line.

405 **(c)**

Here, $a_1a_2 + b_1b_2 = (4 \times 3 + 3 \times 4) = 24 > 0$

$\therefore$ The equation of the bisector is

$$\frac{4x - 3y + 7}{5} = \pm\frac{3x - 4y + 14}{5}$$

Talking negative sign.

$x - y + 3 = 0$

406 **(d)**

If the points (1,2) and (3,4) are on the same side of $3x - 5y + a = 0$, then $(3 - 10 + a)$ and $9 - 20 + a$ are of the same sign

$\therefore (3 - 10 + a)(9 - 20 + a) > 0$

$\Rightarrow (a - 7)(a - 11) > 0 \Rightarrow a < 7$ or $a > 11$

407 **(b)**

Given, $x^2 + y^2 = 9$ ...(i)

and $x+y=3$ ...(ii)
From Eqs. (i) and (ii), we make a homogeneous equation.
$\Rightarrow\ x^2+y^2=(x+y)^2$
$\Rightarrow\ x^2+y^2=x^2+y^2+2xy$
$\Rightarrow\ xy=0$

408 **(d)**
Since, line L passes through (13, 32)
$\therefore \frac{13}{5}+\frac{32}{b}=1$
$\Rightarrow \frac{32}{b}=1-\frac{13}{5}=-\frac{8}{5}$
$\Rightarrow b=-\frac{32\times 5}{8}=-20$
$\Rightarrow L:\frac{x}{5}-\frac{y}{20}=1$
Given, $K:\frac{x}{c}+\frac{y}{3}=1$ is parallel to $L=0$
$\therefore$ The line K must have equation
$\frac{x}{5}-\frac{y}{20}=a$
or $\frac{x}{5a}-\frac{y}{20a}=1$
Comparing with $\frac{x}{c}+\frac{y}{3}=1$
$\Rightarrow\ -20a=3, c=5a$
$\Rightarrow a=-\frac{3}{20}, c=-\frac{15}{20}$
$\therefore$ Distance between line is
$$\left|\frac{a-1}{\sqrt{\frac{1}{25}+\frac{1}{400}}}\right|=\left|\frac{-\frac{3}{20}-1}{\sqrt{\frac{17}{400}}}\right|=\frac{23}{\sqrt{17}}$$

409 **(c)**
The length of perpendicular from point $(a\cos\alpha, a\sin\alpha)$ to the line
$x\tan\alpha-y+c=0$ or $x\sin\alpha-y\cos\alpha+c\cos\alpha=0$
$=\frac{a\cos\alpha\sin\alpha-a\sin\alpha\cos\alpha+c\cos\alpha=0}{\sqrt{\sin^2\alpha+\cos^2\alpha}}$
$=c\cos\alpha$

410 **(c)**
The equations $ax+by+c=0$ and $dx+ey+f=0$ will represent the same straight line if their slopes and y-intercepts are equal
$\therefore -\frac{a}{b}=-\frac{d}{e}$ and $-\frac{c}{b}=-\frac{f}{e}$
$\Rightarrow \frac{a}{d}=\frac{b}{e}$ and $\frac{b}{e}=\frac{c}{f}\Rightarrow \frac{a}{d}=\frac{b}{e}=\frac{c}{f}$

411 **(d)**
We know that the coordinates of the image of (x_1,y_1) with respect to the line $ax+by+c=0$ are given by
$$\frac{x-x_1}{a}=\frac{y-y_1}{b}=-\frac{2\,(ax_1+by_1+c)}{a^2+b^2}$$
Thus, the coordinates of the required point are given by
$\frac{x-0}{1}=\frac{y-0}{1}=-2\left(\frac{0+0+1}{1^2+1^2}\right)$
$\Rightarrow \frac{x}{1}=\frac{y}{1}=-1\Rightarrow x=-1, y=-1$

412 **(d)**
The intersection point of $y-x+7=0$ and $y+2x-2=0$ is $(3,-4)$
$\therefore$ Equation of dtrianght line joining from origin t6o the point $(3,-4)$ is
$y-0=\frac{-4}{3}(x-0)$
$\Rightarrow 3y=-4x\ \Rightarrow 4x+3y=0$

413 **(d)**
Since one of the lines represented by $ax^2+2\,hxy+by^2=0$ bisects the angle between the axes in the first quadrant. Therefore, its equation is $y=x$
Clearly, $y=x$ must satisfy $ax^2+2\,hxy+by^2=0$
$\therefore ax^2+2\,hx^2+bx^2=0$
$\Rightarrow a+b=-2\,h\Rightarrow (a+b)^2=4\,h^2$

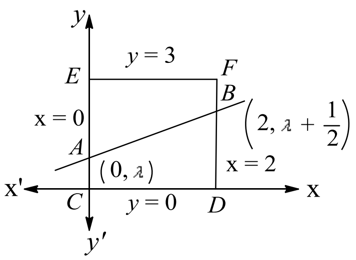
415 **(a)**
Let the image of the point $(-1,3)$ in the line $y=x$ is $(3,-1)$

416 **(c)**
The joint equation of the given lines is
$(x+y-1)(x-y-4)=0$

417 **(d)**
Let a and b intercepts on the coordinate axes.
$\therefore a+b=-1\ \Rightarrow\ b=-(a+1)$
Equation of line is $\frac{x}{a}+\frac{y}{b}=1$
$\Rightarrow \frac{x}{a}-\frac{y}{a+1}=1$ ...(i)
Since, this line passes through (4, 3)
$\therefore \frac{4}{a}-\frac{3}{a+1}=1$
$\Rightarrow\ a+4=a^2+a$
$\Rightarrow\ a^2=4\ \Rightarrow\ a=\pm 2$
$\therefore$ Equation of line is
$\frac{x}{2}-\frac{y}{3}=1$ or $\frac{x}{-2}+\frac{y}{1}=1$ [from Eq.(i)]

419 **(d)**
The given equation represent coincident lines, if $h^2-ab=0$
$\Rightarrow \left(\frac{h}{2}\right)^2-4\cdot 1=0\ \Rightarrow\ h=\pm 4$

420 **(a)**
Equation of sides are $x=0, x=2, y=0, y=3$



Line parallel to $y = \frac{1}{4}x$ is $y = \frac{1}{4}x + \lambda$

Clearly, $AC = BF$

$\Rightarrow \lambda = 3 - \lambda - \frac{1}{2} \Rightarrow \lambda = \frac{5}{4}$

$\therefore$ Equation of required line is $x - 4y + 5 = 0$

421 **(a)**

Since, the angle is right angle.

$\therefore$ Homogenising, $x^2 + y^2 = 4\left(\frac{y - 3x}{c}\right)^2$

$\Rightarrow c^2(x^2 + y^2) = 4(y^2 + 9x^2 - 6xy)$

Since, lines are at right angle.

$\therefore$ Coefficient of x^2 + coefficient of $y^2 = 0$

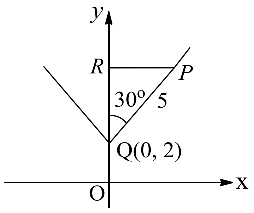
$\Rightarrow c^2 - 36 + c^2 - 4 = 0$

$\Rightarrow c^2 = 20$

422 **(b)**

Given that, $y = \sqrt{3}|x| + 2$

and $PQ = 5$, so, $QR = \frac{5\sqrt{3}}{2}$



$\therefore$ Coordinates of R are $\left(0, 2 + \frac{5\sqrt{3}}{2}\right)$ or $\left(0, \frac{4 + 5\sqrt{3}}{2}\right)$

423 **(a)**

The vertices of triangle are the intersection points of the lines

$x + y = 0$ ...(i)

$3x + y = 4$ ...(ii)

and $x + 3y = 4$ ...(iii)

On solving Eqs. (i) and (ii), (ii) and (iii), (iii) and (i), we get, the vertices of triangle are

$A(-2, 2), B(1, 1)$ and $C(2, -2)$

Now, $AB = \sqrt{(1 + 2)^2 + (1 - 2)^2}$

$= \sqrt{9 + 1} = \sqrt{10}$

$BC = \sqrt{(2 - 1)^2 + (-2 - 1)^2}$

$= \sqrt{1^2 + (-3)^2} = \sqrt{10}$

$AC = \sqrt{(2 + 2)^2 + (-2 - 2)^2}$

$= \sqrt{16 + 16} = 4\sqrt{2}$

$\because AB = BC$

$\therefore$ Triangle is isosceles

424 **(b)**

The point of intersection of lines $2x - 3y + 4 = 0$ and $3x + 4y - 5 = 0$ is

$\left(-\frac{2}{34}, \frac{22}{17}\right)$

The slope of required line which is perpendicular to

$6x - 7y + 3 = 0$ is $-\frac{7}{6}$

$\therefore$ Equation of required line

$y - \frac{22}{17} = -\frac{7}{6}\left(x + \frac{2}{34}\right)$

$\Rightarrow \frac{6(17y - 22)}{17} = -\frac{7(34x + 2)}{34}$

$\Rightarrow 119x + 102y = 125$

425 **(c)**

Since, the given lines are concurrent

$\therefore \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0 \Rightarrow a^3 + b^3 + c^3 - 3abc = 0$

$\Rightarrow (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca) = 0$

$\Rightarrow \frac{(a + b + c}{2}\{(a - b)^2 + (b - c)^2 + (c - a)^2\}$

$= 0$

$\Rightarrow a + b + c = 0 \quad (\text{as } a \neq b \neq c)$