STRAIGHT LINES

OBJECTIVES

1. The line $(3x - y + 5) + \lambda(2x - 3y - 4) = 0$ will be parallel to *y*-axis, if $\lambda =$

(a) $\frac{1}{3}$ (b) $\frac{-1}{3}$

(c) $\frac{3}{2}$ (d) $\frac{-3}{2}$

2. If the transversal $y = m_r x$; $r = 1, 2, 3$ cut off equal intercepts on the transversal $x + y = 1$, then $1 + m_1, 1 + m_2, 1 + m_3$ are in

(a) A. P. (b) G. P.

(c) H. P. (d) None of these

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

(a) $x + 5y = 5$ (b) $x + 5y = \pm 5\sqrt{2}$

(c) $x - 5y = 5$ (d) $x - 5y = 5\sqrt{2}$

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

(a) $x - y = 5$ (b) $x + y = 5$

(c) $x + y = 1$ (d) $x - y = 1$

5. If the coordinates of the points *A*, *B*, *C* be (– 1, 5), (0, 0) and (2, 2) respectively and *D* be the middle point of *BC*, then the equation of the perpendicular drawn from *B* to the line *AD* is

(a) $x + 2y = 0$ (b) $2x + y = 0$

(c) $x - 2y = 0$ (d) $2x - y = 0$

6. A line passes through the point (3, 4) and cuts off intercepts from the coordinates axes such that their sum is 14. The equation of the line is

(a) $4x - 3y = 24$ (b) $4x + 3y = 24$

(c) $3x - 4y = 24$ (d) $3x + 4y = 24$

7. If the middle points of the sides *BC*, *CA* and *AB* of the triangle *ABC* be (1, 3), (5, 7) and (– 5, 7), then the equation of the side *AB* is

(a) $x - y - 2 = 0$ (b) $x - y + 12 = 0$ (c) $x + y - 12 = 0$ (d) None of these

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

(a) $\sqrt{3}x + y - \sqrt{3} = 0,\ \sqrt{3}x - y - \sqrt{3} = 0$

(b) $\sqrt{3}x + y + \sqrt{3} = 0,\ \sqrt{3}x - y + \sqrt{3} = 0$

(c) $x + \sqrt{3}y - \sqrt{3} = 0,\ x - \sqrt{3}y - \sqrt{3} = 0$

(d) None of these

9. A line passes through the point of intersection of $2x + y = 5$ and $x + 3y + 8 = 0$ parallel to the line $3x + 4y = 7$ is

(a) $3x + 4y + 3 = 0$ (b) $3x + 4y = 0$

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

10. A line meets *x*–axis and *y*-axis at the points *A* and *B* respectively. If the middle point of *AB* be (x_1, y_1), then the equation of the line is

(a) $y_1 x + x_1 y = 2x_1 y_1$ (b) $x_1 x + y_1 y = 2x_1 y_1$

(c) $y_1 x + x_1 y = x_1 y_1$ (d) $x_1 x + y_1 y = x_1 y_1$

11. Equation of a line through the origin and perpendicular to, the line joining (*a*, 0) and (– *a*, 0), is

(a) $y = 0$ (b) $x = 0$

(c) $x = -a$ (d) $y = -a$

12. The equation of line, which bisect the line joining two points (2, – 19) and (6, 1) and perpendicular to the line joining two points (– 1, 3) and (5, – 1), is

(a) $3x - 2y = 30$ (b) $2x - y - 3 = 0$

(c) $2x + 3y = 20$ (d) None of these

13. The equation of the lines which passes through the point (3, – 2) and are inclined at 60^{o} to the line $\sqrt{3}x + y = 1$

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

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

(c) $\sqrt{3}x - y - 2 - 3\sqrt{3} = 0$

(d) None of these

14. **The equation of a straight line passing through** $(-3, 2)$ **and cutting an intercept equal in magnitude but opposite in sign from the axes is given by**

(a) $x - y + 5 = 0$ (b) $x + y - 5 = 0$

(c) $x - y - 5 = 0$ (d) $x + y + 5 = 0$

15. **The equation of the line passing through (4, – 6) and makes an angle** 45^o **with positive *x*–axis, is**

(a) $x - y - 10 = 0$ (b) $x - 2y - 16 = 0$

(c) $x - 3y - 22 = 0$ (d) None of these

16. **Equation of the line passing through (–1,1) and perpendicular to the line** $2x + 3y + 4 = 0,$ **is**

(a) $2(y - 1) = 3(x + 1)$ (b) $3(y - 1) = -2(x + 1)$

(c) $y - 1 = 2(x + 1)$ (d) $3(y - 1) = x + 1$

17. **The equation of a line passing through the point of intersection of the lines** $x + 5y + 7 = 0,\ 3x + 2y - 5 = 0,$ **and perpendicular to the line** $7x + 2y - 5 = 0,$ **is given by**

(a) $2x - 7y - 20 = 0$ (b) $2x + 7y - 20 = 0$

(c) $-2x + 7y - 20 = 0$ (d) $2x + 7y + 20 = 0$

18. **The equation of line passing through (*c, d*) and parallel to** $ax + by + c = 0,$ **is**

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

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

19. **The points *A* (1, 3) and *C* (5, 1) are the opposite vertices of rectangle. The equation of line passing through other two vertices and of gradient 2, is**

(a) $2x + y - 8 = 0$ (b) $2x - y - 4 = 0$

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

20. **The straight line passes through the point of inter -section of the straight lines** $x + 2y - 10 = 0$ **and** $2x + y + 5 = 0,$ **is**

(a) $5x - 4y = 0$ (b) $5x + 4y = 0$

(c) $4x - 5y = 0$ (d) $4x + 5y = 0$

21. **If the equation** $y = mx + c$ **and** $x\cos\alpha + y\sin\alpha = p$ **represents the same straight line, then**

(a) $p = c\sqrt{1 + m^2}$ (b) $c = p\sqrt{1 + m^2}$ (c) $cp = \sqrt{1 + m^2}$ (d) $p^2 + c^2 + m^2 = 1$

22. Equations of lines which passes through the points of intersection of the lines $4x-3y-1=0$ and $2x-5y+3=0$ and are equally inclined to the axes are

(a) $y \pm x = 0$ (b) $y-1=\pm 1(x-1)$

(c) $x-1=\pm 2(y-1)$ (d) None of these

23. 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)** $2x+y-4=0$

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

(a) $3x-4y-6=0$ and $4x+3y+1=0$

(b) $3x-4y+6=0$ and $4x-3y-1=0$

(c) $3x-4y+6=0$ and $4x-3y+1=0$

(d) None of these

25. The equation of the straight line joining the point (a, b) to the point of intersection of the lines $\frac{x}{a}+\frac{y}{b}=1$ and $\frac{x}{b}+\frac{y}{a}=1$ is

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

(c) $a^2y+b^2x=ab$ (d) $a^2x+b^2y=ab\,(a-b)$

26. Equation of a straight line on which length of perpendicular from the origin is four units and the line makes an angle of 120° with the *x*–axis, is

(a) $x\sqrt{3}+y+8=0$ (b) $x\sqrt{3}-y=8$

(c) $x\sqrt{3}-y=8$ (d) $x-\sqrt{3}\,y+8=0$

27. 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

28. A line is such that its segment between the straight lines $5x-y-4=0$ and $3x+4y-4=0$ is bisected at the point (1, 5), then its equation is

(a) $83x-35y+92=0$ (b) $35x-83y+92=0$ (c) $35x+35y+92=0$ (d)None of these

29. Equation to 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 axis of *x*, is

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

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

30. Equation of the line which passes through the point $(-4, 3)$ and the portion of the line intercepted between the axes is divided internally in the ratio 5 : 3 by this point, is

(a) $9x + 20y + 96 = 0$ (b) $20x + 9y + 96 = 0$

(c) $9x - 20y + 96 = 0$ (d) None of these

31. A straight the makes an angle of 135^o with the *x*–axis and cuts *y*–axis at a distance – 5 from the origin. The equation of the line is

(a) $2x + y + 5 = 0$ (b) $x + 2y + 3 = 0$

(c) $x + y + 5 = 0$ (d) $x + y + 3 = 0$

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

(a) $x\cos\theta - y\sin\theta = a\cos 2\theta$

(b) $x\cos\theta + y\sin\theta = a\cos 2\theta$

(c) $x\sin\theta + y\cos\theta = a\cos 2\theta$

(d) None of these

33. If the intercept made by the line between the axis is bisected at the point (5, 2), then its equation is

(a) $5x + 2y = 20$ (b) $2x + 5y = 20$

(c) $5x - 2y = 20$ (d) $2x - 5y = 20$

34. 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) $4/3$

35. The equation of straight line passing through point of intersection of the straight lines $3x - y + 2 = 0$ and $5x - 2y + 7 = 0$ having infinite slope is

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

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

(a) $y=4$ (b) $4x-3y+8=0$

(c) $4x-3y=0$ (d) $4x-3y+6=0$

37. **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) $x+2y-7=0$

38. **If $u=a_1x+b_1y+c_1=0$, $v=a_2x+b_2y+c_2=0$ and $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$, then the curve $u+kv=0$ is**

(a) The same straight line u (b)Different straight line

(c) It is not a straight line (d)None of these

39. **The diagonal passing through origin of a quadrilateral formed by $x=0, y=0, x+y=1$ and $6x+y=3$, is**

(a) $3x-2y=0$ (b) $2x-3y=0$

(c) $3x+2y=0$ (d) None of these

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

(a) $x+2y=0$ (b) $2x+y=0$

(c) $x-y=0$ (d) None of these

41. ***A*(–1, 1), *B*(5, 3) are opposite vertices of a square in *xy*-plane. The equation of the other diagonal (not passing through (*A*, *B*) of the square is given by**

(a) $x-3y+4=0$ (b) $2x-y+3=0$

(c) $y+3x-8=0$ (d) $x+2y-1=0$

42. **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) $b=c$ (b) $c=a$

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

(e) All the above

43. 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) $3x - 4y + 4a = 0$

44. The equation to the line 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) $2x + y = 7$

45. The points (1, 3) and (5, 1) are the opposite vertices of a rectangle. The other two vertices lie on the line $y = 2x + c$, then the value of *c* will be

(a) 4 (b) – 4

(c) 2 (d) – 2

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

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

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

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

(d) None of these

47. If *a, b, c* are in harmonic progression, then straight line $\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes through a fixed point, that point is

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

48. The equation of the line which makes right angled triangle with axes whose area is 6 *sq. units* and whose hypotenuse is of 5 *units*, is

(a) $\frac{x}{4} + \frac{y}{3} = \pm 1$ (b) $\frac{x}{4} - \frac{y}{3} = \pm 3$ (c) $\frac{x}{6} + \frac{y}{1} = \pm 1$ (d) $\frac{x}{1} - \frac{y}{6} = \pm 1$

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

(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 $\frac{x}{-2} + \frac{y}{1} = -1$

50. A straight line moves so that the sum of the reciprocals of its intercepts on two perpendicular lines is constant, then the line passes through

(a) A fixed point (b)A variable point

(c) Origin (d) None of these

51. The triangle *PQR* is inscribed in the circle $x^2+y^2=25$. If *Q* and *R* have co-ordinates (3,4) and (– 4, 3) respectively, then $\angle QPR$ is equal to

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

52. A line passing through origin and is perpendicular to two given lines $2x+y+6=0$ and $4x+2y-9=0$, then the ratio in which the origin divides this line is

(a) 1 : 2 (b) 2 : 1

(c) 4 : 3 (d) 3 : 4

53. 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)

54. A straight line makes an angle of 135^o with *x*–axis and cuts *y*-axis at a distance of – 5 from the origin. The equation of the line is

(a) $2x+y+5=0$ (b) $x+2y+3=0$

(c) $x+y+5=0$ (d) $x+y+3=0$

55. The line 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 3/2 from it

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

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

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

56. If the slope of a line passing through the point A (3, 2) be 3/4, then the points on the line which are 5 units away from *A* are

(a) (5, 5), (– 1, – 1) (b) (7, 5), (– 1, – 1)

(c)(5, 7), (– 1, – 1) (d) (7, 5), (1, 1)

57. The equations of the lines through the origin making an angle of 60^o with the line $x+y\sqrt{3}+3\sqrt{3}=0$ are

(a) $y=0, x-y\sqrt{3}=0$ (b) $x=0, x-y\sqrt{3}=0$

(c) $x=0, x+y\sqrt{3}=0$ (d) $y=0, x+y\sqrt{3}=0$

58. Angle between the lines $2x-y-15=0$ and $3x+y+4=0$ is

(a) 90^o (b) 45^o

(c) 180^o (d) 60^o

59. The lines $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ are perpendicular to each other, if

(a) $a_1b_2-b_1a_2=0$ (b) $a_1a_2+b_1b_2=0$

(c) $a_1^2b_2+b_1^2a_2=0$ (d) $a_1b_1+a_2b_2=0$

60. Equation of angle bisectors between *x* and *y* -axes are

a) $y=\pm x$ (b) $y=\pm 2x$

(c) $y=\pm\frac{1}{\sqrt{2}}x$ (d) $y=\pm 3x$

61. The angle between the lines $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0,$ is

(a) $\tan^{-1}\frac{a_1b_2+a_2b_1}{a_1a_2-b_1b_2}$ (b) $\cot^{-1}\frac{a_1a_2+b_1b_2}{a_1b_2-a_2b_1}$

(c) $\cot^{-1}\frac{a_1b_1-a_2b_2}{a_1a_2+b_1b_2}$ (d) $\tan^{-1}\frac{a_1b_1-a_2b_2}{a_1a_2+b_1b_2}$

62. Angle between the lines $\frac{x}{a}+\frac{y}{b}=1$ and $\frac{x}{a}-\frac{y}{b}=1$ is

(a) $2\tan^{-1}\frac{b}{a}$ (b) $\tan^{-1}\frac{2ab}{a^2+b^2}$

(c) $\tan^{-1}\frac{a^2-b^2}{a^2+b^2}$ (d) None of these

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

(a) 90^o (b) 60^o

(c) 75^o (d) 30^o

64. The angle between the lines whose intercepts on the axes are *a, – b* and *b, – a* respectively, is

(a) $\tan^{-1}\frac{a^2-b^2}{ab}$ (b) $\tan^{-1}\frac{b^2-a^2}{2}$

(c) $\tan^{-1}\frac{b^2-a^2}{2ab}$ (d) None of these

65. **If** $\frac{1}{ab'}+\frac{1}{ba'}=0,$ **then lines** $\frac{x}{a}+\frac{y}{b}=1$ **and** $\frac{x}{b'}+\frac{y}{a'}=1$ **are**

(a) Parallel

(b) Inclined at 60^o to each other

(c) Perpendicular to each other

(d) Inclined at 30^o to each other

66. **Let** $P(-1,0),$ $Q(0,0)$ **and** $R(3,3\sqrt{3})$ **be three points. Then the equation of the bisector of the angle** ***PQR*** **is**

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

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

67. **The number of straight lines which is equally inclined to both the axes is**

(a) 4 (b) 2

(c) 3 (d) 1

68. **If the lines** $y=3x+1$ **and** $2y=x+3$ **are equally inclined to the line** $y=mx+4,$ **then** ***m*** **=**

(a) $\frac{1+3\sqrt{2}}{7}$ (b) $\frac{1-3\sqrt{2}}{7}$

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

69. **The angle between the lines** $x\cos\alpha_1+y\sin\alpha_1=p_1$ **and** $x\cos\alpha_2+y\sin\alpha_2=p_2$ **is**

(a) $(\alpha_1+\alpha_2)$ (b) $(\alpha_1 \sim \alpha_2)$

(c) $2\alpha_1$ (d) $2\alpha_2$

70. **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) $3x+y-7=0$

71. **If the lines** $y=(2+\sqrt{3})x+4$ **and** $y=kx+6$ **are inclined at an angle** 60^o **to each other, then the value of** ***k*** **will be**

(a) 1 (b) 2

(c) – 1 (d) – 2

72. The product of the perpendiculars drawn from the points $(\pm\sqrt{a^2-b^2},0)$ **on the line** $\frac{x}{a}\cos\theta+\frac{y}{b}\sin\theta=1$ **, is**

(a) a^2 (b) b^2

(c) a^2+b^2 (d) a^2-b^2

73. If p **and** p' **be the distances of origin from the lines** $x\sec\alpha+y\,\text{cosec}\,\alpha=k$ **and** $x\cos\alpha-y\sin\alpha=k\cos 2\alpha$ **, then** $4p^2+p'^2=$

(a) k (b) $2k$

(c) k^2 (d) $2k^2$

74. The length of the perpendicular from the point (b,a) **to the line** $\frac{x}{a}-\frac{y}{b}=1$**, is**

(a) $\left|\frac{a^2-ab+b^2}{\sqrt{a^2+b^2}}\right|$ (b) $\left|\frac{b^2-ab-a^2}{\sqrt{a^2+b^2}}\right|$

(c) $\left|\frac{a^2+ab-b^2}{\sqrt{a^2+b^2}}\right|$ (d) None of these

75. The point on the line $x+y=4$ **which lie at a unit distance from the line** $4x+3y=10$ **, are**

(a) $(3,1),(-7,11)$ (b) $(3,1),(7,11)$

(c) $(-3,1),(-7,11)$ (d) $(1,3),(-7,11)$

76. The vertex of an equilateral triangle is (2,–1) and the equation of its base in $x+2y=1$**. The length of its sides is**

(a) $4/\sqrt{15}$ (b) $2/\sqrt{15}$

(c) $4/3\sqrt{3}$ (d) $1/\sqrt{5}$

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

(a) 3/2 (b) 3/10

(c) 6 (d) None of these

78. If the length of the perpendicular drawn from the origin to the line whose intercepts on the axes are *a* and *b* be *p*, then

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

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

79. In what ratio the line $y-x+2=0$ divides the line joining the points (3, –1) and (8, 9)

(a) 1 : 2 (b) 2 : 1

(c) 2 : 3 (d) 3 : 4

80. Which pair of points lie on the same side of $3x-8y-7=0$

(a) (0, –1) and (0, 0) (b)(4, –3) and (0, 1)

(c) (–3, –4) and (1, 2) (d)(–1, –1) and (3, 7)

81. 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

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

(a) $\sqrt{3/2}$ (b) $\sqrt{2}$

(c) $\sqrt{2/3}$ (d) None of these

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

(a) $\sqrt{2}$ (b) $\frac{5}{\sqrt{2}}$

(c) $\frac{1}{\sqrt{2}}$ (d) 6

84. 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) $c\cos\alpha$ (b) $c\sin^2\alpha$

(c) $c\sec^2\alpha$ (d) $c\cos^2\alpha$

85. If $2p$ is the length of perpendicular from the origin to the lines $\frac{x}{a}+\frac{y}{b}=1$, then $a^2, 8p^2, b^2$ are in

(a) A. P. (b) G.P.

(c) H. P. (d) None of these

86. If the lines $ax+y+1=0, x+by+1=0$ and $x+y+c=0$ (*a, b, c* being distinct and different from 1) are concurrent, then $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=$

(a) 0 (b) 1 (c) $\frac{1}{a+b+c}$ (d)None of these

87. If the given lines $y = m_1x + c_1, y = m_2x + c_2$ **and** $y = m_3x + c_3$ **be concurrent, then**

(a) $m_1(c_2 - c_3) + m_2(c_3 - c_1) + m_3(c_1 - c_2) = 0$

(b) $m_1(c_2 - c_1) + m_2(c_3 - c_2) + m_3(c_1 - c_3) = 0$

(c) $c_1(m_2 - m_3) + c_2(m_3 - m_1) + c_3(m_1 - m_2) = 0$

(d) None of these

88. The straight lines $4ax + 3by + c = 0$ **where** $a + b + c = 0$**, will be concurrent, if point is**

(a) (4, 3) (b) (1/4, 1/3)

(c) (1/2, 1/3) (d) None of these

89. If the lines $ax + by + c = 0$**,** $bx + cy + a = 0$ **and** $cx + ay + b = 0$ **be concurrent, then**

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

(c) $a^3 + b^3 + c^3 - 3abc = 0$ (d)None of these

90. The value of *k* for which the lines $7x - 8y + 5 = 0$**,** $3x - 4y + 5 = 0$ **and** $4x + 5y + k = 0$ **are concurrent is given by**

(a) – 45 (b) 44

(c) 54 (d) – 54

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

(a) All *a* (b) $a = 4$ only

(c) $-1 \le a \le 3$ (d) $a > 0$ only

92. The lines

$(p - q)x + (q - r)y + (r - p) = 0$, $(q - r)x + (r - p)y + (p - q) = 0$, $(r - p)x + (p - q)y + (q - r) = 0$ are

(a) Parallel (b) Perpendicular

(c) Concurrent (d) None of these

93. The line $2x + 3y = 12$ **meets the *x*-axis at *A* and *y*-axis at *B*. The line through (5, 5) perpendicular to** AB **meets the *x*- axis, *y* axis and the** AB **at *C, D* and *E* respectively. If *O* is the origin of coordinates, then the area of** $OCEB$ **is**

(a) 23 *sq. units* (b) $\frac{23}{2}$ *sq. units*

(c) $\frac{23}{3}$ *sq. Units* (d) None of these

94. If for a variable line $\frac{x}{a}+\frac{y}{b}=1$, the condition $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{c^2}$ (*c* is a constant) is satisfied, then locus of foot of perpendicular drawn from origin to the line is

(a) $x^2+y^2=c^2/2$ (b) $x^2+y^2=2c^2$

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

95. The point (4, 1)undergoes the following two successive transformation

(i) Reflection about the line $y=x$

(ii)Translation through a distance 2 units along the positive *x*-axis

Then the final coordinates of the point are

(a) (4, 3) (b) (3, 4)

(c) (1, 4) (d) $\left(\frac{7}{2},\frac{7}{2}\right)$

96. Coordinates 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) None of these

97. A straight line passes through a fixed point (h,k). The locus of the foot of perpendicular on it drawn from the origin is

(a) $x^2+y^2-hx-ky=0$ (b) $x^2+y^2+hx+ky=0$

(c) $3x^2+3y^2+hx-ky=0$ (d)None of these

98. If *A* and *B* are two points on the line $3x+4y+15=0$ such that $OA=OB=9$ units, then the area of the triangle OAB is

(a) 18 *sq. units* (b) $18\sqrt{2}\,sq.$ *units*

(c) $18/\sqrt{2}$ *sq. units* (d) None of these

99. The co-ordinates of the foot of perpendicular from the point (2, 3) on the line $x+y-11=0$ are

(a) $(-6,5)$ (b) $(5,6)$

(c) $(-5,6)$ (d) $(6,5)$

100. Line *L* has intercepts *a* and *b* on the co-ordinate axes. When the axes are rotated through a given angle keeping the origin fixed, the same line *L* has intercepts *p* and *q*, then

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

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

101. If a variable line drawn 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 midpoint 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

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

(a) Isosceles (b) Equilateral

(c) Right–angled (d) None of these

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

(a) $5a^2 sq$. *units* (b) $\frac{5}{2}a^2 sq.$ *units*

(c) $\frac{25a^2}{2}sq.$ *units* (d) None of these

104. The locus of a point so that sum of its distance from two given perpendicular lines is equal to 2 unit in first quadrant, is

(a) $x+y+2=0$ (b) $x+y=2$

(c) $x-y=2$ (d) None of these

105. Area of the parallelogram formed by the lines $a_1x+b_1y+c_1=0$, $a_1x+b_1y+d_1=0$ and $a_2x+b_2y+c_2=0$, $a_2x+b_2y+d_2=0$ is

(a) $\frac{(d_1-c_1)(d_2-c_2)}{[(a_1^2+b_1^2)(a_2^2+b_2^2)]^{1/2}}$ (b) $\frac{(d_1-c_1)(d_2-c_2)}{a_1a_2-b_1b_2}$ (c) $\frac{(d_1+c_1)(d_2+c_2)}{a_1a_2+b_1b_2}$ (d) $\frac{(d_1-c_1)(d_2-c_2)}{a_1b_2-a_2b_1}$

106. The triangle formed by $x^2 - 9y^2 = 0$ and $x = 4$ is

(a) Isosceles (b) Equilateral

(c) Right angled (d) None of these

107. Locus of the points which are at equal distance from $3x + 4y - 11 = 0$ and $12x + 5y + 2 = 0$ which is near the origin is

(a) $21x - 77y + 153 = 0$ (b) $99x + 77y - 133 = 0$

(c) $7x - 11y = 19$ (d) None of these

108. 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

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

(a) Square (b) Circle

(c) Straight line (d) Two intersecting lines

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

(a) $\frac{c^2}{ab}$ (b) $\frac{2c^2}{ab}$

(c) $\frac{c^2}{2ab}$ (d) None of these

111. The graph of the function $\cos x \cos(x + 2) - \cos^2(x + 1)$ is

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

(b) A straight line passing through (0, 0)

(c) A parabola with vertex $(1, -\sin^2 1)$

(d) A straight line passing through the point $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and parallel to the x–axis

112. A ray of light coming from the point (1, 2) is reflected at a point *A* on the *x*–axis and then passes through the point (5, 3). The coordinates of the point *A* are

(a) $(13/5, 0)$ (b) $(5/13, 0)$

(c) (– 7, 0) (d) None of these

113. 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) $2x + 9y + 7 = 0$

114. The equation of perpendicular bisectors of the sides *AB* and *AC* of a triangle *ABC* are $x - y + 5 = 0$ and $x + 2y = 0$ respectively. If the point *A* is $(1, -2)$, then the equation of line *BC* is

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

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

115. 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) $\sqrt{\frac{15}{2}}$

116. A line *L* passes through the points (1, 1) and (2, 0) and another line L' passes through $\left(\frac{1}{2}, 0\right)$ and perpendicular to *L*. Then the area of the triangle formed by the lines L, L' and *y*- axis, is

(a) 15/8 (b) 25/4

(c) 25/8 (d) 25/16

117. If straight lines $ax + by + p = 0$ and $x\cos\alpha + y\sin\alpha - p = 0$ include an angle $\pi/4$ between them and meet the straight line $x\sin\alpha - y\cos\alpha = 0$ in the same point, then the value of $a^2 + b^2$ is equal to

(a) 1 (b) 2

(c) 3 (d) 4

118. A variable line passes through a fixed point *P*. The algebraic sum of the perpendicular drawn from (2,0), (0, 2) and (1, 1) on the line is zero, then the coordinates of the *P* are

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

119. A line $4x+y=1$ passes through the point $A(2,-7)$ meets the line *BC* whose equation is $3x-4y+1=0$ at the point *B*. The equation to the line *AC* so that *AB* = *AC*, is

(a) $52x+89y+519=0$ (b) $52x+89y-519=0$

(c) $89x+52y+519=0$ (d) $89x+52y-519=0$

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

(a) Rectangle (b) Square

(c) Cyclic quadrilateral (d) Rhombus

121. The vertices of a triangle are (2, 1), (5, 2) and (4, 4). The lengths of the perpendicular from these vertices on the opposite sides are

(a) $\frac{7}{\sqrt{5}},\frac{7}{\sqrt{13}},\frac{7}{\sqrt{6}}$ (b) $\frac{7}{\sqrt{6}},\frac{7}{\sqrt{8}},\frac{7}{\sqrt{10}}$

(c) $\frac{7}{\sqrt{5}},\frac{7}{\sqrt{8}},\frac{7}{\sqrt{15}}$ (d) $\frac{7}{\sqrt{5}},\frac{7}{\sqrt{13}},\frac{7}{\sqrt{10}}$

122. In what direction a line be drawn through the point (1, 2) so that its points of intersection with the line $x+y=4$ is at a distance $\frac{\sqrt{6}}{3}$ from the given point

(a) 30^o (b) 45^o

(c) 60^o (d) 75^o

123. The equations of two equal sides of an isosceles triangle are $7x-y+3=0$ and $x+y-3=0$, the third side passes through the point (1, – 10). The equation of the third side is

(a) $x-3y-31=0$ But not $3x+y+7=0$

(b) $3x+y+7=0$ But not $x-3y-31=0$

(c) $3x+y+7=0$ Or $x-3y-31=0$

(d) Neither $3x+y+7$ nor $x-3y-31=0$

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

(a) $\sqrt{2}$ (b) 1 (c) $\sqrt{3}$ (d) 2

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

(a) $2x+3y+22=0$ (b) $5x-4y+7=0$ (c) $3x-2y+3=0$ (d) None of these

STRAIGHT LINES

HINTS AND SOLUTIONS

1. (b) The given line can be written in this form $(3+2\lambda)x+(-1-3\lambda)y+(5-4\lambda)=0$

It is will be parallel to *y*-axis, if $-1-3\lambda=0 \Rightarrow \lambda=-\frac{1}{3}$.

2. (c) Solving $y=m_r x$ and $x+y=1$, Thus the points of intersection of the three lines on the transversal are $\left(\frac{1}{1+m_1},\frac{m_1}{1+m_1}\right)$, $\left(\frac{1}{1+m_2},\frac{m_2}{1+m_2}\right)$ and $\left(\frac{1}{1+m_3},\frac{m_3}{1+m_3}\right)$

By hypothesis, $\left(\frac{1}{1+m_1}-\frac{1}{1+m_2}\right)^2+\left(\frac{m_1}{1+m_1}-\frac{m_2}{1+m_2}\right)^2 = \left(\frac{1}{1+m_2}-\frac{1}{1+m_3}\right)^2+\left(\frac{m_2}{1+m_2}-\frac{m_3}{1+m_2}\right)^2$

$\Rightarrow$ $1+m_1, 1+m_2, 1+m_3$ are in H.P.

3. (b) A line perpendicular to the line $5x-y=1$ is given by $x+5y-\lambda=0=L$, (given)

In intercept form $\frac{x}{\lambda}+\frac{y}{\lambda/5}=1$

So, area of triangle is $\frac{1}{2}\times$(Multiplication of intercepts)

$\Rightarrow \frac{1}{2}(\lambda)\times\left(\frac{\lambda}{5}\right)=5 \Rightarrow \lambda=\pm 5\sqrt{2}$

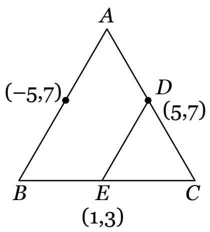
Hence the equation of required straight line is $x+5y=\pm 5\sqrt{2}$.

4. (b) Let the required equation is $y=-x+c$ which is perpendicular to $y=x$ and passes through (3, 2). So $2=-3+c \Rightarrow c=5$. Hence required equation is $x+y=5$.

5. (c) Here *D*(1, 1) therefore equation of line *AD* is given by $2x+y-3=0$. Thus the line perpendicular to *AD* is $x-2y+k=0$ and it passes through *B*, so $k=0$. Hence required equation is $x-2y=0$.

6. (b) This question can be checked with the options as the line $4x+3y=24$ passes through (3, 4) and also cuts the intercepts from the axes whose sum is 14.

7. (b) Slope of $DE=\frac{7-3}{5-1}=1 \Rightarrow$ Slope of *AB* = 1



Hence equation of *AB*

8. (a) The equation of lines passing through (1, 0) are given by $y = m(x-1)$. Its distance from origin is $\frac{\sqrt{3}}{2}$.

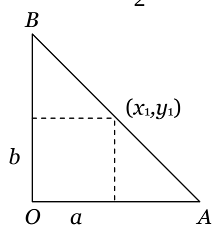
$\Rightarrow \left|\frac{-m}{\sqrt{1+m^2}}\right| = \frac{\sqrt{3}}{2} \Rightarrow m = \pm\sqrt{3}$. Hence the lines are $\sqrt{3}x + y - \sqrt{3} = 0$ and $\sqrt{3}x - y - \sqrt{3} = 0$.

9. (a) Point of intersection $y = -\frac{21}{5}$ and $x = \frac{23}{5}$

$\therefore\ 3x + 4y = \frac{3(23)+4(-21)}{5} = \frac{69-84}{5} = -3$.

Hence, required line is $3x + 4y + 3 = 0$.

10. (a) Obviously, $x_1 = \frac{a}{2}$ and $y_1 = \frac{b}{2}$.



Therefore the equation of line AB is $\frac{x}{a} + \frac{y}{b} = 1$

$\Rightarrow \frac{x}{2x_1} + \frac{y}{2y_1} = 1 \Rightarrow xy_1 + yx_1 = 2x_1y_1$.

11. (b) The required equation passing through (0, 0) and its gradient is $m = \frac{1}{0}$, is $y = \frac{1}{0}x \Rightarrow x = 0$.

12. (a) Mid point $\equiv (4, -9)$; Slope $= \frac{-1}{\frac{3+1}{-1-5}} = \frac{3}{2}$

Hence the required line is $3x - 2y = 30$.

13. (a) The equation of any straight line passing through (3, –2) is $y + 2 = m(x-3)$ .....(i)

The slope of the given line is $-\sqrt{3}$.

So, $\tan 60^o = \pm\frac{m-(-\sqrt{3})}{1+m(-\sqrt{3})}$

On solving, we get $m = 0$ or $\sqrt{3}$

Putting the values of *m* in (i), the required equation of lines are $y + 2 = 0$ and $\sqrt{3}x - y = 2 + 3\sqrt{3}$.

14. (a) Let the equation be $\frac{x}{a} + \frac{y}{-a} = 1 \Rightarrow x - y = a$

But it passes through $(-3, 2)$, hence $a = -3 - 2 = -5$. Hence the equation is $x - y + 5 = 0$.

15. (a) The required equation is $y + 6 = \tan 45^o(x-4) \Rightarrow x - y - 10 = 0$.

16. (a) The gradient of line $2x+3y+4=0$ is $-\frac{2}{3}$. Now the equation of line passing through (–1,1) is

$y-1=m(x+1)$, but $m=-\frac{1}{-2/3}=\frac{3}{2}$.

17. (a) Point of intersection of the lines is (3, –2).

Hence the equation is $2x-7y=2(3)-7(-2)=20$.

18. (c) The required equation which passes through (c, d) and its gradient is $-\frac{a}{b}$, is $y-d=-\frac{a}{b}(x-c)$

$\Rightarrow a(x-c)+b(y-d)=0$.

19. (b) Mid point $\equiv(3,2)$. Equation is $2x-y-4=0$.

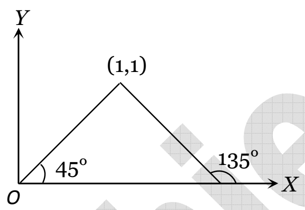
20. (b) From (b),

$$\begin{vmatrix} 1 & 2 & -10 \\ 2 & 1 & 5 \\ 5 & 4 & 0 \end{vmatrix} = 1(0-20)-2(-25)-10(3)=0$$

21. (b) If the given lines represent the same line, then the length of the perpendiculars from the origin to the lines are equal, so that $\frac{c}{\sqrt{1+m^2}}=\frac{p}{\sqrt{\cos^2\alpha+\sin^2\alpha}}$

$\Rightarrow c=p\sqrt{1+m^2}$.

22. (b) Slopes of the lines are 1 and –1



Since the point of intersection is (1, 1)

Hence the required equations are $y-1=\pm1(x-1)$.

23. (d) Let the equation of the line be $\frac{x}{a}+\frac{y}{b}=1$. The coordinates of the midpoint of the intercept AB between the axes are $\left(\frac{a}{2},\frac{b}{2}\right)$.

$\therefore\ \frac{a}{2}=1, \frac{b}{2}=2 \Rightarrow a=2, b=4$.

Hence the equation of the line is $\frac{x}{2}+\frac{y}{4}=1$, $2x+y=4$.

24. (c) Point of intersection is (2, 3). the equation of line is $y - 3 = m(x-2)$ ……(i)

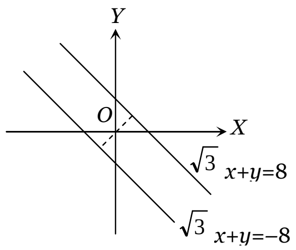
NOW $\frac{3m - 2 - (2m-3)}{\sqrt{1+m^2}} = \frac{7}{5} \Rightarrow m = \frac{3}{4}, \frac{4}{3}$

Equations are $3x - 4y + 6 = 0$ and $4x - 3y + 1 = 0$.

25. (a) The given lines intersect at $\left(\frac{ab}{a+b}, \frac{ab}{a+b}\right)$ and join of this with (a, b) will have slope $\frac{b^2}{a^2}$.

26. (a) Slope $= -\sqrt{3}$

$\therefore$ Line is $y = -\sqrt{3}x + c \Rightarrow \sqrt{3}x + y = c$



Now $\frac{c}{2} = |4| \Rightarrow c = \pm 8 \Rightarrow x\sqrt{3} + y = \pm 8$.

27. (b) The equation of any line parallel to $2x + 6y + 7 = 0$ is $2x + 6y + k = 0$.

This meets the axes at $A\left(-\frac{k}{2}, 0\right)$ and $B\left(0, -\frac{k}{6}\right)$.

By hypothesis, $AB = 10$

$\Rightarrow \sqrt{\frac{k^2}{4} + \frac{k^2}{36}} = 10 \Rightarrow \sqrt{\frac{10k^2}{36}} = 10$

$\Rightarrow 10k^2 = 3600 \Rightarrow k = \pm 6\sqrt{10}$.

28. (a) Any line through the middle point $M(1, 5)$ of the intercept AB may be taken as

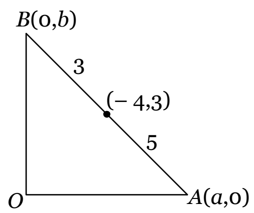
$\frac{x-1}{\cos\theta} = \frac{y-5}{\sin\theta} = r$ …..(i)

Where 'r' is the distance of any point (x, y) on the line (i) from the point $M(1, 5)$.

29. (d) $y = mx + c$; $\because$ $m = \tan 30° = \frac{1}{\sqrt{3}}$; $c = -2$

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

30. (c)



By the section formula, we get $a=-\frac{32}{3}$ and $b=\frac{24}{5}$.

$\therefore \frac{x}{-(32/3)}+\frac{y}{(24/5)}=1 \Rightarrow 9x-20y+96=0$.

31. (c) $\because y=mx+c \implies y=(\tan 135^{\circ})x-5$

$\implies y=-x-5 \Rightarrow x+y+5=0$.

32. (a) $x\cos\theta - y\sin\theta = a(\cos^4\theta-\sin^4\theta)=a\cos 2\theta$.

33. (b) The intercept made by the line between the axis is (10, 4).

Hence, equation of line, $\frac{x}{10}+\frac{y}{4}=1 \Rightarrow 2x+5y=20$.

34. (d) The equation of a line passing through (2, 2) and perpendicular to $3x+y=3$ is $y-2=\frac{1}{3}(x-2)$

or $x-3y+4=0$.

Putting $x=0$ in this equation, we obtain $y=4/3$.

So, y-intercept $=4/3$

35. (c) Required line should be,

$(3x-y+2)+\lambda(5x-2y+7)=0$ ..... (i)

$\implies (3+5\lambda)x-(2\lambda+1)y+(2+7\lambda)=0$

$\implies y=\frac{3+5\lambda}{2\lambda+1}x+\frac{2+7\lambda}{2\lambda+1}$ ..... (ii)

As the equation (ii), has infinite slope, $2\lambda+1=0$

$\implies \lambda=-1/2$ Putting $\lambda=-1/2$ in equation (i) we have $(3x-y+2)+(-1/2)(5x-2y+7)=0 \implies x=3$.

36. (c) Given, line making 0 intercepts on x-axis and y-axis. Therefore, it is passing through origin and its equation is $4x-3y=0$.

37. (a) The equation of line passing through the midpoint of $(-4,6)$ and $(8,8)$ and perpendicular to this line is $6x+y-19=0$.

38. (a) $u=a_1x+b_1y+c_1=0, v=a_2x+b_2y+c_2=0$

And $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}=c$ (Let)

$\implies a_2=\frac{a_1}{c}, b_2=\frac{b_1}{c}, c_2=\frac{c_1}{c}$

Given that $u + kv = 0$

$\Rightarrow a_1x + b_1y + c_1 + k(a_2x + b_2y + c_2) = 0$

$\Rightarrow a_1x + b_1y + c_1 + k\frac{a_1}{c}x + k\frac{b_1}{c}y + k\frac{c_1}{c} = 0$

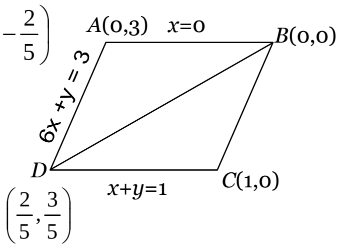
$\Rightarrow a_1x\left(1+\frac{k}{c}\right) + b_1y\left(1+\frac{k}{c}\right) + c_1\left(1+\frac{k}{c}\right) = 0$

$\Rightarrow a_1x + b_1y + c_1 = 0 = u$.

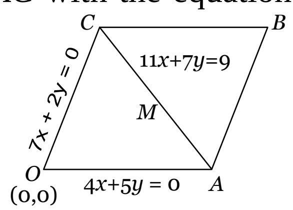
39. (a) According to the figure, diagonal *BD* is passing through origin, therefore its equation is given by

$\left(y - \frac{3}{5}\right) = \frac{-(3/5)}{-(2/5)}\left(x - \frac{2}{5}\right)$

$\Rightarrow 3x - 2y = 0$.



40. (c) Since equation of diagonal $11x + 7y = 9$ does not pass through origin, so it cannot be the equation of the diagonal *OB*. Thus on solving the equation *AC* with the equations *OA* and *OC*, we get $A\left(\frac{5}{3}, -\frac{4}{3}\right)$ and $C\left(\frac{-2}{3}, \frac{7}{3}\right)$.



Therefore, the middle point *M* is $\left(\frac{1}{2}, \frac{1}{2}\right)$

Hence the equation of *OB* is $y = x$ *i.e.*, $x - y = 0$

41. (c) The required diagonal passes through the mid-point of AB and is perpendicular to AB. So its equation is $y - 2 = -3(x - 2)$ or $3x + y - 8 = 0$.

42. (e) The two lines will be identical if there exists some real number *k* such that

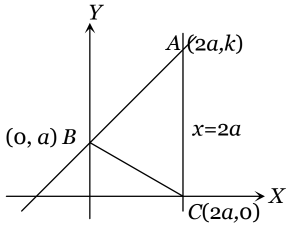
$b^3 - c^3 = k(b - c),\ c^3 - a^3 = k(c - a)$, $a^3 - b^3 = k(a - b)$

$\Rightarrow b - c = 0$ Or $b^2 + c^2 + bc = k$ & $c - a = 0$ or $c^2 + a^2 + ac = k$ & $a - b = 0$ or $a^2 + b^2 + ab = k$

$\Rightarrow b = c, c = a, a = b$ Or $b^2 + c^2 + bc = c^2 + a^2 + ca$

$\Rightarrow b^2 - a^2 = c(a - b) \Rightarrow b = a$ or $a + b + c = 0$.

43. (d) Obviously, other line AB will pass through (0, a) and $(2a, k)$.



But as we are given $AB = AC$

$\Rightarrow k = \sqrt{4a^2 + (k-a)^2} \Rightarrow k = \frac{5a}{2}$

Hence the required equation is $3x - 4y + 4a = 0$.

44. (c) Given equation of line having it intercepts on the x- axis and y–axis in the ratio 2:1 *i.e.*, 2a and a

$\therefore \frac{x}{2a} + \frac{y}{a} = 1 \Rightarrow x + 2y = 2a$ .....(i)

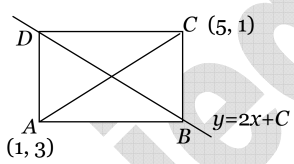
According to question,

Line (i) also passes through midpoint of $(3,-4)$ and (5,2) *i.e.*, $(4,-1)$.

$\therefore 4 + 2(-1) = 2a \Rightarrow a = 1$

Hence the equation of required line is, $x + 2y = 2$.

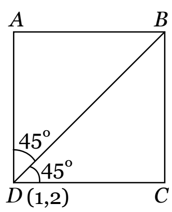
45. (b) Let $ABCD$ be a rectangle. Given A (1, 3) and C (5, 1). Equation B and D lie on $y = 2x + c$



We know that intersecting point of diagonal of rectangle is same or at midpoint. So midpoint of AC is (3, 2). So $y = 2x + c$ passes through (3, 2). Hence $c = -4$.

46. (c) Slope of BD is $\frac{8}{15}$ and angle made by BD with AD and DC is 45^o. So let slope of DC be m,

then $\tan 45^o = \pm \frac{m - \frac{8}{15}}{1 + \frac{8}{15}m}$



$\Rightarrow (15 + 8m) = \pm(15m - 8)$

$\Rightarrow m = \frac{23}{7}$ and $-\frac{7}{23}$

Find the equations of the req. lines

47. (c) Checking from options, let a, b, c are $\frac{1}{1},\frac{1}{2},\frac{1}{3}$.

Then $x+2y+3=0$ will satisfy (c) option.

48. (a) Check with options. Obviously, the line $\frac{x}{4}+\frac{y}{3}=\pm 1$ satisfies both the conditions.

49. (a) Here $a+b=-1$. Required line is $\frac{x}{a}-\frac{y}{1+a}=1$ .....(i)

Since line (i) passes through (4, 3)

$$\therefore \frac{4}{a}-\frac{3}{1+a}=1 \Rightarrow 4+4a-3a=a+a^2$$

$$\Rightarrow a^2=4 \Rightarrow a=\pm 2$$

$\therefore$ Required lines are $\frac{x}{2}-\frac{y}{3}=1$ and $\frac{x}{-2}+\frac{y}{1}=1$.

50. (a) $\frac{x}{a}+\frac{y}{b}=1$ .....(i)

According to the question $\frac{1}{a}+\frac{1}{b}=\frac{1}{k}$, (say)

i.e., $\frac{k}{a}+\frac{k}{b}=1$ .....(ii)

The result (ii) shows that the straight line (i) passes through a fixed point (k, k).

51. (c) Here the centre $0(0,0)$. So 'm' of OQ is $\frac{4}{3}$ and 'm' of OR is $\frac{-3}{4}$, $\therefore \angle QOR=\frac{\pi}{2}$

Hence $\angle QPR=\frac{1}{2}\times\frac{\pi}{2}=\frac{\pi}{4}$.

52. (c) Equation of line Perpendicular to $2x+y+6=0$ passes through (0, 0) is $x-2y=0$

Now point of intersection of $x-2y=0$ and $2x+y+6=0$ is $\left(\frac{-12}{5},\frac{-6}{5}\right)$ and point of intersection of $x-2y=0$ and $4x+2y-9=0$ is $\left(\frac{9}{5},\frac{9}{10}\right)$.

Now say origin divide the line $x-2y=0$ in the ratio $\lambda:1$

$$\therefore x=\frac{\frac{9}{5}\lambda-\frac{12}{5}}{\lambda+1}=0 \Rightarrow \frac{9}{5}\lambda=\frac{12}{5}, \therefore \lambda=\frac{4}{3}$$

Thus origin divides the line $x=2y$, in the ratio 4 : 3.

53. (a) Equation of the required line is, $\frac{x}{a}+\frac{y}{b}=1$.

From option (a), only point $(3a,-2b)$ lies on it.

54. (c) Let the equation of line is $y = mx + c$

Given line makes an angle of $135°$ with *x*-axis

So, $m = \tan\theta = \tan 135° = -1$ and cuts the intercepts -5 from origin to *y*-axis *i.e.*, $c = -5$

Hence, equation of line is $y = -x - 5 \Rightarrow x + y + 5 = 0$.

55. (c) The lines passing through the intersection of the lines $ax + 2by + 3b = 0$ and $bx - 2ay - 3a = 0$ is

$ax + 2by + 3b + \lambda(bx - 2ay - 3a) = 0$

$\Rightarrow (a + b\lambda)x + (2b - 2a\lambda)y + 3b - 3\lambda a = 0$ .....(i)

Line (i) is parallel to *x*-axis, $\therefore\ a + b\lambda = 0 \Rightarrow \lambda = \frac{-a}{b} = 0$

Put the value of λ in (i)

$ax + 2by + 3b - \frac{a}{b}(bx - 2ay - 3a) = 0$

$y\left(2b + \frac{2a^2}{b}\right) + 3b + \frac{3a^2}{b} = 0$, $y\left(\frac{2b^2 + 2a^2}{b}\right) = -\left(\frac{3b^2 + 3a^2}{b}\right)$

$y = \frac{-3(a^2 + b^2)}{2(b^2 + a^2)} = \frac{-3}{2}$, $y = -\frac{3}{2}$

So, it is 3/2 unit below *x*-axis.

56. (b) The equation of line passes through (3, 2) and of slope $\frac{3}{4}$ is $3x - 4y - 1 = 0$

Let the point be (h, k) then $3h - 4k - 1 = 0$ ......(i)

And $(h - 3)^2 + (y - 2)^2 = 5^2$ ...... (ii)

On solving the equations, we get $h = -1, 7$ and $k = -1, 5$. Hence points are (–1, –1) and (7, 5).

57. (b) Since the line $x + y\sqrt{3} + 3\sqrt{3} = 0$ makes an angle of $150°$ with x-axis. Therefore, the required lines will make angles of $90°$ and $210°$ *i.e.*, $30°$ with the positive direction of *x*-axis.

Hence the lines are $x = 0$ and $y = \frac{1}{\sqrt{3}}x$.

58. (b) If angle between them is θ, then

$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right| = \left|\frac{2 + 3}{1 - 6}\right| = \left|\frac{5}{-5}\right| = 1$

$\tan\theta = \tan\frac{\pi}{4} \Rightarrow \theta = \frac{\pi}{4} = 45°$.

59. (b) concept

60. (a) Equations of angle bisectors between x and y-axis are $x+y=0$ and $x-y=0$, $(\because \theta = 45^o$ or $135^o)$

Or $y = \pm x$.

61. (b) It is a fundamental concept.

62. (a) $\tan^{-1}\left|\frac{ab-(-ab)}{b^2+(-a^2)}\right| = \tan^{-1}\left|\frac{2ab}{b^2-a^2}\right| = 2\tan^{-1}\frac{b}{a}$.

63. (a) As $a_1a_2+b_1b_2=(1)(\sqrt{3})+(-\sqrt{3})(1)=0$

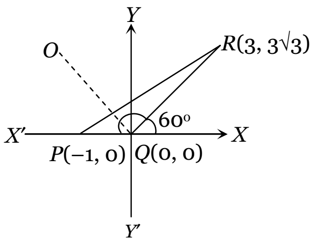
$\therefore$ Lines are perpendicular, $\therefore$ $\theta = 90°$.

64. (c) $\theta = \tan^{-1}\frac{\frac{b}{a}-\frac{a}{b}}{1+\frac{b}{a}.\frac{a}{b}} = \tan^{-1}\frac{b^2-a^2}{2ab}$.

65. (c) $a_1a_2+b_1b_2 = \frac{1}{ab'}+\frac{1}{a'b}=0$

Therefore, the lines are perpendicular.

66. (c)



Slope of QR = $\frac{3\sqrt{3}-0}{3-0}=\sqrt{3}$ *i.e.*, $\theta = 60^o$

Clearly, $\angle PQR = 120^o$

Therefore equation of the bisector of $\angle PQR$ is $y = \tan 120^o x$

67. (b) It is obvious.

68. (d) Let the angle between first and third line is θ_1 and between second and third is θ_2, then

$\tan\theta_1 = \frac{3-m}{1+3m}$ and $\tan\theta_2 = \frac{m-\frac{1}{2}}{1+\frac{m}{2}}$

But $\theta_1=\theta_2 \Rightarrow \frac{3-m}{1+3m} = \frac{m-\frac{1}{2}}{1+\frac{m}{2}}$

$\Rightarrow 7m^2-2m-7=0 \Rightarrow m = \frac{1\pm 5\sqrt{2}}{7}$.

69. (b) $\theta = \tan^{-1}\left[\frac{-\cot\alpha_1+\cot\alpha_2}{1+\cot\alpha_1\cot\alpha_2}\right]$

$= \tan^{-1}\left[\frac{\tan\alpha_2-\tan\alpha_1}{1+\tan\alpha_2\tan\alpha_1}\right] = (\alpha_2 \sim \alpha_1)$

70. (c)The equation of bisector of acute angle formed between the lines $4x-3y+7=0$ and $3x-4y+14=0$ is $\frac{4x-3y+7}{\sqrt{16+9}}=-\frac{3x-4y+14}{\sqrt{16+9}}$

71. (c) $\frac{k-(2+\sqrt{3})}{1+k(2+\sqrt{3})}=\sqrt{3}$ or $k-2-\sqrt{3}=\sqrt{3}+k2\sqrt{3}+3k$,

$k=\frac{-2(1+\sqrt{3})}{2(1+\sqrt{3})}=-1$.

72. (b) Let $a=2, b=1$ and $\theta=\frac{\pi}{2}$, then the points are $(\pm\sqrt{3},0)$ and the line is $y=1$. Length from $(\sqrt{3},0)$ on $y=1$ is 1 and that of from $(-\sqrt{3},0)$ is also 1. Hence product is $1\times 1=1$, which is given by (b).

73. (c) Here $p=\left|\frac{-k}{\sqrt{\sec^2\alpha+\operatorname{cosec}^2\alpha}}\right|$, $p'=\left|\frac{-k\cos 2\alpha}{\sqrt{\cos^2\alpha+\sin^2\alpha}}\right|$

Hence $4p^2+p'^2=\frac{4k^2}{\sec^2\alpha+\operatorname{cosec}^2\alpha}+\frac{k^2(\cos^2\alpha-\sin^2\alpha)^2}{1}$

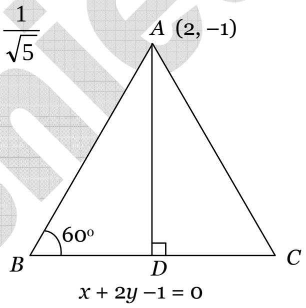
$=4k^2\sin^2\alpha\cos^2\alpha+k^2(\cos^4\alpha+\sin^4\alpha)-2k^2\cos^2\alpha\sin^2\alpha$

$=k^2(\sin^2\alpha+\cos^2\alpha)^2=k^2$.

74. (b) Length of perpendicular is $\left|\frac{\frac{b}{a}-\frac{a}{b}-1}{\sqrt{\left(\frac{1}{a}\right)^2+\left(\frac{1}{b}\right)^2}}\right|=\left|\frac{b^2-a^2-ab}{\sqrt{a^2+b^2}}\right|$

75. (a) Check with options. Obviously, points (3, 1) and (–7,11) lie on $x+y=4$ and perpendicular distance of these points from $4x+3y=10$ is 1.

76. (b) $|AD|=\left|\frac{2-2-1}{\sqrt{1^2+2^2}}\right|=\frac{1}{\sqrt{5}}$



$\tan 60°=\frac{AD}{BD}$

$\Rightarrow \sqrt{3}=\frac{1/\sqrt{5}}{BD}$

$\Rightarrow BD=\frac{1}{\sqrt{15}}$

$BC=2BD=2/\sqrt{15}$.

77. (b) Put $y=0$ in the first equation, we get $x=3$ therefore, the point (3, 0) lies on it. So the required distance between these two lines is the perpendicular length of the line $6x+8y=15$ from the point (3, 0). *i.e.*, $\frac{6\times 3-15}{\sqrt{6^2+8^2}}=\frac{3}{10}$.

78. (d) $p=\frac{ab}{\sqrt{a^2+b^2}}$ or $\frac{a^2+b^2}{a^2b^2}=\frac{1}{p^2}\Rightarrow\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{p^2}$.

79. (c) $2:3$.

80. (d) $L_{(-1,-1)} = 3(-1) - 8(-1) - 7 < 0$

$L_{(3,7)} = 3\times 3 - 8\times 7 - 7 < 0$

Hence (–1, –1) and (3, 7) lie on the same side of line

81. (b) Lines $3x+4y+2=0$ and $3x+4y+5=0$ are on the same side of the origin. The distance between these lines is $d_1 = \left|\frac{2-5}{\sqrt{3^2+4^2}}\right| = \frac{3}{5}$.

Lines $3x+4y+2=0$ and $3x+4y-5=0$ are on the opposite sides of the origin. The distance between these lines is $d_2 = \left|\frac{2+5}{\sqrt{3^2+4^2}}\right| = \frac{7}{5}$.

82. (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 $p = a\sin 60^o \Rightarrow \frac{1}{\sqrt{2}} = \frac{a\sqrt{3}}{2} \Rightarrow a = \sqrt{\frac{2}{3}}$.

83. (a) 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, $\frac{x-1}{\cos 135^o} = \frac{y-1}{\sin 135^o} = r$

$\Rightarrow \frac{x-1}{-1/\sqrt{2}} = \frac{y-1}{1/\sqrt{2}} = r$

Co-ordinates 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

$2\left(1-\frac{r}{\sqrt{2}}\right) - 3\left(1+\frac{r}{\sqrt{2}}\right) = 4 \Rightarrow r = \sqrt{2}$.

84. (a) Here, equation of line is $y = x\tan\alpha + c$, $c>0$

Length of the perpendicular drawn on line from point $(a\cos\alpha, a\sin\alpha)$

$p = \frac{-a\sin\alpha + a\cos\alpha\tan\alpha + c}{\sqrt{1+\tan^2\alpha}}$; $p = \frac{c}{\sec\alpha} = c\cos\alpha$.

85. (c) We have $2p = \left|\frac{0+0-1}{\sqrt{\frac{1}{a^2}+\frac{1}{b^2}}}\right| \Rightarrow \frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{4p^2}$

$\Rightarrow \frac{1}{a^2} + \frac{1}{b^2} = \frac{2}{8p^2} \Rightarrow \frac{1}{a^2}, \frac{1}{8p^2}, \frac{1}{b^2}$ are in A. P.

$\Rightarrow$ $a^2, 8p^2, p^2$ are in H.P .

86. (b) If the given lines are concurrent, then

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

{Apply $C_2 \to C_2 - C_1$ and $C_3 \to C_3 - C_1$ }

$\Rightarrow a(b-1)(c-1) - (b-1)(1-a) - (c-1)(1-a) = 0$

$\Rightarrow \frac{a}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 0$

{Divide by $(1-a)(1-b)(1-c)$ }

$\Rightarrow \frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1$.

87. (a) $\begin{vmatrix} m_1 & -1 & c_1 \\ m_2 & -1 & c_2 \\ m_3 & -1 & c_3 \end{vmatrix} = 0$

88. (b) The set of lines is $4ax + 3by + c = 0$, where $a + b + c = 0$.

Eliminating c, we get $4ax + 3by - (a+b) = 0$

$\Rightarrow a(4x-1) + b(3y-1) = 0$

This passes through the intersection of the lines $4x - 1 = 0$ and $3y - 1 = 0$ *i.e.* $x = \frac{1}{4}, y = \frac{1}{3}$ *i.*e., $\left(\frac{1}{4}, \frac{1}{3}\right)$.

89. (c) The lines will be concurrent, if $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$

90. (a) The lines are concurrent, if $\begin{vmatrix} 7 & -8 & 5 \\ 3 & -4 & 5 \\ 4 & 5 & k \end{vmatrix} = 0$

$\Rightarrow 7(-4k - 25) + 8(3k - 20) + 5(15 + 16) = 0 \Rightarrow k = -45$.

91. (a) Given lines are concurrent, if $\begin{vmatrix} 2 & 1 & -1 \\ a & 3 & -3 \\ 3 & 2 & -2 \end{vmatrix} = 0$.

92. (c) $\begin{vmatrix} p-q & q-r & r-p \\ q-r & r-p & p-q \\ r-p & p-q & q-r \end{vmatrix} = \begin{vmatrix} 0 & q-r & r-p \\ 0 & r-p & p-q \\ 0 & p-q & q-r \end{vmatrix} = 0$

Hence the lines are concurrent.

93. (c) Area of figure $OCEB =$ area of ΔOCE + area of $\Delta OEB = \frac{23}{3} sq.$ *units.*

94. (c) Equation of perpendicular drawn from origin to the line $\frac{x}{a}+\frac{y}{b}=1$ is $y-0=\frac{a}{b}(x-0)$

$\Rightarrow by-ax=0 \Rightarrow \frac{x}{b}-\frac{y}{a}=0$

Now, the locus of foot of perpendicular is the intersection point of line $\frac{x}{a}+\frac{y}{b}=1$ .....(i)

And $\frac{x}{b}-\frac{y}{a}=0$ ......(ii)

To find locus, squaring and adding (i) and (ii)

$$\left(\frac{x}{a}+\frac{y}{b}\right)^2+\left(\frac{x}{b}-\frac{y}{a}\right)^2=1$$

$$\Rightarrow x^2\left(\frac{1}{a^2}+\frac{1}{b^2}\right)+y^2\left(\frac{1}{a^2}+\frac{1}{b^2}\right)=1$$

$$\Rightarrow x^2\left(\frac{1}{c^2}\right)+y^2\left(\frac{1}{c^2}\right)=1, \left[\because \frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{c^2}\right]$$

$$\Rightarrow x^2+y^2=c^2.$$

95. (b) After first transformation, the point will be (1, 4) and therefore, final point is $(1+2,4)=(3,4)$.

96. (b) Slope of perpendicular

$$=-\left[\frac{\cos\alpha-\cos\beta}{\sin\alpha-\sin\beta}\right]=\tan\frac{\alpha+\beta}{2}$$

Hence equation of perpendicular is

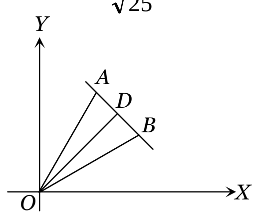
$$y=\tan\left(\frac{\alpha+\beta}{2}\right)x \quad \text{.....(i)}$$

Now on solving the equation (i) with the line, we get the required point.

97. (a) $y-k=m(x-h)$ and $y-0=-\frac{1}{m}(x-0)$. Eliminate m and replace (h,k) by (x,y), we get

$x^2+y^2-hx-ky=0$, which is the required locus of the point.

98. (b) $OA=OB=9, OD=\frac{15}{\sqrt{25}}=3$



Therefore $AB = 2AD = 2\sqrt{81-9} = 2\sqrt{72} = 12\sqrt{2}$

Hence $\Delta = \frac{1}{2}(3\times 12\sqrt{2}) = 18\sqrt{2}$ *sq. units*.

99. (b) Equation of perpendicular on the line $x+y-11=0$ is $x-y+\lambda=0$, but it passes through (2, 3), so $\lambda=1$.

Equation of perpendicular is $x-y+1=0$. Now the coordinates of the foot of the perpendicular are the intersection point of the lines, hence point is (5, 6).

100. (b)Suppose we rotate the coordinate axes in the anti clockwise direction through an angle α.

The equation of the line *L* with respect to old axes is $\frac{x}{a}+\frac{y}{b}=1$. In this question replacing *x* by $x\cos\alpha - y\sin\alpha$ and y by $x\sin\alpha + y\cos\alpha$, the equation of the line with respect to new axes is

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

$$\Rightarrow x\left(\frac{\cos\alpha}{a}+\frac{\sin\alpha}{b}\right) + y\left(\frac{\cos\alpha}{b}-\frac{\sin\alpha}{a}\right) = 1 \qquad .....(i)$$

The intercepts made by (i) on the co-ordinate axes are given as *p* and *q*.

Therefore $\frac{1}{p} = \frac{\cos\alpha}{a}+\frac{\sin\alpha}{b}$ and $\frac{1}{q} = \frac{\cos\alpha}{b}-\frac{\sin\alpha}{a}$

Squaring and adding, we get $\frac{1}{p^2}+\frac{1}{q^2} = \frac{1}{a^2}+\frac{1}{b^2}$.

101. (b) The equation of a line passing through the intersection of straight lines $\frac{x}{\alpha}+\frac{y}{\beta}=1$ and $\frac{x}{\beta}+\frac{y}{\alpha}=1$ is

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

Or $$x\left(\frac{1}{\alpha}+\frac{\lambda}{\beta}\right) + y\left(\frac{1}{\beta}+\frac{\lambda}{\alpha}\right) - \lambda - 1 = 0$$

This meets the 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 midpoint of *AB*,

Then $h = \frac{1}{2}.\frac{\lambda+1}{\frac{1}{\alpha}+\frac{\lambda}{\beta}}, k = \frac{1}{2}.\frac{\lambda+1}{\frac{1}{\beta}+\frac{\lambda}{\alpha}}$

Eliminating λ from these two, we get

$$2hk(\alpha+\beta)=\alpha\beta(h+k).$$

$\therefore$ The locus of (h,k) is $2xy(\alpha+\beta)=\alpha\beta(x+y)$.

102. (a) The vertices of triangle are the intersection points of these given lines. The vertices of Δ are $A(0,4),\ \ B(1,2),\ C(4,0)$

Now, $\quad AB=\sqrt{(0-1)^2+(4-1)^2}=\sqrt{10}$

$$BC=\sqrt{(1-4)^2+(0-1)^2}=\sqrt{10}$$

$$AC=\sqrt{(0-4)^2+(0-4)}=4\sqrt{2}$$

$\because AB=BC$; $\therefore$ Δ is isosceles.

103. (b) Let the co-ordinates of the third vertex be $(2a,\ t)$.

$$AC=BC\Rightarrow t=\sqrt{4a^2+(a-t)^2}\Rightarrow t=\frac{5a}{2}$$

So the coordinates of third vertex C are $\left(2a,\frac{5a}{2}\right)$

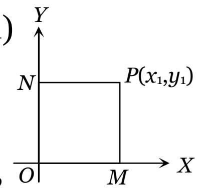
Therefore area of the triangle

$$=\pm\frac{1}{2}\begin{vmatrix}2a & \frac{5a}{2} & 1\\ 2a & 0 & 1\\ 0 & a & 1\end{vmatrix}=\begin{vmatrix}a & \frac{5a}{2} & 1\\ 0 & -\frac{5a}{2} & 0\\ 0 & a & 1\end{vmatrix}=\frac{5a^2}{2}\,sq.\,units.$$

104. (b) We take the coordinate axes as two perpendicular lines. Let $P(x_1,y_1)$ be the required point.

From $P(x_1,y_1)$, we draw PM and PN perpendicular to OX and OY respectively.

Given, $PM+PN=2$ ......(i)



But, $\quad PM=y_1, PN=x_1$

Hence from (i), $y_1+x_1=2$

Thus locus of (x_1,y_1) is $x+y=2$

Which is a straight line.

105. (d) concept

106. (a) Find the sides of the triangle.

107. (b) Let point be (x_1,y_1), then according to the condition $\frac{3x_1+4y_1-11}{5}=-\left(\frac{12x_1+5y_1+2}{13}\right)$

Since the given lines are on opposite sides with respect to origin, hence the required locus is $99x + 77y - 133 = 0$.

108. (b) It is obvious.

109. (a) Apply $\frac{2c^2}{ab}$ formula.

110. (b) Conceptual question. ans $\frac{2c^2}{ab}$

111. (d) $y = \cos(x+1-1)\cos(x+1+1) - \cos^2(x+1)$

$= \cos^2(x+1) - \sin^2 1 - \cos^2(x+1) = -\sin^2 1$,

Which represents a straight line parallel to x-axis with $y = -\sin^2 1$ for all x and so also for $x = \pi/2$.

112. (a) Let the coordinates of A be $(a, 0)$. Then the slope of the reflected ray is $\frac{3-0}{5-a} = \tan\theta$, (say).

The slope of the incident ray $= \frac{2-0}{1-a} = \tan(\pi - \theta)$

Since $\tan\theta + \tan(\pi-\theta) = 0 \Rightarrow \frac{3}{5-a} + \frac{2}{1-a} = 0$

$\Rightarrow 13 - 5a = 0 \Rightarrow a = \frac{13}{5}$

Thus the coordinates of A are $\left(\frac{13}{5}, 0\right)$.

113. (d) S = midpoint of $QR = \left(\frac{6+7}{2}, \frac{-1+3}{2}\right) = \left(\frac{13}{2}, 1\right)$

$\therefore$ 'm' of $PS = \frac{2-1}{2-\frac{13}{2}} = -\frac{2}{9}$,

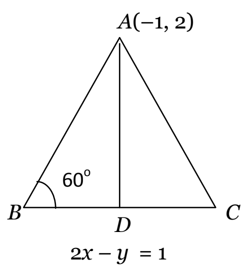
$\therefore$ The required equation is $y + 1 = \frac{-2}{9}(x-1)$

i.e., $2x + 9y + 7 = 0$

114. (d) $B(-7, 6)$.

115. (a) $AD = \left|\frac{-2-2-1}{\sqrt{(2)^2+(-1)^2}}\right| = \left|\frac{-5}{\sqrt{5}}\right| = \sqrt{5}$

$\because \tan 60^o = \frac{AD}{BD} \Rightarrow \sqrt{3} = \frac{\sqrt{5}}{BD} \Rightarrow BD = \sqrt{\frac{5}{3}}$



$\therefore\ BC = 2BD = 2\sqrt{\frac{5}{3}} = \sqrt{\frac{20}{3}}$.

116. (d) Here $L \equiv x + y = 2$ and $L' \equiv 2x - 2y = 1$.

Equation of *y*-axis is $x = 0$

Hence the vertices of the triangle are $A(0,2), B\left(0,-\frac{1}{2}\right)$ and $C\left(\frac{5}{4},\frac{3}{4}\right)$. Therefore, the area of the triangle is $\frac{1}{2}\begin{vmatrix} 0 & 2 & 1 \\ 0 & -\frac{1}{2} & 1 \\ \frac{5}{4} & \frac{3}{4} & 1 \end{vmatrix} = \frac{25}{16}$.

117. (b) $ax + by + p = 0$ and $x\cos\alpha + y\sin\alpha = p$ are inclined at an angle $\frac{\pi}{4}$.

$$\tan\frac{\pi}{4} = \frac{-\frac{a}{b} + \frac{\cos\alpha}{\sin\alpha}}{1 + \frac{a\cos\alpha}{b\sin\alpha}}$$

$\Rightarrow a\cos\alpha + b\sin\alpha = -a\sin\alpha + b\cos\alpha$ .....(i)

$ax + by + p = 0$, $x\cos\alpha + y\sin\alpha - p = 0$ and $x\sin\alpha - y\cos\alpha = 0$ are concurrent.

$$\therefore \begin{vmatrix} a & b & p \\ \cos\alpha & \sin\alpha & -p \\ \sin\alpha & -\cos\alpha & 0 \end{vmatrix} = 0$$

$\Rightarrow -ap\cos\alpha - bp\sin\alpha - p = 0 \Rightarrow -a\cos\alpha - b\sin\alpha = 1$

$\Rightarrow a\cos\alpha + b\sin\alpha = -1$ ......(ii)

From (i) and (ii), $-a\sin\alpha + b\cos\alpha = -1$

From (ii) and (iii),

$(a\cos\alpha + b\sin\alpha)^2 + (-a\sin\alpha + b\cos\alpha)^2 = 2$

$\Rightarrow a^2 + b^2 = 2$.

118. (b) Let $P(x_1, y_1)$, then the equation of line passing through *P* and whose gradient is *m*, is $y - y_1 = m(x - x_1)$

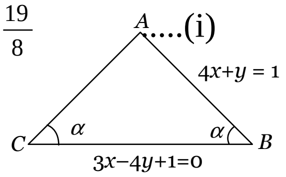
$$\frac{-2m + (mx_1 - y_1)}{\sqrt{1+m^2}} + \frac{2 + (mx_1 - y_1)}{\sqrt{1+m^2}} + \frac{1 - m + (mx_1 - y_1)}{\sqrt{1+m^2}} = 0$$

$\Rightarrow 3 - 3m + 3mx_1 - 3y_1 = 0 \Rightarrow y_1 - 1 = m(x_1 - 1)$

Since it is a variable line, so hold for every value of *m*. Therefore $y_1 = 1, x_1 = 1 \Rightarrow P(1,1)$.

119. (a) Slopes of AB and BC are – 4 and $\frac{3}{4}$ respectively. If α be the angle between AB and BC,

then $\tan\alpha = \dfrac{-4-\frac{3}{4}}{1-4\left(\frac{3}{4}\right)} = \dfrac{19}{8}$ .....(i)



Since $AB = AC$

$\Rightarrow \angle ABC = \angle ACB = \alpha$

Thus the line AC also makes an angle α with BC. If m be the slope of the line AC, then its equation is $y+7 = m(x-2)$ .....(ii)

Now $\tan\alpha = \pm\left[\dfrac{m-\frac{3}{4}}{1+m.\frac{3}{4}}\right] \Rightarrow \dfrac{19}{8} = \pm\dfrac{4m-3}{4+3m}$

$\Rightarrow m = -4$ Or $-\dfrac{52}{89}$.

But slope of AB is – 4, so slope of AC is $-\dfrac{52}{89}$.

Therefore the equation of line AC given by (ii) is $52x + 89y + 519 = 0$.

120. (d) $m_1 = -1/3$ and $m_2 = 3$. Hence lines $x+3y=4$ and $6x-2y=7$ are perpendicular to each other. Therefore the parallelogram is rhombus.

121. (d) $L_{12} \equiv x - 3y + 1 = 0$

$L_{23} \equiv 2x + y - 12 = 0$

$L_{13} \equiv 3x - 2y - 4 = 0$

Therefore, the required distances are

$D_3 = \left|\dfrac{4-3\times4+1}{\sqrt{10}}\right| = \dfrac{7}{\sqrt{10}}$

$D_1 = \left|\dfrac{4+1-12}{\sqrt{5}}\right| = \dfrac{7}{\sqrt{5}}$

$D_2 = \left|\dfrac{3\times5-2\times2-4}{\sqrt{9+4}}\right| = \dfrac{7}{\sqrt{13}}$.

122. (d) $\dfrac{x-1}{\cos\theta} = \dfrac{y-2}{\sin\theta} = r$ .....(i)

Where r is distance of any point (x, y) on the line from the point (1, 2)

Any point on the line (i) are $(1 + r\cos\theta, 2 + r\sin\theta)$. $r = \dfrac{\sqrt{6}}{3}$.

$\left(1+\dfrac{\sqrt{6}}{3}\cos\theta,\ 2+\dfrac{\sqrt{6}}{3}\sin\theta\right)$.

But this point lies on the line $x+y=4$.

$\Rightarrow \frac{\sqrt{6}}{3}(\cos\theta+\sin\theta)=1$ Or $\sin\theta+\cos\theta=\frac{3}{\sqrt{6}}$

$\Rightarrow \frac{1}{\sqrt{2}}\sin\theta+\frac{1}{\sqrt{2}}\cos\theta=\frac{\sqrt{3}}{2}$,

$\Rightarrow \sin(\theta+45^o)=\sin 60^o$ Or sin 120^o

$\Rightarrow \theta=15^o$ Or 75^o.

123. (c) Any line through (1, –10) is given by $y+10=m(x-1)$

Since it makes equal angle say 'α' with the given lines $7x-y+3=0$ and $x+y-3=0$, therefore

$\tan\alpha=\frac{m-7}{1+7m}=\frac{m-(-1)}{1+m(-1)}\Rightarrow m=\frac{1}{3}$ Or -3

Hence the two possible equations of third side are $3x+y+7=0$ and $x-3y-31=0$.

124. (d) Required area = $\frac{2c^2}{|ab|}=\frac{2\times1^2}{|1\times1|}=2$.

125. (a) $\frac{x+5}{\cos\theta}=\frac{y+4}{\sin\theta}=\frac{r_1}{AB}=\frac{r_2}{AC}=\frac{r_3}{AD}$

$(r_1\cos\theta-5, r_1\sin\theta-4)$ lies on $x+3y+2=0$.

$\therefore r_1=\frac{15}{\cos\theta+3\sin\theta}$

Similarly $\frac{10}{AC}=2\cos\theta+\sin\theta$ and $\frac{6}{AD}=\cos\theta-\sin\theta$

Putting in the given relation, we get $(2\cos\theta+3\sin\theta)^2=0$

$\therefore \tan\theta=-\frac{2}{3}\Rightarrow y+4=-\frac{2}{3}(x+5)\Rightarrow 2x+3y+22=0.$