# Chapter-10
# STRAIGHT LINES

## I One Mark Questions:

1. Define a straight line.

   It is the locus of point which maintains the least distance between ends.

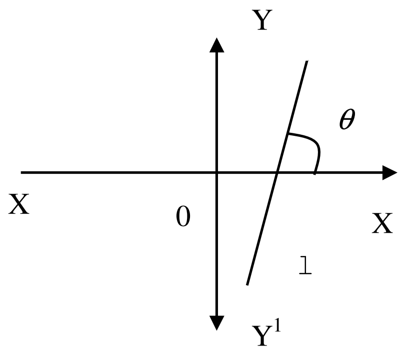
2. What are characteristics of a straight line?

   Characteristics of a straight line are

   $\left.\begin{array}{ll} 1)\ \text{Inclination } (\theta) & 3)\ \text{x-intercepts} \\ 2)\ \text{Slope (m)} & 4)\ \text{y-intercepts.} \end{array}\right\}$ Intercepts

3. Define inclination of a straight line.

   It is defined as the angle made by given line with OX.

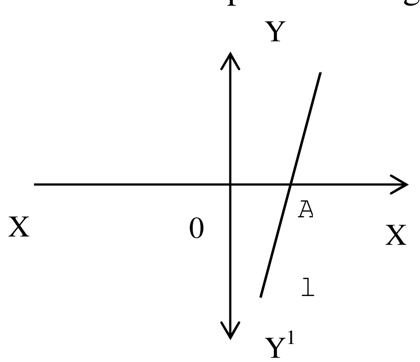



4. Define slope of a straight line.

   It is defined as tangent of inclination. i.e. $m = \tan\theta$

5. Define x-intercept of a straight line.

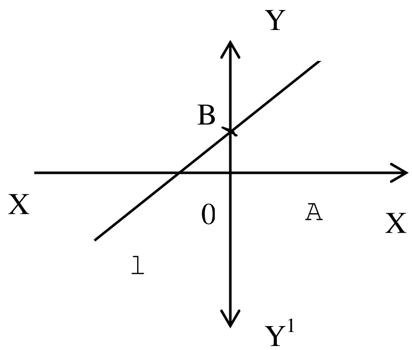
   It is the distance of the point where given line cuts x-axis from the origin.




OA=a = X-intercept of l

6. Define y-intercept of a straight line.

It is the distance of point where line cuts y-axis from the origin.




OB=b = y-intercept of l

7. Give the formula for slope of a line joining A($x_1$ $y_1$) and B($x_2$ $y_2$).

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

8. Give the condition of parallel lines.

   Slopes of parallel lines are equal.

9. Give the condition of perpendicular lines.

   Product of slopes of perpendicular lines is -1.

10. Find slope of a line joining A(2, 4).

    Given, $x_1 = 2; \quad y_1 = 4$

    $x_2 = 1; \quad y_2 = 1$

    $$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1-4}{1-2} = \frac{-3}{-1} = 3$$

11. What is the slope of a line parallel to i) x-axis ii) y-axis.

    $i)\ m = 0 \qquad ii) m = \infty$

12. What is the slope of i) x-axis? ii) y-axis ?

    $i)\ m = 0 \qquad ii) m = \infty$

13. Give the formula for the acute angle between 2 lines whose slopes are $m_1$and $m_2$.

    If $\theta$ is the required angle then

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

14. Find the acute angle between two lines where slopes are $\sqrt{3}$ & $\frac{1}{\sqrt{3}}$.

$m_1 = \sqrt{3}\ :\ m_2 = \frac{1}{\sqrt{3}} \qquad \theta = ?$

$$\tan\theta = \left|\frac{m_1 - m_2}{1+m_1m_2}\right| = \left|\frac{\sqrt{3}-\frac{1}{\sqrt{3}}}{1+\cancel{\sqrt{3}}.\frac{1}{\cancel{\sqrt{3}}}}\right| = \left|\frac{\frac{3-1}{\sqrt{3}}}{1+1}\right| = \frac{\cancel{2}}{\sqrt{3}.\cancel{2}} = \frac{1}{\sqrt{3}} \quad \therefore \theta = 30^0$$

15. Find equation of a straight line i) Where slope and y-intercept are 2 & 3 respectively.

Given m = 2 : c = -3

Required equation is y = mx + c i.e. y = 2x – 2 $\Rightarrow$ 2x – y -3 = 0.

ii) Whose slope is 1 and which passes through P (1, 1).

Required equation is $y - y_1 = m(x - x_1)$

$\Rightarrow$ y -1 = 1. (x – 1) = x – 1 $\Rightarrow$ x – y = 0.

iii) Which passes through A(2, 1) & B(3, -1)

Given $x_1 = 2$ ; $y_1 = 1$ : $x_2 = 3$ ; $y_2 = -1$

Required equation is $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$ *i.e.* $\frac{y-1}{-1-1} = \frac{x-2}{3-2}$

$$\Rightarrow \frac{y-1}{-2} = \frac{x-2}{1} \Rightarrow y-1 = -2x+4 \Rightarrow 2x+y-5=0$$

iv) Whose intercepts are 2 & 3 respectively.

Given a = 2, b= 3

$$R.E.\ is\ \frac{x}{a}+\frac{y}{b}=1\ i.e.\ \frac{x}{2}+\frac{y}{3}=1$$

$$\Rightarrow \frac{3x+2y}{6}=1 \Rightarrow 3x+2y-6=0$$

v) Whose length and inclination of normal are $\sqrt{2}$ & $45^0$ respectively.

$$R.E.\ is\ \ x\cos\alpha + y\sin\alpha = p \Rightarrow x\cos 45 + y\sin 45 = \sqrt{2}$$

$$\Rightarrow \frac{x}{\sqrt{2}}+\frac{y}{\sqrt{2}} = \sqrt{2} \Rightarrow x+y=1 \Rightarrow x+y-1=0$$

16. Give the equation of a straight line

i) Whose slope and y-intercept are m & c respectively.

$y = mx + c$

ii) Whose slope is m and which passes through $A(x_1, y_1)$

$y - y_1 = m(x - x_1)$

iii) Which passes through $A(x_1, y_1)$ & $B(x_2, y_2)$

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

iv) Whose intercepts are a & b respectively.

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

v) Whose length and inclination of normal are P and $\alpha$ respectively.

$x\cos\alpha + y\sin\alpha = P$.

17. Give the expression for perpendicular direction of a point $p(x_1, y_1)$ from a line $l$: $ax + by + c = 0$.

$$d = \left|\frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}}\right|$$

18. Give formulae for angle bisectors of $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$.

$$\left[\frac{a_1x + b_1y + c_1}{\sqrt{a_1^2 + b_1^2}}\right] = \pm\left[\frac{a_2x + b_2y + c_2}{\sqrt{a_2^2 + b_2^2}}\right]$$

19. Give the formula for ratio of division of a line by a line.

Suppose $l$: $ax + by + c = 0$ divides the join of $A(x_1, y_1)$ & $B(x_2, y_2)$ in the ratio of k : 1 then

$$k = -\left(\frac{ax_1 + by_1 + c}{ax_2 + by_2 + c}\right)$$

20. Give the condition of position of 2 points w.r.t. line.

Suppose $P(x_1, y_1)$ : $Q(x_2, y_2)$ and $l$: $ax + by + c = 0$ are given. Let perpendicular direction of P from $l = |d_1|$

perpendicular direction of Q from $l = |d_2|$

If $d_1$ & $d_2$ are of same sign then P & Q lie on the same side of $l$ otherwise P & Q lie on different side of $l$.

21. Give the equation of a line parallel to $ax + by + c = 0$.

$ax + by + c^1 = 0$.

22. Give the equation of a line perpendicular to ax + by + c=0.

bx - ay + $c^1$=0.

23. Find slope of a line whose inclination is 45.

$\theta = 45 \ \tan\theta = \tan 45 = 1 = 45$.

24. Find inclination of a straight line whose slope is $\dfrac{1}{\sqrt{3}}$.

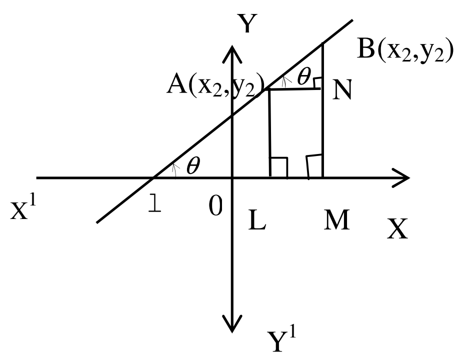
$Given\ m = \dfrac{1}{\sqrt{3}} \ \therefore \tan\theta = \dfrac{1}{\sqrt{3}} \ \therefore \theta = 30^0$.

**II Two Marks questions:**

1. Obtain and expression for slope of a line joining A($x_1$, $y_1$) & B($x_2$, $y_2$).

Consider an expression for slope a line joining A($x_1$, $y_1$) & B($x_2$, $y_2$). If m & $\theta$ are slope and inclination of l then $m = \tan\theta$ & slope of AB=m.

Draw AL & BM perpendicular OX & AN perpendicular to BM.

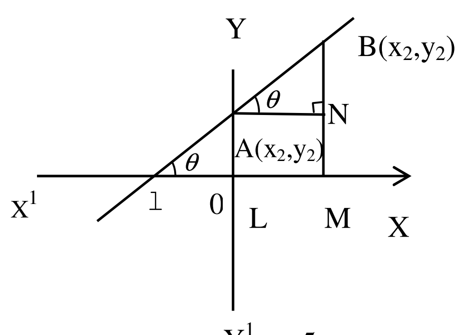



From the figure OL=$x_1$, OM=$x_2$ AL=$y_1$ BM=$y_2$ & $\therefore B\hat{A}N = \theta \quad (\because corresponding\ \ angles)$

$\therefore In\ \Delta^{le} ANB,\ \tan\theta = \dfrac{BN}{AN} \Rightarrow m = \dfrac{BM - MN}{LM}$

$= \dfrac{BM - AL}{OM - OL} = \dfrac{y_2 - y_1}{x_2 - x_1}$

2. Obtain equation of a straight line in the form of y = mx + c.



Consider a straight line $l$ whose slope = m, inclination = $\theta$ and y-intercept = c. let P(x, y) be any point on $l$ then m = $\tan\theta$. If $l$ cuts y-axis at A then OA=c. Draw PM $\perp$ OX & AN $\perp$PM;

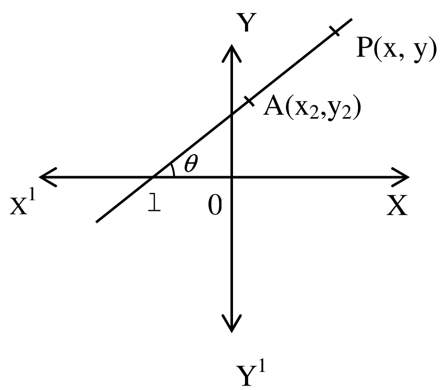
(from the fig.) $P\hat{A}N = \theta$ ($\because$ *corresponding angles*)

$$AN = OM = x,\ PM = y\ \&\ MN = OA = c \quad \left( from\ \ \Delta^{le}\ ANP,\ \ \tan\theta = \frac{PN}{AN} \right)$$

$$\Rightarrow m = \frac{PM - MN}{OM} = \frac{y-c}{x} \ \therefore mx = y - c \Rightarrow\ y = mx + c$$

3. Obtain equation of a straight line in the form of $y - y_1 = m(x - x_1)$.

Consider a straight line $l$ with slope = m, inclination = $\theta$ and which passes through A($x_1$, $y_1$). Let P(x, y) be any point on $l$ then $m = \tan\theta$.

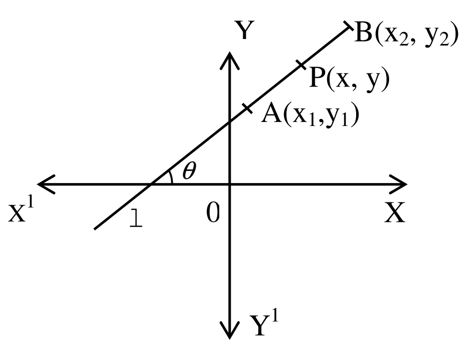



Slope of $AP = \dfrac{y - y_1}{x - x_1}$ But slope of AP=slope of $l$=m.($\because$ AP is a part of $l$)

$$\therefore m = \frac{y - y_1}{x - x_1} \Rightarrow y - y_1 = m(x - x_1)$$

4. Obtain equation of a straight line in the form of $\dfrac{y - y_1}{y_2 - y_1} = \dfrac{x - x_1}{x_2 - x_1}$.

Consider a straight line $l$ passing through A($x_1$, $y_1$) & A($x_2$, $y_2$). Let P(x, y) be any point on $l$.



Since AP and AB are parts of same line l, slope AP=slope of AB

$$\Rightarrow \frac{y-y_1}{x-x_1}=\frac{y_2-y_1}{x_2-x_1} \quad \Rightarrow \frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}.$$

5. Find slope and y-intercept of the following 1) 2x + 3y – 1 = 0.

$$\Rightarrow 3y=-2x+1 \quad \therefore y= \frac{-2}{3}x+\frac{1}{3} \therefore m=-2/3\ ;\ c=1/3$$

2) x + y – 2 = 0 $\therefore$ m = -1, C=2 by comparing with y=mx+C.

6. Find the perpendicular distance of P(1, 2) from l: 3x + 4y – 13 = 0.

Given $x_1=1$ ; $y_1=2$ ; a=3 ; b=4 ; c=-13 d=?

$$d=\left|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right| \quad \therefore d=\left|\frac{3(1)+4(2)-13}{\sqrt{9+16}}\right|$$

$$=\left|\frac{3+8-13}{\sqrt{25}}\right| \quad =\frac{2}{5}$$

7. Find equation of internal angle bisector of 2x + 3y + 1 =0 and x+y–2 = 0.

Given $a_1=2$ ; $b_1=3$ ; $a_1=1$ ; $a_2=1=$ $b_1$; $c_2=-2$

$$\text{R is } d=\frac{a_1x\ +by_1+c}{\sqrt{a_1{}^2+b_1{}^2}} \ =\frac{a_2x\ +by_2+c}{\sqrt{a_2{}^2+b_2{}^2}}$$

$$\Rightarrow \frac{(2x+3y+1)}{\sqrt{4+9}}=\frac{x+y-2}{\sqrt{1+1}} \Rightarrow (2x+3y+1)\sqrt{2}=\sqrt{13}(x+y-2)$$

$$=\Rightarrow \left(2\sqrt{2}-\sqrt{13}\right)x+\left(3\sqrt{2}-\sqrt{13}\right)y+\left(\sqrt{2}-2\sqrt{13}\right)=0$$

8. Find equation of external angle bisector of 3x+ 4y + 2 = 0 and 4x + 3y +3 = 0.

Given $a_1=3$ ; $b_1=4$ ;$c_1=4$ $a_2=3$ ; $b_2=4$ ;$c_2=4$

$$R.E.\ \ is \ \ \frac{a_1x\ +b_1y+c_1}{\sqrt{a_1{}^2+b_1{}^2}} \ =-\left(\frac{a_2x\ +b_2y+c_2}{\sqrt{a_2{}^2+b_2{}^2}}\right)$$

$$\Rightarrow \frac{3x+4y+2}{\sqrt{3^2+4^2}}=-\left(\frac{4x+3y+3}{\sqrt{4^2+3^2}}\right)$$

$$\Rightarrow \frac{3x+4y+2}{\cancel{5}}=-\frac{(4x+3y+3)}{\cancel{5}} \Rightarrow 7x-7y+5=0$$

9. Find position of A(1, 1) & B(-2, 3) w.r.t. l: x + y + 2 = 0.

$$\alpha = \frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}} = \frac{1(1) + 1(-1) + 2}{\sqrt{1+1}} \quad \therefore \alpha = \frac{2}{\sqrt{2}} = \frac{(\sqrt{2})^{\cancel{2}}}{\cancel{\sqrt{2}}} = \sqrt{2}$$

$$\beta = \frac{ax_2 + by_2 + c}{\sqrt{a^2 + b^2}} = \frac{1(-2) + 1(3) + 2}{\sqrt{1+1}} = \frac{-2+3+2}{\sqrt{2}} = \frac{3}{\sqrt{2}}$$

$\therefore \alpha$ & $\beta$ *are of same sign* (*both are* $+ve$)

$\therefore$ *A & B lie on same side of given line* $l$.

10. Find inclination of a straight line joining A(11, 10) & B(10, 9).

Given $x_1=11$, $y_1=10$ : $x_2=10$, $y_2=9$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9-10}{10-11} = \frac{-1}{1} = 1 \quad \therefore \tan\theta = 1 \quad \therefore \theta = 45^0$$

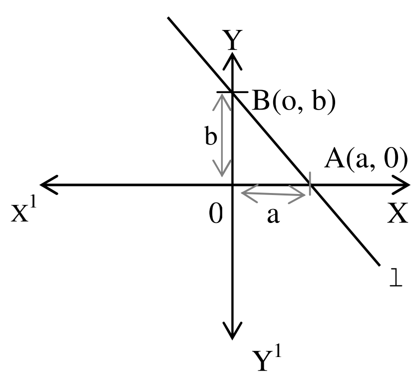
**III 3 Marks questions:**

1. Obtain equation of a straight line in the form of $\frac{x}{a} + \frac{y}{b} = 1$.

Consider a straight line l whose intercepts are $\alpha$ and $\beta$. If l cuts OX at A and OY at B then OA= a & OB =b. $\therefore$ l passes through A(a, 0) & B(0, b)

$$\therefore equation\ of\ line\ is\ \frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

$$i.e.\ \frac{y-0}{b-0} = \frac{x-a}{0-a} \Rightarrow \frac{y}{b} = \frac{x}{-a} - \frac{a}{(-a)} \quad \therefore \frac{y}{b} = \frac{-x}{a} + 1 \Rightarrow \frac{x}{a} + \frac{y}{b} = 1$$

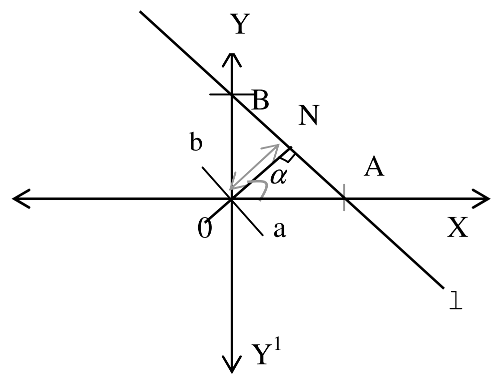



2. Obtain the equation of a straight line in the form of $x\cos\alpha + y\sin\alpha = p$.

Consider a straight line l whose length and inclination of normal are P and $\alpha$ respectively.

If OP is perpendicular to l then ON=P and $N\hat{O}X = \alpha$.

Let l cut OX at A and OY at B. If OA= a & OB=b then intercepts of l are a and b.




From the figure

$$\cos\alpha = \frac{p}{a} \;\&\; \sin\alpha = \frac{p}{b} \;\therefore a = p/\cos\alpha \;\&\; b = p/\sin\alpha$$

$$req.\ equation\ is\ \frac{x}{a} + \frac{y}{b} = 1 \Rightarrow \frac{x}{\left(\frac{p\cos\alpha}{p}\right)} + \frac{y}{\left(\frac{p\sin\alpha}{p}\right)} = 1$$

$$\Rightarrow \frac{x\cos\alpha}{p} + \frac{y\sin\alpha}{p} = 1 \quad \therefore\; x\cos\alpha + y\sin\alpha = p$$

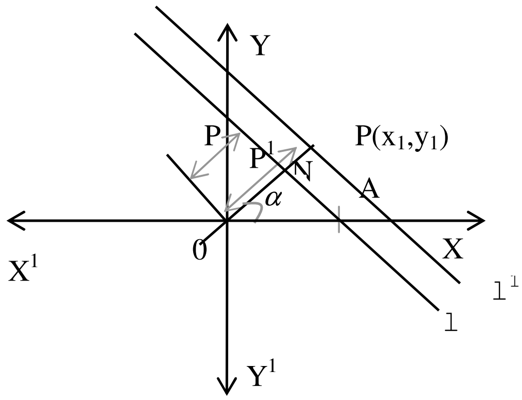
3. Obtain an expression for perpendicular distance of a point from a line.

Let d be the perpendicular distance of P(x, y) from l:ax+by+c=0.

l can also be written as $x\cos\alpha + y\sin\alpha = p$.

$$where\ \cos\alpha = \frac{a}{\sqrt{a^2+b^2}},\ \ \sin\alpha = \frac{b}{\sqrt{a^2+b^2}}\ \ \&\ \ p = \frac{-c}{\sqrt{a^2+b^2}}$$

If ON perpendicular to l then ON=P. Let $l^1$ is parallel and passing through P then $l^1 : x\cos\alpha + y\sin\alpha = p^1,\ p^1 = OP$




$\sin ce\ \ l^1\ \ passes\ \ through\ \ P(x_1, y_1)$

$x_1 \cos\alpha + y_1 \sin\alpha = P^1 \ \therefore P^1 = \dfrac{ax_1}{\sqrt{a^2+b^2}} + \dfrac{by_1}{\sqrt{a^2+b^2}}$

$= \left(\dfrac{ax_1 + by_1}{\sqrt{a^2+b^2}}\right) \ \therefore\ d = PN = OP - ON$

$= P^1 - P = \dfrac{ax_1 + by_1}{\sqrt{a^2+b^2}} - \left(\dfrac{-1}{\sqrt{a^2+b^2}}\right) = \dfrac{ax_1 + by_1 + c}{\sqrt{a^2+b^2}}$

$\sin ce\ \ d\ \not< 0,\ \ d = \left|\dfrac{ax_1 + by_1 + c}{\sqrt{a^2+b^2}}\right|$

4. Find the equation of straight line whose intercepts are in the ratio of 2 & 3 given that it passes through P(1, 2).

Let a = 2k : b = 3k, $x_1$= 1 ; $y_1$=2 (given)

$required\ \ equation\ \ is\ \ \dfrac{x}{a} + \dfrac{y}{b} = 1$

$i.e.\ \dfrac{x}{2k} + \dfrac{y}{3k} = 1 \Rightarrow \dfrac{3x + 2y}{6k} = 1 \Rightarrow 3x + 2y - 6k = 0$

since it passes through P(1, 2)

$3 + 2 - 6k = 0\ \ \therefore 6k = 5 \therefore\ l\ is\ 3x + 2y - 5 = 0$.

5. Find equation of a straight line whose sum of intercepts is 0 given that it passes through P(2, 1).

Given b=-a : $x_1$=2, $y_1$=1 $required\ \ \ equation\ is\ l : \dfrac{x}{a} + \dfrac{y}{b} = 1$

$\Rightarrow \dfrac{x}{a} + \dfrac{y}{-a} = 1 \Rightarrow x - y = 0\ \sin ce\ it\ \ passes\ through\ P(1, 1)$

$2 - 1 - a = 0 \therefore\ a = 1 \therefore\ l : x - y - 1 = 0$

6. Find equation of a straight line which is parallel to $2x + 3y + 1 = 0$ given that i) it passes through P(3, 2).

Given $l^1$: $2x + 3y + 1= 0$ since $l$ is parallel to $l^1$, $l$: $2x+ 3y +c= 0$

As it passes through (3, 2), $6+6+c=0 \Rightarrow c=-12 \quad \therefore \; l: 2x+3y-12= 0$

(ii) its y – intercept is 2

given $l^1$: $2x + 3y + 1= 0$ since $l$ is parallel to $l^1$, $l$: $2x+ 3y +c= 0$

its y-intercept = $-c/3=2 \quad \therefore \; c= -6 \; \therefore \; l: 2x+ 3y -6= 0$.

7. Find equation of straight line which is perpendicular to $3x+4y+2= 0$ given that i) it passes through (2, -3).

i) it passes through (2, -3) given $l^1$: $3x + 4y + 2= 0$

since $l$ is perpendicular to $l^1$, $l$: $4x - 3y +c= 0$

since it passes through (2, -3), $8-9+c=0 \Rightarrow c=1 \; \therefore \; l: 4x-3y+1= 0$

ii) its y – intercept is -3

given $l^1$: $3x + 4y + 2= 0$ since $l$ is perpendicular to $l^1$

$\therefore \; l: 4x - 3y +c= 0$

its y-intercept = $c/3= -3 \quad \therefore \; c = -9 \; \therefore \; l: 4x-3y -9= 0$.

8. Find the equations of angle bisectors of $x + y + 1 = 0$ and $2x – 2y + 3=0$.

$a_1= 1 = b = c : a_2 = 2; b_2=-2 \; ; c_2=3$

$$required\ equations\ are\ \frac{a_1x+b_1y+c_1}{\sqrt{a_1^2+b_1^2}} = \pm\frac{a_2x+b_2y+c_2}{\sqrt{a_2^2+b_2^2}}$$

$$\Rightarrow \frac{x+y+1}{\sqrt{1+1}} = \pm\frac{2x-2y+3}{\sqrt{4+4}} \Rightarrow \frac{x+y+1}{\sqrt{2}} = \pm\frac{2x-2y+3}{\sqrt{8}}$$

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

$$2x+2y+2 = \pm(2x-2y+3)$$

$$case(i)\ \cancel{2x}+2y+2 \;=\; \cancel{2x}-2y-3 \Rightarrow 4y+5=0$$

$$case(ii)\ 2x+2y+2 \;=\; -2x-2y-3 \Rightarrow 4x+4y+5=0$$

9. Find the equation of a straight line which passes through intersection of $x +2y+1=0$ and $2x+3y-2 = 0$.

Given that

i) It passes through origion. Let $l_1$: $x+2y+1= 0$ & $l_2$: $2x+3y-2= 0$

required equation is $l_1+ kl_2=0$. i.e. $(x+2y+1)+k(2x+3y-2)=0$

since it passes through O(0, 0), 1 - 2k = 0 $\therefore$ k= 1/2

$\therefore$ (1) $\Rightarrow$ x+2y+1+1/2 (2x+3y-2)=0

$\Rightarrow$ 2x+4y+2+2x+3y-2=0 $\Rightarrow$ 4x+7y=0.

(2) [upto (1) same].It passes through P(1, 2) Since it passes through P(1, 2).

(1+4+1)+ k (2+3-2)=0 $\Rightarrow$ 6 + 3k =0 $\therefore$ k = -2

$\therefore$ (1) $\Rightarrow$ (x+2y+1) -2 (2x+3y-2)=0 $\Rightarrow$ - 3x - 4y +5= 0 $\Rightarrow$ 3x+ 4y- 5 = 0.

(3) [upto (1) same]. Its slope is 3.

(1) $\Rightarrow$ (1 + 2k)x+(2+ 3k)y+ (1- 2k) = 0 → (2)

$$slope = \frac{-(1+2k)}{(2+3k)} = 3 \Rightarrow -1-2k = 6+9k$$

$$\Rightarrow -7 = 11k \;\therefore k = -\frac{7}{11} \;\therefore (1) \Rightarrow (x+2y+1) - \frac{7}{11}(2x+3y-2=0)$$

$$\Rightarrow 11k + 22y + 11 - 14x - 21y + 14 = 0$$

$$\Rightarrow -3x + y + 25 = 0 \Rightarrow 3x - y - 25 = 0$$

(4) Its y-intercept is -2

upto (2) same.

$$y - \text{int}\,ercept = -\left(\frac{1-2k}{2+3k}\right) = -2 \Rightarrow 1-2k = (2+3k)2$$

$$\Rightarrow 1-2k = (2+3k)2 \Rightarrow -3 = 8k \therefore k = -3/8$$

$$\therefore (1) \Rightarrow (x+2y+1) - \left(\frac{3}{8}\right)(2x+3y-2) = 0$$

$$\Rightarrow 8x + 16y + 8 - 6x - 9y + 6 = 0 \Rightarrow 2x + 7y + 14 = 0$$

(5) It is parallel to x+y+1 =0

[*upto* (2) *same*].

$$l^1 = x + y + 1 = 0 \Rightarrow m^1 = -1$$

$$\therefore m = m^1 = -1 \;\therefore -\left(\frac{1+2k}{2+3k}\right) = -1$$

$$\therefore 1 + 2k = 2 + 3k \Rightarrow -1 = k$$

$$\therefore (1) \therefore \Rightarrow (x+2y+1) - 1(2x+3y-2) = 0$$

$$\Rightarrow -x - y + 3 = 0 \Rightarrow x + y - 3 = 0$$

(6) It is perpendicular to 2x+3y-1 =0

$l^1 : 2x+3y-1=0 \therefore\ m^1 = -2/3$

$[upto\ (2)\ same]$.

$\therefore slope\ of\ l = \dfrac{1}{m^1} = \dfrac{3}{2}$

$\therefore\ \dfrac{(1+2k)}{(2+3k)} = \dfrac{3}{2}\ \Rightarrow -2+4k = 6+9k\ \Rightarrow -8 = 5k \therefore\ k = -8/5$

$\therefore\ (1) \Rightarrow (x+2y+1) - \dfrac{8}{5}(2x+3y-2) = 0$

$\Rightarrow 5x+10y+5-16x-24y+16=0$

$\Rightarrow -11x-14y+21=0 \Rightarrow 11x+14y-21=0$

(7) It is perpendicular to former.

$l\ is \perp^r l^1 : slope\ of\ l_1 = -1/2 = m^1$

$\therefore slope\ of\ l_1 = m = \dfrac{-1}{m^1} = \dfrac{-1}{-1/2} = 2$

$\therefore -\dfrac{(1+2k)}{(2+3k)} = 2\ \Rightarrow -1-2k = 4+6k\ \Rightarrow -5 = 8k \therefore\ k = -5/8$

$\therefore\ (1) \Rightarrow (x+2y+1) - \dfrac{5}{8}(2x+3y-2) = 0$

$\Rightarrow 8x+16y+8-10x-15y+10=0$

$\Rightarrow -2x+y+18=0 \Rightarrow 2x-y-18=0$

(8) It is perpendicular to latter.

Same upto (2):

$l^1 : 2x+3y-2=0\ \therefore m^1 = -2/3\ \therefore\ slope\ of$

$\therefore slope\ of\ l = \dfrac{-1}{m^1} = \dfrac{-1}{-2/3} = 3/2 = m$

$\therefore -\dfrac{(1+2k)}{(2+3k)} = 3/2\ \Rightarrow -2-4k = 6+9k\ \Rightarrow -8 = 13k \therefore\ k = -8/13$

$\therefore\ (1) \Rightarrow (x+2y+1) - \dfrac{8}{13}(2x+3y-2) = 0$

$\Rightarrow 13x+26y+13-16x-24y+16=0$

$\Rightarrow -3x+2y+29=0 \Rightarrow 3x-2y-29=0$

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