॥ जय श्री राधे कृष्णा ॥

← ULTIMATE MATHEMATICS: BY AJAY MITTAL →

CHAPTER: STRAIGHT LINES

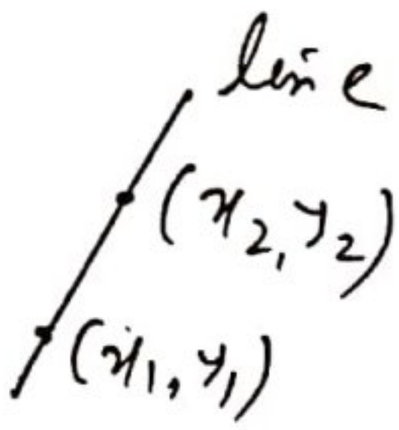
CLASS NO: 1

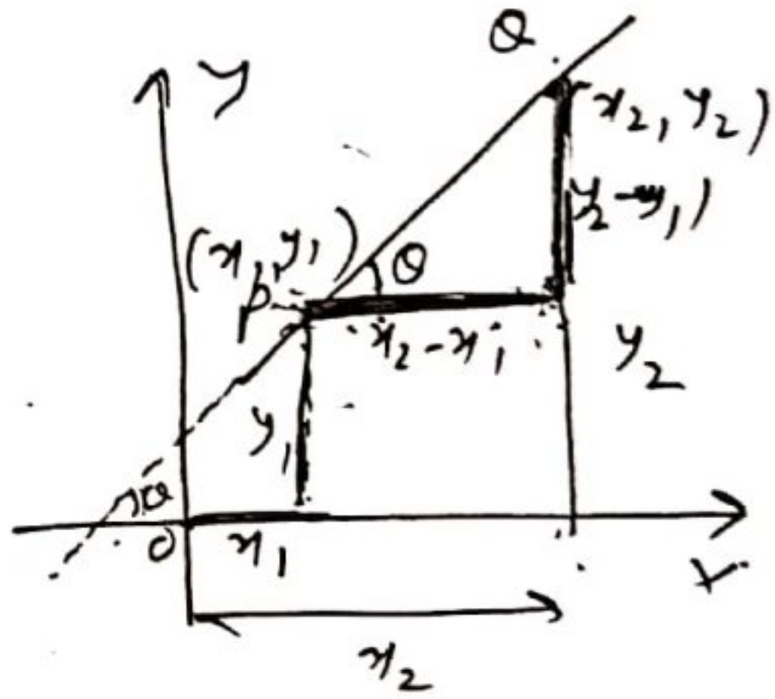
(·) General equation of a line: $ax+by+c=0$ (linear equation)

(·) **Slope of a line**

(·) ✓ denoted by m

① $\boxed{m = \frac{y_2-y_1}{x_2-x_1}}$



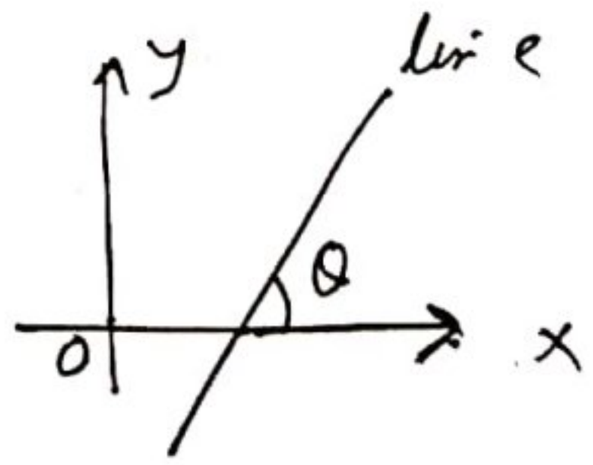


e.g. A(3, -4) & B(1, 2)

find slope line

$$m = \frac{2-(-4)}{1-3} = \frac{6}{-2} = -3$$

② $\boxed{m = \tan\theta}$



θ → angle b/w the line & +ve direction of X-axis

eg I 135° with +ve X-axis.

then $\theta = 135$

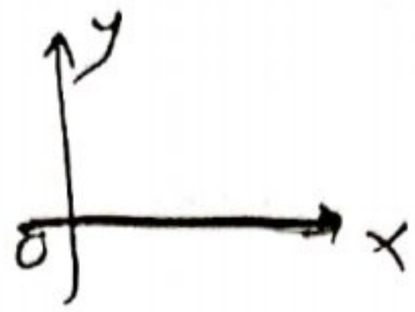
$$m = \tan(135) = \tan(180-45) = -\tan(45) = -1$$

③ $\boxed{m = \frac{-\text{Coefficient of } x}{\text{Coefficient of } y}}$ (when equation of line is given)

eg $3x-4y-2=0 \Rightarrow m = -\frac{3}{-4} = 3/4$

Scanned with CamScanner

(4) Slope of X-axis

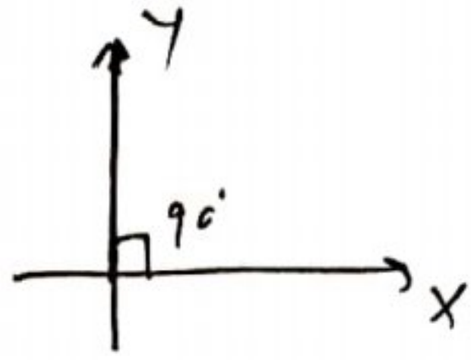


$\tan\theta = 0^\circ$

$m = \tan(0^\circ) = 0$

$\boxed{m = 0}$

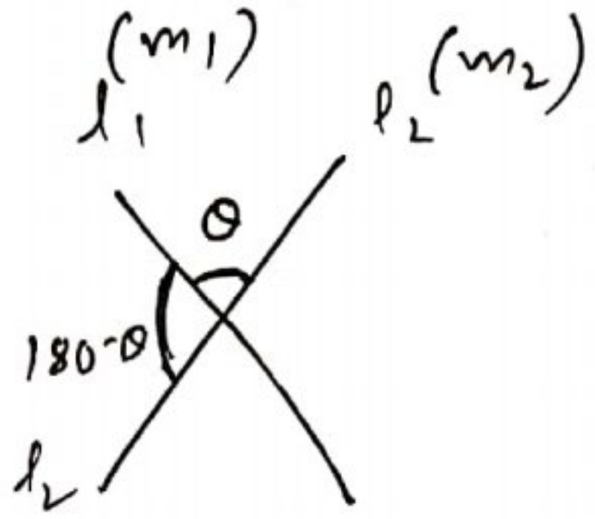
(5) Slope of Y-axis



$m = \tan(90^\circ) = \infty$

$\boxed{m = \infty}$ $\boxed{m = \frac{1}{0}}$

(6) angle b/w two lines

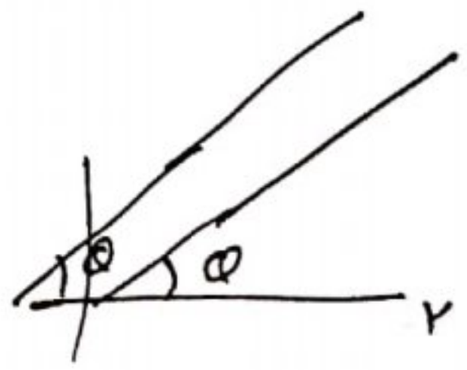


$$\tan\theta = \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right|$$

eg $\theta = 45^\circ$ also $180 - 45^\circ = 135^\circ$

(7) Collinearity of three points (using slopes)

$A(x_1, y_1)$ $B(x_2, y_2)$ $C(x_3, y_3)$

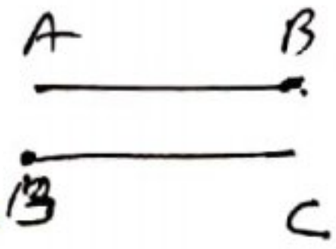


✓ Slope of AB =

✓ Slope of BC

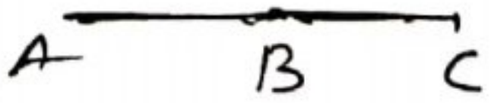
- If Slope of AB = Slope of BC

- then lines are parallel



- But point B is common

- A, B, C must be collinear



$\boxed{\text{If Slope of } AB = \text{Slope of } BC}$ then points are collinear.

Scanned with CamScanner

(8) parallel condition

If two lines are ∥ parallel

then $m_1 = m_2$

(9) 1st condition

when two lines are perpendicular

then $\boxed{m_1 m_2 = -1}$ (-ve Reciprocal)

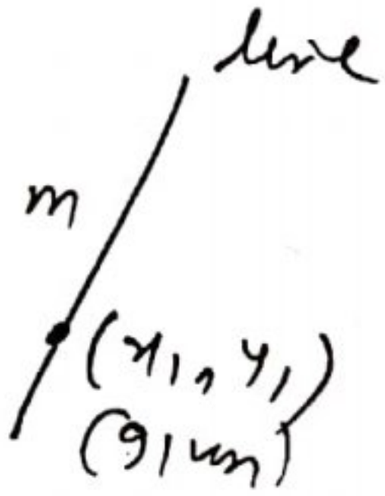
eg $m_1 = -3$

then $m_2 = 1/3$

Different forms of equation of line

(1) point - slope form

(x_1, y_1) m



$$\boxed{y - y_1 = m(x - x_1)}$$

eg Point $(2, -3)$ slope $= -\frac{1}{3}$

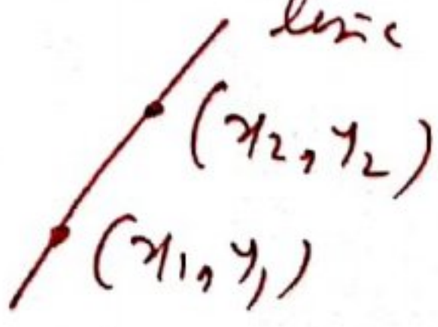
Equation $y + 3 = -\frac{1}{3}(x - 2)$

$\Rightarrow 3y + 9 = -x + 2$

$\Rightarrow x + 3y + 7 = 0$

(2) Two point form

$$\boxed{y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)}$$



Scanned with CamScanner

St. line (Class No. 1)

eg A(2,-3) & B(1,4)

Equah. of line

$$y+3 = \frac{7}{-1}(x-2)$$

$$\Rightarrow y+3 = -7x+14$$

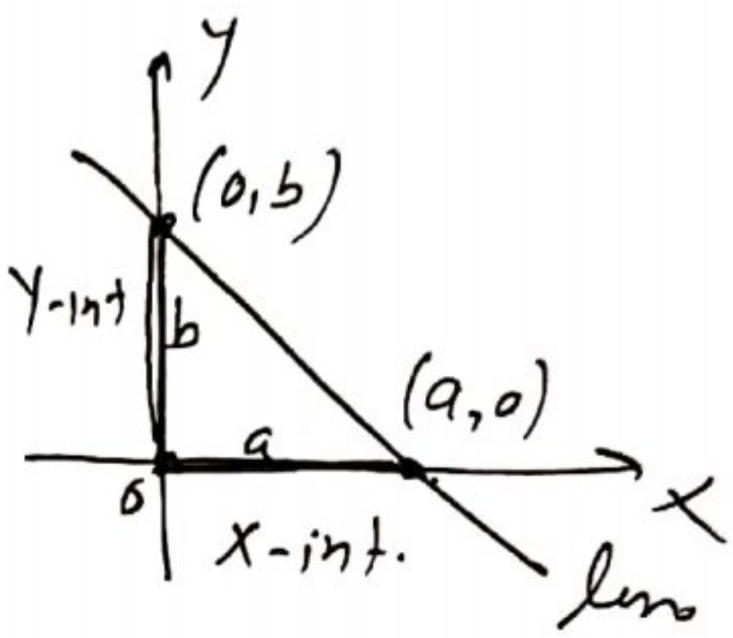
$$\Rightarrow 7x+y-11=0 \quad \text{Ans}$$

(3) Intercept form

X-int = a

Y-int = b

Equation $\boxed{\frac{x}{a}+\frac{y}{b}=1}$



eg X-int = 2 Y-int = -3

a = 2, b = -3

$$\frac{x}{2}+\frac{y}{-3}=1 \Rightarrow \frac{x}{2}-\frac{y}{3}=1 \Rightarrow 3x-2y=6 \quad \text{Ans}$$

(4) Slope - Intercept form

m — y-int (b)

$\boxed{y=mx+c}$ c → y int

eg m = 3 y-int = -3

$\boxed{y=3x-3}$

(a) → point (0, -3)

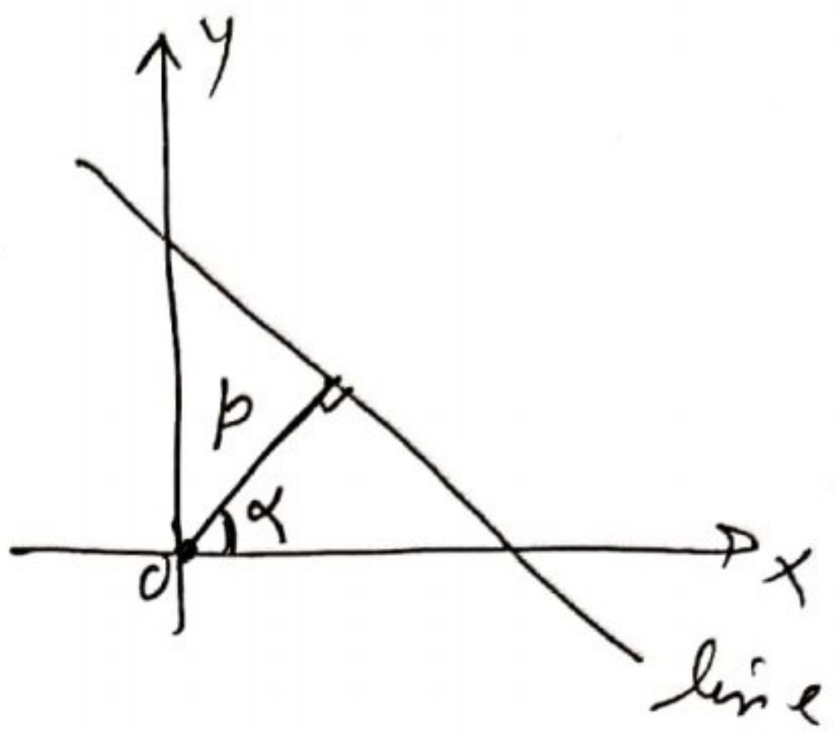
$$y+3 = 3(x-0)$$

$$y+3 = 3x$$

$$y = 3x-3$$

Scanned with CamScanner

(5) Normal form / $\perp^r$ form



p → length of $\perp^r$ drawn from the origin to the line

α → angle made by the $\perp^r$ with +ve X-axis

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

-x-

Ex $y = 3x + 1$.

$y = mx + c$

$3x - y + 1 = 0$

$m = -\frac{3}{-1} = 3$

$m = 3$

$2y = 3x - 1$

$3x - 2y - 1 = 0$

$m = -\frac{3}{-2} = \frac{3}{2}$

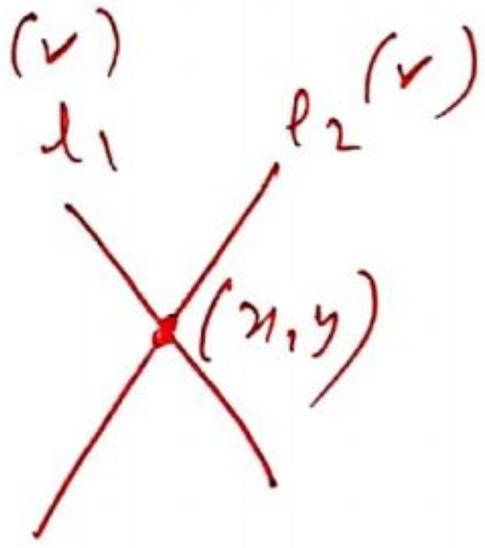
$m = 3/2$

(*) Intersection point of two lines

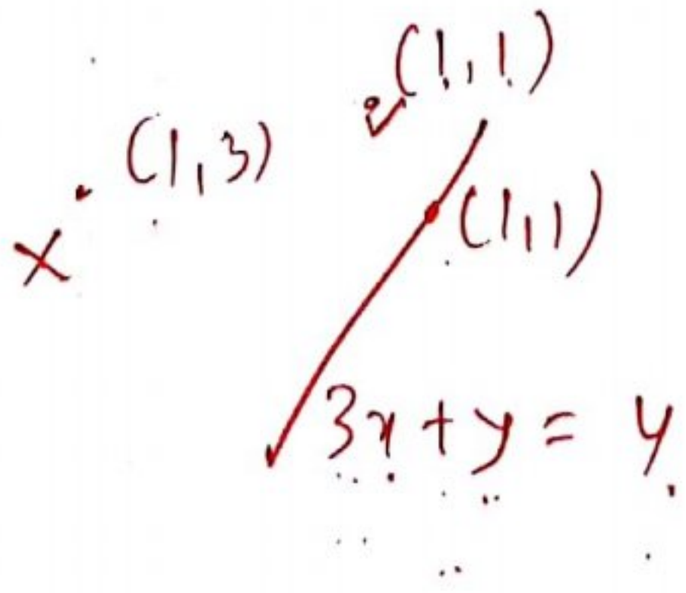
Solve equations of l_1 & l_2 by elimination method

get $x =$

$y =$

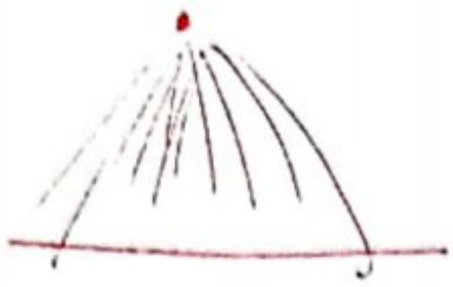


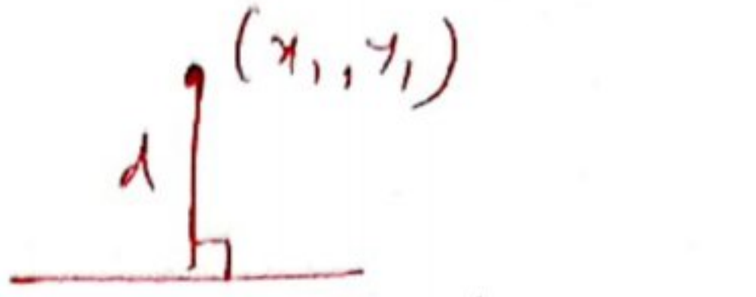
(*)



Scanned with CamScanner

Formula (2) Distance b/w point & a line



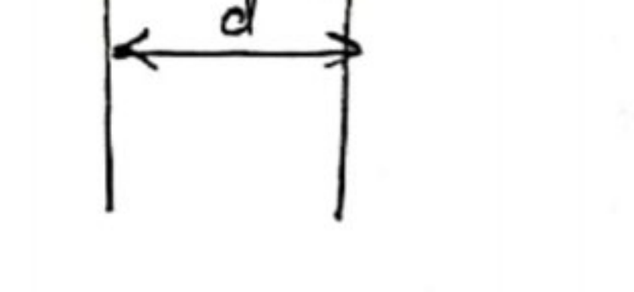


$$d = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2+b^2}}$$

Eg Point: (1, -2) line $3x - 2y = 4$

Find distance

$$d = \frac{|3 + 4 - 4|}{\sqrt{9+4}} = \frac{3}{\sqrt{13}} \text{ units}$$



Formula

Distance b/w two parallel lines

Given equations

$$a_1x + by + c_1 = 0$$
$$ax + by + c_2 = 0$$

distance $$d = \frac{|c_2 - c_1|}{\sqrt{a^2+b^2}}$$

Eg Given equations $x - 2y + 3 = 0$ & $2x - 4y = 8$

$2x - 4y = 8$ → divide by 2 → $x - 2y - 4 = 0$

$$d = \frac{|-4 - 3|}{\sqrt{1+4}} = \frac{7}{\sqrt{5}} \text{ units}$$

Scanned with CamScanner