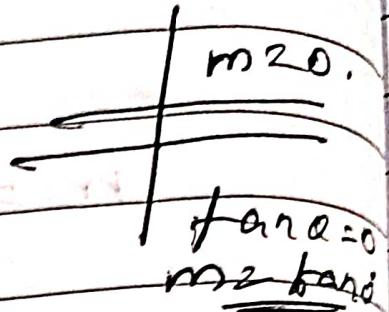


0°
Slope is 0 for the y-axis
and any line parallel to y-axis.

Q. $(-3, 2), (4, 2)$,

$$(x_1, y_1) = (-3, 2)$$

$$(x_2, y_2) = (4, 2)$$



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 2}{4 - (-3)} = \frac{0}{7} = 0.$$

$$\tan \theta = 0.$$

The line parallel to x-axis

~~or~~
Slope is 0 for the y-axis
and any line perpendicular
to y-axis.

The slope is also called gradient.

Equations of straight lines.

Case (i) Slope- Intercept form

Given slope and y-intercept

A straight line having an angle of inclination α with the x-axis and having y-intercept c .

Let (x, y) be any point on the straight line.

Draw $PN \perp x$ to the x-axis and $PA \perp RN$. $OP = c$.

From the right angle PQR , $IP = \alpha$.

$$\tan \alpha = \frac{RQ}{PQ} = \frac{RN - OP}{ON} = \frac{RN - OP}{ON}$$

$$= \frac{y - c}{x}$$

$\tan \alpha = m$.

$$m = \frac{y - c}{x}$$

$$mx = y - c \Rightarrow y = mx + c$$

Remark. Y-intercept is the distance between the intersecting point of straight line and Y-axis, from the origin.

Q. Write down the equations of the line with slope y_2 and y-intercept -1.

$$\text{Slope} = m = y_2$$

$$\text{y-intercept}, c = -1$$

Slope-intercept form

$$y = mx + c$$

$$= y_2 x - 1 = \frac{x}{2} - 1$$

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

$$2y = x - 2$$

$$\therefore \cancel{2y} - \cancel{x} - 2 = 0$$

Q. Find the equation of a line with angle of inclination 45° with the x-axis and y-intercept -1.

$$\theta = 45^\circ \rightarrow c = -1$$

$$m = \tan \theta = \tan 45^\circ = 1$$

slope-intercept form

$$y = mx + c$$

$$y = x - 1$$

$$x - y - 1 = 0$$

Q. Write down the equation of a line which makes an angle 150° with the x-axis and cutting the y-axis at the point $(0, -2)$.

$$\theta = 150^\circ$$

$$m = \tan \theta$$

$$= \tan 150^\circ$$

$$= \tan(90 + 60)$$

$$= -\cot 60^\circ = -\frac{1}{\sqrt{3}}$$

$$y - \text{intercept } c = -2.$$

Slope-intercept form

$$y = mx + c$$

$$y = -\frac{1}{\sqrt{3}}x - 2.$$

$$y = -x - 2\sqrt{3}, \quad -x - 2\sqrt{3} = \sqrt{3}y$$

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

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

Carte I

Slope - point form

Gives slope and any one point (x_1, y_1) on the line.

It having an inclination α with the x-axis and passing through a given point (x_1, y_1) . Let (x, y) be any other point on the line.

Draw BM , CN \perp to x-axis and $BQ \parallel$ to CN .

$\Delta BAC\alpha$, $\angle B = 0$

$$\tan \alpha = \frac{CQ}{BQ} = \frac{CN - BN}{MN}$$

$$\tan \alpha = \frac{y - BM}{ON - OM} = \frac{y - y_1}{x - x_1}$$

$$\tan \alpha = m = \frac{y - y_1}{x - x_1}$$

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

1. Write down the equation of the line determined by the slope -2 and passing through (-2, 3).

$$m = -2, (x_1, y_1) = (-2, 3)$$

$$m = \frac{y - y_1}{x - x_1}$$

$$-2 = \frac{y - 3}{x + 2}$$

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

$$-2x - 4 = y - 3$$

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

$$-2x - y - 1 = 0$$

$$\underline{2x + y + 1 = 0}$$

2. Write down the equation of the line determined by the inclination to x-axis is 45° and passing through (2, 3).

$$\theta = 45^\circ$$

$$m = \tan \theta = \tan 45^\circ = 1$$

$$(x_1, y_1) = (2, 3)$$

$$m = \frac{y - y_1}{x - x_1} \Rightarrow 1 = \frac{y - 3}{x - 2}$$

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

$$x - y + 1 = 0$$

- Q. A straight line is inclined at 135° with the x-axis and it passes through $(3, -4)$. Find the equation.

$$\theta = 135^\circ$$

$$m = \tan \theta = \tan 135^\circ$$

$$= \tan(90 + 45)$$

$$= -\cot 45$$

$$m = -1$$

$$(x_1, y_1) = (3, -4)$$

$$m = \frac{y - y_1}{x - x_1}$$

$$\therefore \frac{y - 4}{x - 3} = -1$$

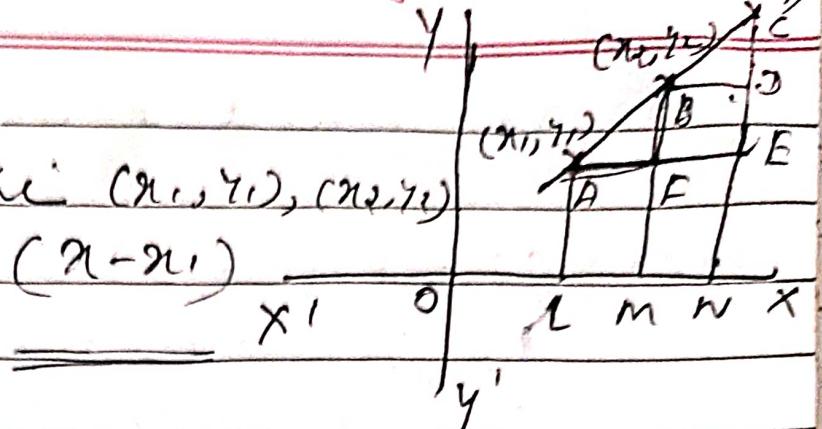
$$-(x - 3) = y + 4$$

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

$$\therefore -x - y - 1 = 0 \Rightarrow x + y + 1 = 0$$

Case IIITwo-point formGiven. Two points are $(x_1, y_1), (x_2, y_2)$

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



Write down the equations to the lines joining the pairs of points

$$① (3, 8), (6, 12)$$

$$(x_1, y_1) \rightarrow (3, 8)$$

$$(x_2, y_2) \rightarrow (6, 12)$$

Two-point form is

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

$$y - 8 = \frac{12 - 8}{6 - 3} (x - 3)$$

$$y - 8 = \frac{4}{3} (x - 3)$$

(After multiplying, we get)

$$3(y - 8) = 4(x - 3) \Rightarrow 3y - 24 = 4x - 12$$

$$3y - 24 - 4x + 12 = 0$$

$$-4x + 3y - 12 = 0$$

$4x - 3y + 12 = 0$ is the required

Required equation

$$(2) (2, -1), (-6, 3).$$

$$(x_1, y_1) \rightarrow (2, -1)$$

$$(x_2, y_2) \rightarrow (-6, 3)$$

The two point form is

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

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

$$y + 1 = \frac{4}{-8} (x - 2)$$

$$-8(y + 1) = 4(x - 2)$$

$$-8y - 8 = 4x - 8$$

$$-8y - 8 - 4x + 8 = 0$$

$$-4x - 8y = 0$$

$$4x + 8y = 0$$

$$4(x + 2y) = 0$$

$x + 2y = 0$. is the

Required equation.

(3) The vertices of a triangle are $A(3, 4)$, $B(5, 6)$ and $C(-1, -2)$. Find the equation to the median through A .

median \rightarrow the line segment from any vertex of a triangle to the mid-point of the opposite side.

\overline{AD} is the median. $B(5, 6)$, $C(-1, -2)$, $D(2, 2)$ is the mid-point of \overline{BC} . The points of D are $= \left(\frac{-1+5}{2}, \frac{-2+6}{2} \right)$

$$= (4/2, 4/2) = (2, 2)$$

The pairs of A and D are $(3, 4)$ and $(2, 2)$. Using two point form

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

$$(x_1, y_1) \rightarrow (3, 4), (x_2, y_2) \rightarrow (2, 2)$$

$$y - 4 = \frac{2 - 4}{2 - 3} (x - 3)$$

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

$$y - 4 = 2(n - 3)$$

$$y - 4 = 2n - 6$$

$$y - 4 - 2n + 6 = 0$$

$$-2n + y + 2 = 0$$

$$\therefore 2n - y - 2 = 0$$

Case IV

Intercept form . y

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

$B(0, b)$

$P(x, y)$

$m \cdot A(a, 0) X$

Here a is called

x -intercept and

b is called y -intercept

The x -intercept ' a ' and y -intercept ' b ' are given.

Q Write down the equation of a line which has x -intercept 3 and y -intercept 5

x -intercept $\rightarrow 3$, $a = 3$

y -intercept $\rightarrow 5$, $b = 5$

Intercept form is

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

$$\frac{x}{3} + \frac{y}{5} = 1.$$

$$\frac{5x+3y}{15} = 1$$

$$5x+3y = 15$$

$5x+3y-15=0$ is the required equation.

2. Write down the equations of a line having x -intercept 5 and passing through $(3, -2)$.

Here x -intercept 5 and passing through $(x, y) = (3, -2)$ are given.

y -intercept - unknown.

Intercept form is

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

$\frac{x}{5} + \frac{y}{b} = 1$. But this line to pass through $(3, -2)$.
 $\therefore (x, y) \rightarrow (3, -2)$

$$\frac{3}{5} + \frac{-3}{b} = 1$$

$$\frac{3b - 10}{5b} = 1$$

$$\Rightarrow 3b - 10 = 5b$$

$$3b - 5b = 10$$

$$-2b = 10 \Rightarrow b = \frac{10}{-2} = -5$$

∴ $a = 5, b = -5$. The required equations, using intercept form

$$\frac{x}{a} + \frac{y}{b} = 1$$
 find the equation

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

$$-5x + 5y = 1$$

$$-25 \Rightarrow -5x + 5y = -25$$

$$-5x + 5y + 25 = 0$$

$$5x - 5y - 25 = 0$$

$$5(x - y - 5) = 0$$

$$\Rightarrow (x - y - 5) = 0$$

is the required equation.