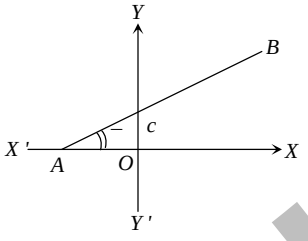
10.3 Equations of straight line in different forms

(1) **Slope form :** Equation of a line through the origin and having slope m is $y = mx$.

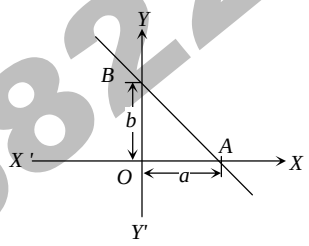
(2) **One point form or Point slope form :** Equation of a line through the point (x_1, y_1) and having slope m is $y - y_1 = m(x - x_1)$.

(3) **Slope intercept form :** Equation of a line (non-vertical) with slope m and cutting off an intercept c on the y-axis is $y = mx + c$.



The equation of a line with slope m and the x-intercept d is $y = m(x - d)$.

(4) **Intercept form :** If a straight line cuts x-axis at A and the y-axis at B then OA and OB are known as the intercepts of the line on x-axis and y-axis respectively.



Then, equation of a straight line cutting off intercepts a and b on x–axis and y–axis respectively is $\frac{x}{a} + \frac{y}{b} = 1$.

If given line is parallel to X axis, then X-intercept is undefined.

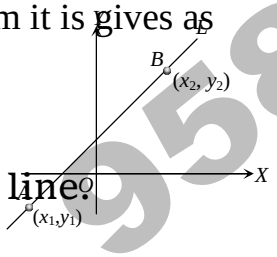
If given line is parallel to Y axis, then Y-intercept is undefined.

(5) **Two point form:** Equation of the line through the points $A(x_1, y_1)$ and $B(x_2, y_2)$ is, $(y - y_1) = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$.

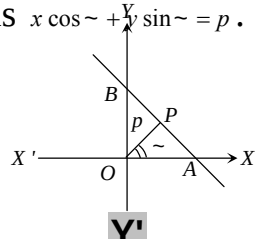
In the determinant form it is gives as

$$\begin{vmatrix} x & y & 1 \\ x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \end{vmatrix} = 0$$

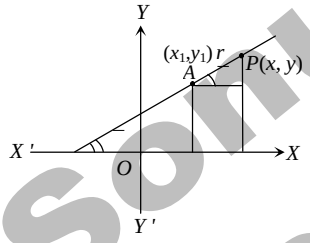
is the equation of line.



(6) **Normal or perpendicular form :** The equation of the straight line upon which the length of the perpendicular from the origin is p and this perpendicular makes an angle ~ with x-axis is $x\cos\sim + y\sin\sim = p$.



(7) **Symmetrical or parametric or distance form of the line :** Equation of a line passing through (x_1, y_1) and making an angle $^{-}$ with the positive direction of x-axis is $\frac{x - x_1}{\cos^{-}} = \frac{y - y_1}{\sin^{-}} = \pm r$, where r is the distance between the point $P(x, y)$ and $A(x_1, y_1)$.



The co-ordinates of any point on this line may be taken as $(x_1 \pm r\cos^{-}, y_1 \pm r\sin^{-})$, known as parametric co-ordinates. 'r' is called the parameter.

Equation of parallel and perpendicular lines to a given line

(1) Equation of a line which is parallel to $ax + by + c = 0$ is $ax + by + ª = 0$.

(2) Equation of a line which is perpendicular to $ax + by + c = 0$ is $bx - ay + ª = 0$.

The value of $ª$ in both cases is obtained with the help of additional information given in the problem.

(3) If the equation of line be $a\sin^{-} + b\cos^{-} = c$, then line

(i) Parallel to it, $a\sin^{-} + b\cos^{-} = d$

(ii) Perpendicular to it, $a\sin\left(\frac{®}{2} + ^{-}\right) + b\cos\left(\frac{®}{2} + ^{-}\right) = d$.