

IIT-JEE · CBSE **eBOOKS**

CLASS 11 & 12th



Learning Inquiry
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CLASS 11th

Straight Lines

misostudy



01. Straight Lines

A straight line is a curve such that every point on the line segment joining any two points on it lies on it.

Every first degree equation in x, y represent a straight line. so, $ax + by + c = 0$ is the general equation of a line.

It should be noted that there are only two unknowns in the equation of a straight line because equation of every straight line can be put in the form $ax + by + 1 = 0$ where a, b are two unknowns.

(i) Slope (Gradient) of a Line

The trigonometrical tangent of the angle that a line makes with the positive direction of the x -axis in anticlockwise sense is called the slope or gradient of the line.

The slope of a line is generally denoted by m .

Remark The angle of inclination of a line with the positive direction of x -axis in anticlockwise sense always lies between 0° and 180° .

If (x_1, y_1) and (x_2, y_2) are coordinates of any two points on a line, then its slope m is given by

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{Difference of ordinates}}{\text{Difference of abscissae}}$$

(ii) Angle Between Two Lines

The angle θ between the lines having slopes m_1 and m_2 is given by

$$\tan \theta = \pm \frac{m_2 - m_1}{1 + m_1 m_2}$$

If two lines of slopes m_1 and m_2 are parallel, then the angle θ between them is of 0° .

$$\therefore \tan \theta = \tan 0^\circ = 0 \Rightarrow \frac{m_2 - m_1}{1 + m_1 m_2} = 0 \Rightarrow m_2 = m_1$$

Thus, when two lines are parallel, their slopes are equal.

Also, points A, B and C are collinear, iff

$$\text{Slope of } AB = \text{Slope of } BC = \text{Slope of } AC.$$

If two lines of slopes m_1 and m_2 are perpendicular, then the angle θ between them is of 90°

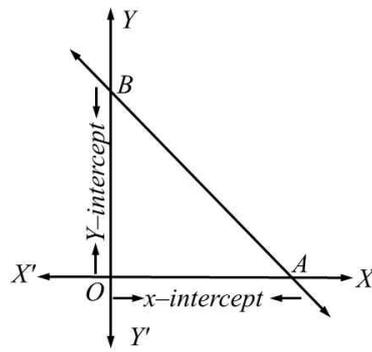
$$\therefore \cot \theta = 0 \Rightarrow \frac{1 + m_1 m_2}{m_2 - m_1} = 0 \Rightarrow m_1 m_2 = -1$$

(iii) Intercepts of a Line on The Axes

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.

The intercepts are positive or negative according as the line meets with positive or negative directions of the coordinate axes.

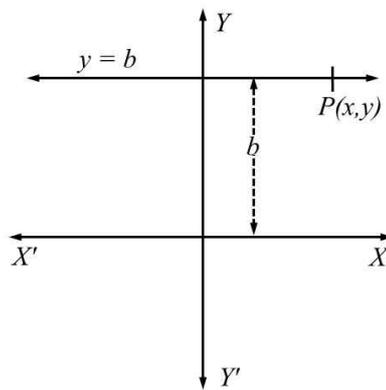
In Figure, we have $OA = x$ -intercept, $OB = y$ -intercept.



Figure

(iv) Line Parallel to x -Axis

The equation of a line parallel to x -axis at a distance b from it is $y = b$.



Figure

Since x -axis is parallel to itself at a distance 0 from it. Therefore, the equation of x -axis is $y = 0$.

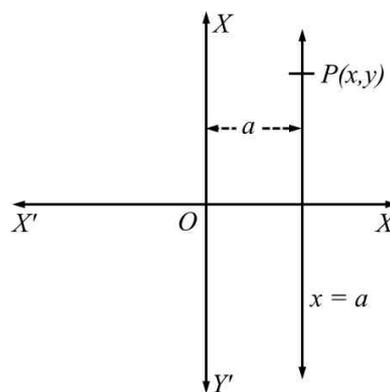
If a line is parallel to x -axis at a distance b and below x -axis, then its equation is $y = -b$.

(v) Line Parallel to y -Axis

The equation of a line parallel to y -axis at a distance a from it is $x = a$.

Since y -axis is parallel to itself at a distance 0 from it, therefore the equation of y -axis is $x = 0$.

If a line is parallel to y -axis at a distance a and to the left of y -axis, then its equation is $x = -a$.



Figure