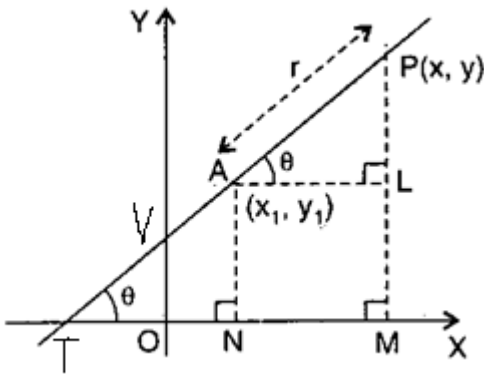


## Distance form of a line

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The [equation of the straight line](#) passing through  $(x_1, y_1)$  and making an

angle  $\theta$  with the positive direction of  $x$  – axis is

$$x - x_1 = y - y_1 = r$$

$$\cos \theta \quad \sin \theta$$

where  $r$  is the [distance](#) of the point  $(x, y)$  on the line from the point  $(x_1, y_1)$

Proof: Let the given line meets  $x$  – axis at  $T$ ,  $y$  – axis at  $V$  and passes through the point  $A (x_1, y_1)$ . Let  $P (x, y)$  be any point on the line at a distance  $r$  from  $Q (x_1, y_1)$  i. e.  $PA = r$ .

Draw  $PM$  [perpendicular](#) to  $OX$ ,  $AN$  perpendicular to  $OX$  and  $AL$  perpendicular to  $PM$ . Then,

$$AL = NM = OM - ON = x - x_1$$

$$\text{and, } PL = PM - LM = PM - AN = y - y_1$$

In  $\triangle PAL$ , we have

$$\cos \theta = AL/PA$$

$$\cos \theta = (x - x_1)/r \text{ – (i)}$$

$$\text{and } \sin \theta = PL/PA$$

$$\sin \theta = (y - y_1)/r \text{ – (ii)}$$

From (i) and (ii), we get

$$x - x_1 = y - y_1 = r$$

$$\cos \theta \quad \sin \theta$$

This is the required equation of the line in the distance form.

## Important Remarks

1. The equation of the line is

$$x - x_1 = y - y_1 = r$$

$$\cos \theta \quad \sin \theta$$

$$x - x_1 = r \cos \theta \text{ and } y - y_1 = r \sin \theta$$

$$x = x_1 + r \cos \theta \text{ and } y = y_1 + r \sin \theta$$

Thus, the coordinates of any point on the line at a distance  $r$  from the given point  $(x_1, y_1)$  are  $(x_1 + r \cos \theta, y_1 + r \sin \theta)$ . If  $P$  is on the right side of  $(x_1, y_1)$ , then  $r$  is positive and if  $P$  is on the left side of  $(x_1, y_1)$ , then  $r$  is negative. Since different values of  $r$  determine different points on the line, therefore the above form of the line is also called [parametric](#) form or symmetric form of a

line.

2. In the above form one can determine the coordinates of any point on the line at a given distance from the given point through which it passes. At a given distance  $r$  from the point  $(x_1, y_1)$  on the line  $x - x_1 = y - y_1$

$$\cos \theta \quad \sin \theta$$

there are two points viz.  $(x_1 + r \cos \theta, y_1 + r \sin \theta)$  and  $(x_1 - r \cos \theta, y_1 - r \sin \theta)$

Now try it yourself! Should you still need any help, [click here](#) to schedule live online session with e Tutor!

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## Reference Links :

- [http://en.wikipedia.org/wiki/Linear\\_equation#Standard\\_form](http://en.wikipedia.org/wiki/Linear_equation#Standard_form)
- <http://en.wikipedia.org/wiki/Distance>
- <http://en.wikipedia.org/wiki/Perpendicular>
- <http://www.answers.com/topic/parametric-equation>

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