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Distance form of a line

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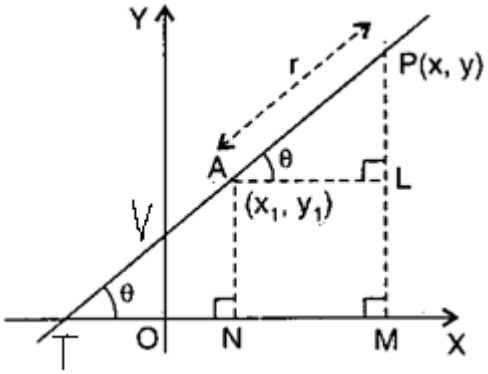

The equation of the straight line passing through (x1, y1¬) and making an angle ? with the positive direction of x – axis is

x – x1 = y – y1 = r
cos ? sin ?

where r is the distance of the point (x, y) on the line from the point (x1, y1)

Proof: Let the given line meets x – axis at T, y – axis at V and passes through the point A (x1, y1). Let P (x, y) be any point on the line at a distance r from Q (x1, y1) i. e. PA = r.

Draw PM perpendicular to OX, AN perpendicular to OX and AL perpendicular to PM. Then,

AL = NM = OM – ON = x – x1
and, PL = PM – LM = PM – AN = y – y1
In ?PAL, we have
cos ? = AL/PA
cos ? = (x – x1)/r – (i)
and sin ? = PL/PA
sin ? = (y – y1)/r – (ii)
From (i) and (ii), we get

x – x1 = y – y1 = r
cos ? sin ?

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

Important Remarks

1. The equation of the line is
x – x1 = y – y1 = r
cos ? sin ?
x – x1 = r cos ? and y – y1 = r cos ?
x = x1 + r cos ? and y = y1 + r cos ?

Thus, the coordinates of any point on the line at a distance r from the given point (x1¬, y1) are (x1 + r cos ?, y1 + r sin ?). If P is on the right side of (x1, y1), then r is positive and if P is on the left side of (x1, y1), 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 (x1, y1) on the line x – x1 = y – y1

cos ? sin ?

there are two points viz. (x1 + r cos ?, y1 + r sin ?) and
(x1 – r cos ?, y1 – r sin ?)

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/Distance
- http://en.wikipedia.org/wiki/Perpendicular
- http://www.answers.com/topic/parametric-equation

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