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Solutions
Class 11 Maths
Chapter 23
Ex 23.18

Let the required equation be ax + by = c but here it passes through origin (0,0).

$$C = 0$$

$$Equation is an abu = 0$$

$$5ax + by = 0$$

$$-\sqrt{3}$$

Slope of the line
$$(m_1) = \frac{-a}{b}$$
 and $m_2 = \frac{-\sqrt{3}}{1}$

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 $1 - \frac{\sqrt{3}a}{h} = \frac{-a}{h} - \sqrt{3}$ and $1 + \frac{a}{h}\sqrt{3} = \frac{-a}{h} + \sqrt{3}$

 $b - \sqrt{3}a = -a - \sqrt{3}b$ and $b + a\sqrt{3} = -a + b\sqrt{3}$

 $\frac{\partial}{\partial x} - \frac{1 - \sqrt{3}}{\sqrt{3} - 1} = \frac{\left(\sqrt{3} - 1\right)^2}{2} = 2 - \sqrt{3}$

:. Required lines are $\frac{y}{y} = \sqrt{3} \pm 2$ or $y = (\sqrt{3} \pm 2)x$

 $\frac{a}{b} = \frac{\sqrt{3} - 1}{\sqrt{3} + 1} = -2 - \sqrt{3}$

Straight lines Ex 23.18 Q2

Let the required equation be y = mx + c

But, c = 0 as it passes through origin (0,0)

Equation of the lines is y = mx.

 $a(1-\sqrt{3}) = b(-\sqrt{3}-1)$ and $a(\sqrt{3}+1) = b(\sqrt{3}-1)$

$$\Rightarrow$$
 Angle between $\sqrt{3}$

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 Angle between $\sqrt{3}$.

$$\Rightarrow \text{ Angle between } \sqrt{3}x + y = 11 \text{ and } ax + by = 0 \text{ is } 45^{\circ}$$

ope of the line
$$(m_1) = \frac{1}{b}$$

Angle between $\sqrt{3}x$

 $1 = \frac{\frac{-\partial}{b} \pm \left(-\sqrt{3}\right)}{1 \mp \frac{\partial}{b} \times \sqrt{3}}$

Slope of the line
$$(m_1) = \frac{3}{b}$$

Slope of the line
$$(m_1) = \frac{-a}{b}$$

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 $tan 45^{\circ} = \frac{m_1 \pm m_2}{1 \mp m_1 m_2}$

ope of the line
$$(m_1) = \frac{-a}{b}$$

$$m_1 = \frac{-a}{b}$$

$$a_1 = \frac{-a}{a}$$

or
$$(\sqrt{3} + 1)x + (1 - \sqrt{3})y = a$$
 is $\sqrt{3} + 1 = 4 - 2\sqrt{3} = 3 = \sqrt{3}$

$$\frac{\sqrt{3}+1}{\sqrt{3}-1} = \frac{4-2\sqrt{3}}{2} = 2-\sqrt{3}.$$

 $\frac{\frac{1}{\sqrt{3}} + 1}{1 - \frac{1}{\sqrt{5}} \times 1} = \frac{m \pm 2 - \sqrt{3}}{1 - m(2 - \sqrt{3})}$

 $\therefore \frac{1}{m} = 0 \quad \text{or} \quad m = -\sqrt{3}$

Straight lines Ex 23.18 Q3

Given equation is 6x + 5y - 8=0.

Slope of given line = $m = -\frac{6}{5}$

Equations of required line is,

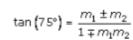
 $y+1=\frac{-\frac{6}{5}-1}{1+\frac{6}{5}}(x-2)$

 $2 + \sqrt{3} = \frac{m + 2 - \sqrt{3}}{1 + m(\sqrt{3} - 2)} \text{ and } 2 + \sqrt{3} = \frac{m + \sqrt{3} - 2}{1 + m(2 - \sqrt{3})}$

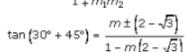
 $y = -\sqrt{3}x$ and x = 0 are the required equations.

Slope of $x + y + \sqrt{3}y = \sqrt{3}x = a$

The angle between $x + y + \sqrt{3}y - \sqrt{3} = a$ and y = mx is 75°







$$y - k = m'(x - h)$$
And this line is inclined at $\tan^{-1} m$ to straight line $y = mx + c$.

Slope $= m = \tan \theta$

Passing through (h, k)
 (x_0, y_1)

$$\therefore \text{ Equation of line is } y - y_1 = m(x - x_1) \qquad ----(i)$$

Also, $\tan \theta = \left| \frac{m - m'}{1 + mm'} \right|$

Here, $m = m'$

$$\therefore \tan \theta = \frac{m - m}{1 + m^2} \text{ or } \left| \frac{-m - m}{1 - m^2} \right|$$

$$= 0 \text{ or } \frac{+2m}{1 - m^2}$$

Substituting in (i)
 $y - k = 0$

$$\Rightarrow y = k \qquad \text{or}$$
 $y - k = \frac{+2m}{1 - m^2}(x - h)$

 $(1-m^2)(y-k) = +2m(x-h)$

 $y+1=\frac{-11}{11}(x-2)$

 $y+1=\frac{-\frac{6}{5}+1}{1-\frac{6}{5}}(x-2)$

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

Straight lines Ex 23.18 Q4

The required equation is

y+1=x-2x-y=3

y+1=-x+2x+y-1=0

Here,
$$x_1 = 2$$
, $y_1 = 3$, $\alpha = 45^{\circ}$

Here,
$$x_1 = 2$$
, $y_1 = 3$, $\alpha = 45^\circ$
 $m = \text{slope of line } 3x + y - 5 = 0$

$$= \frac{-\text{coeff of } x}{\text{coeff of } y} = -3$$

The equations of the required line are

$$y - y_1 = \frac{-3 - \tan 45^\circ}{1 + (-3) \tan 45^\circ} (x - 2)$$

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

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

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

2x - y - 1 = 0

Also, $y-3=\frac{-3+\tan 45^{\circ}}{1-(-3)\tan 45}(x-2)$

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

x + 2y - 8 = 0

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

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

$$y - y_1 = \frac{-3 - \tan 45^{\circ}}{1 + (-3)\tan 45^{\circ}} (x - 2)$$

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

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



AC = 3x + 4y = 4

c(2,2)

Then, slope of $AC = \frac{-3}{4}$

AB = BC

 $1 = \frac{m_1 + \frac{3}{4}}{1 - \frac{3}{4}m}$

 $m_2 \times \frac{1}{7} = -1$ $m_2 = -7$. The equation of BC is

and

The equation of AB is

 $(y-2)=\frac{1}{7}(x-2)$ 7y - 14 = x - 2x - 7y + 12 = 0

(y-2) = -7(x-2)y - 2 = -x + 14y + 7x - 16 = 0

and, $AB \perp BC$

 $4 - 3m_1 = 4m_1 + 3$

 $7m_1 = 1$ $m_1 = \frac{1}{7}$

: (slope of AB) \times (slope of BC) = -1

Let the isosceles right triangle be.

[... It is an isoscales right triangle]

Then, angle between (AB and AC) and (BC and AC) is 45°.

 $\tan\frac{\pi}{4} = \frac{m_1 - \left(\frac{-3}{4}\right)}{1 + \left(\frac{-3}{4}\right)m_1} \qquad \qquad \left[\text{when } m_1 = \text{slope of } BC\right]$

Let $C(2 + \sqrt{3}, 5)$ be one vertex and x = y be the opposite side of equilateral triangle ABC.

The other two sides makes an angle of 60° with other two sides. slope of x - y = 0 is 1.

$$y - 5 = \frac{1 \pm \tan 60^{\circ}}{1 \mp \tan 60^{\circ}} \left(x - 2 - \sqrt{3} \right)$$

$$y - 5 = \frac{1 + \sqrt{3}}{1 - \sqrt{3}} \left(x - 2 - \sqrt{3} \right) \text{ and } y - 5 = \frac{1 - \sqrt{3}}{1 + \sqrt{3}} \left(x - 2 - \sqrt{3} \right)$$

$$y - 5 = \left(\sqrt{3} - 2 \right) \left(x - 2 - \sqrt{3} \right) \text{ and } y - 5 = \left(\sqrt{3} - 2 \right) \left(x - 2 - \sqrt{3} \right)$$

$$y + \left(2 + \sqrt{3} \right) x = 12 + 4\sqrt{3} \text{ and } y + \left(2 - \sqrt{3} \right) x = 6$$

Hence proved the 2nd side of $\triangle ABC$ is $y + (2 - \sqrt{3})x = 6$ and the 3rd side is $y + (2 + \sqrt{3})x = 12 + 4\sqrt{3}$.

Straight lines Ex 23.18 Q8

Let ABCD be a square whose diagnal BD is 4x + 7y = 12

Then, slope of
$$BD = \frac{-4}{7}$$

Let slope of AB = m

Then,
$$\tan 45^{\circ} = \frac{m + \frac{4}{7}}{1 - \frac{4}{7}m}$$

$$7 - 4m = 7m + 4$$

$$11m = 3$$

$$m = \frac{3}{11}$$

:. Slope of
$$BC = \frac{-1}{\text{slope of } AB}$$
$$= \frac{-11}{3}$$

.: Equation f of AB is

$$(y-2) = \frac{3}{11}(x-1)$$

$$11y - 22 = 3x - 3$$

$$3x - 11y + 19 = 0$$

and

Equation of BC is

$$(y-2) = \frac{-11}{3}(x-1)$$

$$11x + 3y - 17 = 0$$