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Mat 104 {19/MHS01/194}

1.) $y - 3x - 2 = 0$ and $3y + x + 9 = 0$

Solution

$y - 3x - 2 = 0$; For them to be perpendicular then $m_1 m_2 = -1$

$y - 3x - 2 = 0$

Making y the subject of formula

$y = 3x + 2$

$m_1 = 3$

& $3y + x + 9 = 0$

Making y the subject of formula

$3y = -x - 9$

$y = -\frac{x}{3} - \frac{9}{3}$; $y = -\frac{1}{3}x - 3$

$y = mx + c$. $m_2 = -1/3$

$m_1 m_2 = -1$ $\quad 3 \times -\frac{1}{3} = -1$; Since $m_1 m_2 = -1$ then the lines $y = 3x - 2 = 0$ and $3y + x + 9 = 0$ are Perpendicular.

2.) $3y - 4 = 2x + 3$ and $y - 5 = x + 6$

$3y - 4 = 2x + 3$ —(i)

$y - 5 = x + 6$ —(ii)

Making y the subject of formula in equ (i)

$3y = 2x + 3 + 4$

$3y = 2x + 7 = y = \frac{2x}{3} + \frac{7}{3}$

By comparing with $y = mx + c$

$m_1 = \frac{2}{3}$

Making y the subject of formula in (ii)

$y - 5 = x + 6$

$y = x + 6 + 5$

$y = x + 11$

By comparing with $mx + c$

$m_2 = 1$; For lines to be perpendicular $m_1 m_2 = -1$; $m_1 m_2 = \frac{2}{3} \times 1 = \frac{2}{3}$

$m_1 m_2 \neq -1$

Hence, the lines $3y - 4 = 2x + 3$ and $y - 5 = x + 6$ is not Perpendicular

(3) ~~Find~~ $x^2+y^2+3xy-11=0$ $(x=1, y=2)$

$m = \frac{dy}{dx}$ $\quad x^2+y^2+3xy-11=0$

$\frac{dy}{dx}$ $\quad 2x+2y\frac{dy}{dx}+3\left(x.\frac{dy}{dx}+y\cdot 1\right)=0$

$2x+2y\frac{dy}{dx}+3\left(x\cdot\frac{dy}{dx}+y\right)=0$

$2x+2y\frac{dy}{dx}+3x\frac{dy}{dx}+3y=0$

$2y\frac{dy}{dx}+3x\frac{dy}{dx}=-2x-3y$

$\frac{dy}{dx}=\frac{-2x-3y}{2y+3x}$

$m = \frac{dy}{dx}\Big|_{x=1, y=2} = \frac{-2(1)-3(2)}{2(2)+3(1)} = \frac{-2-6}{4+3} = \frac{-8}{7}$

Equation of tangent

$y-y_1=m(x-x_1)$

$y-2=\frac{-8}{7}(x-1)$

$7(y-2)=-8(x-1)$

$7y-14=-8x+8$

$7y+8x-14-8=0$

$7y+8x-14-8=0$

$7y+8x-22=0$ {Equation of tangent}

ii Equation of Normal

$y-y_1=\frac{-1}{m}(x-x_1)$

$y-2=\frac{-1}{-8/7}(x-1)$

$y-2=\frac{7}{8}(x-1)$

$8(y-2)=7(x-1)$

$8y-16=7x-7$

$8y-7x-16+7=0$

$8y-7x-9=0$

{It is the equation of Normal}