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COLLEGE / DEPT: MEDICINE AND HEALTH SCIENCES / MEDICINE AND SURGERY

COURSE CODE: MAT 104

MATRIC NO: 19/MHS01/030

Examine whether or not these pair of lines are perpendicular to each other

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

For perpendicular line $m_1 m_2 = -1 \therefore m_1 = \frac{1}{m_2}$, $m_2 = -\frac{1}{m_1}$

from $y = mx+c$

$y-3x-2=0$ -(i)

$3y+x+9=0$ -(ii)

from equation (i)

$y = 3x-2$

$m_1 = 3$

from equation (ii)

$3y = -x-9$

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

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

$m_2 = -\frac{1}{3}$

$m_1 = -1/m_2$

$m_1 = \frac{-1}{-\frac{1}{3}}$

$m_1 = 3$

$M_2 = \frac{-1}{M_1}$

$M_2 = \frac{-1}{3}$

Therefore the lines are perpendicular to each other.

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

For perpendicular lines, $M_1 M_2 = -1$, therefore $m_1 = \frac{-1}{m_2}$ and $m_2 = \frac{-1}{m_1}$

From $y = mx + c$

$3y - 4 = 2x + 3$

$3y = 2x + 3 + 4$

$3y = 2x + 7$

$y = \frac{2}{3}x + \frac{7}{3}$ - (i)

$m_1 = 2/3$

$y - 5 = x + 6$

$y = x + 5 + 6$

$y = x + 11$ - (ii)

$m_2 = 1$

$m_1 = \frac{-1}{m_2} = \frac{-1}{1} = -1$

$m_2 = \frac{-1}{m_1} = \frac{-1}{2/3} = -3/2$

Therefore the lines are not perpendicular to each other.

3) Find the equations of the tangent and normal to the curve $x^2+y^2+3xy-11=0$ at point $x=1$ and $y=2$

Solution:

$x^2+y^2+3xy-11=0$

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

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

$2x+3y = -2y\,dy/dx - 3x\,dy/dx$

$2x+3y = (-2y-3x)\,dy/dx$

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

at point $x=1, y=2$

$\frac{dy}{dx} = \frac{2(1)+3(2)}{-2(2)-3(1)} = \frac{2+6}{-4-3} = \frac{8}{-7} = -8/7 = m$

Using,

$M = \frac{y-y_1}{x-x_1}$ For the equation of the tangent at (1, 2)

$-8/7 \times \frac{y-2}{x-1}$

$-8[x-1] = 7[y-2]$

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

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

$7y = -8x+22$ -> Equation of the tangent to the Curve

Using

$-1/m = \frac{y-y_1}{x-x_1}$ for equation of the normal at (1,2)

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

$\frac{7}{8} \times \frac{y-2}{x-1}$

$7[x-1] = 8[y-2]$

$7x - 7 = 8y - 16$

$8y = 7x - 7 + 16$

$8y = 7x + 9$ -> Equation of the Normal to the Curve