SURNAME: OKAM

OTHER NAMES: EMMANUEL CHIJIOKE

MATRIC NO.:19/MHS01/309

COLLEGE: Medicine and Health Sciences

DEPARTMENT: Medicine and Surgery LEVEL: 100

Assignment Title: Calculus For MBBS Students ONLY
Course Title: General Mathematics III
Course Code: MAT 104

Question

Examine whether or not these pair of lines are perpendicular to each other. (1) y - 3x - 2 = 0 and 3y + x + 9 = 0 (2) 3y - 4 = 2x + 3 and y-5 = x+ 6 (3) Find the equations of the tangent and normal to the curve xsquare + ysquare+3xy-11 = 0 at the point x = 1, y = 2.

① $y - 3x - 2 = 0$ ie $-3x + y - 2 = 0$ — (1) $a_1 = -3, b_1 = 1$

$3y + x + 9 = 0$ ie $x + 3y + 9 = 0$ — (2) $a_2 = 1, b_2 = 3$

$a_1 a_2 + b_1 b_2 = -3(1) + 1(3) = -3 + 3 = 0$

$a_1 a_2 + b_1 b_2 = 0$

$\therefore$ (1) $\perp$ (2)

If product of slopes is -1 then lines are perpendicular.

$m_1, m_2 = -1$; $y = mx + c$

② $y - 3x - 2 = 0 \Rightarrow y = 3x + 2 \Rightarrow m_1 = 3$

$3y + x + 9 = 0 \Rightarrow y = \frac{-1}{3}x - 3 \Rightarrow m_2 = -1/3$

$m_1, m_2 = (3)\left(\frac{-1}{3}\right) = -1$

$\therefore$ The lines are perpendicular

(2) $3y - 4 = 2x + 3 \Rightarrow y = \frac{2}{3}x + \frac{7}{3} \Rightarrow m_1 = \frac{2}{3}$

$y - 5 = x + 6 \Rightarrow y = x + 11 \Rightarrow m_2 = 1$

$m_1 \cdot m_2 = \left(\frac{2}{3}\right)(1) = \frac{2}{3} \neq -1$

∴ The lines are not perpendicular

(3) $x^2 + y^2 + 3xy - 11 = 0$; $(x_0, y_0) = (1, 2)$

differentiate implicitly w.r.t x

$2x + 2y \cdot y' + 3 \cdot 1 \cdot y + 3x \cdot y' - 0 = 0$

$(2y + 3x)y' = -2x - 3y$

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

Slope of tanged line $m_1 = y'(1, 2) = \frac{-2-6}{4+3} = \frac{-8}{7}$

Tanget line $y - y_0 = m_1(x - x_0)$

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

$y = \frac{-8}{7}x + \frac{22}{7}$

Normal line and tanged line are perpendicular

∴ $m_1 \cdot m_2 = -1$

(1)

$\frac{-8}{7} - m_2 = -1$

$m_2 = \frac{7}{8}$

Normal line $y - y_0 = m_2(x - x_0)$

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

$y = \frac{7}{8}x + \frac{9}{8}$