Name: Baji Fatimah Jinoh
Matric no: 19/MHS01/386
Dept: MBBS
Course: Maths 104

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 $x^2 + y^2 + 3xy - 11 = 0$ at the point $x = 1, y = 2$

Solutions

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

For the lines to be perpendicular than $M_1 M_2 = -1$

$y - 3x - 2 = 0$

making y the subject of the formula

$y = 3x + 2$

$y = mx + c$

$m_1 = 3$

$3y + x + 9 = 0$

making y the subject of the formula

$3y = -x - 9$

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

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

$y = mx + c \quad M_2 = -1/3$

$m_1 m_2 = -1$

$3 \times -1/3 = -1$ since $m_1 m_2 = -1$

$\therefore y - 3x - 2 = 0$ and $3y + x + 9 = 0$ are perpendicular

2. $3y - 4 = 2x + 3$ —①
$y - 5 = x + 6$ —②

Making y the subject of formular in eqn ①

$3y = 2x + 3 + 4$

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

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

By comparing with $y = mx + c$

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

making y the subject of formula in eqn ②

$y - 5 = x + 6$

$y = x + 6 + 5$

$y = x + 11$

$m_2 = 1$

$m_1 m_2 = -1$

$m_1 m_2 = \frac{2}{3} \times 1 = \frac{2}{3}$

$m_1 m_2 \neq -1$

∴ The lines $3y - 4 = 2x + 3$ and $y - 5 = x + 6$ are not perpendicular

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

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

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

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

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

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

Equation of tangent

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

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

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

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

$$7y + 8x - 148 = 0$$

~~A~~ $7y + 8x - 22 = 0$ is the equation of tangent

(b) Equation of normal

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

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

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

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

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

$$8y - 7x - 9 = 0$$