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19/MHS01/272
Assignment solution

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

$y - 3x - 2 = 0$
$y = 3x - 2$
$\frac{dy}{dx} = 3 = m_1$

$3y + x + 9 = 0$
$3y = -x - 9$
$y = \frac{-x}{3} - \frac{9}{3}$

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

For $\frac{dy}{dx} = -\frac{1}{3} = m_2$

For $\perp$, $m_1 m_2 = -1$
$m_1 m_2 = 3 \times -\frac{1}{3} = -1$

∴ $y - 3x - 2 = 0$ and $3y + x + 9 = 0$ are perpendicular.

2) $3y - 4 = 2x + 3$ — I
$y - 5 = x + 6$ — II

$3y - 4 = 2x + 3$
$3y = 2x + 7$
$y = \frac{2}{3}x + \frac{7}{3}$

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

$y - 5 = x + 6$
$y = x + 11$
$\frac{dy}{dx} = 1 = m_2$

For $\perp$, $m_1 m_2 = -1$

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

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

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

soln

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

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

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

$\frac{dy}{dx} = 2x + 5y + 3x\frac{dy}{dx}$

$-2x - 5y = 3x\frac{dy}{dx} - \frac{dy}{dx}$

$-2x - 5y = \frac{dy}{dx}(3x - 1)$

$\frac{dy}{dx} = \frac{-2x - 5y}{3x - 1}$

$\left.\frac{dy}{dx}\right|_{(1,2)} = \frac{-2(1) - 5(2)}{3(1) - 1}$

$\frac{dy}{dx} = \frac{-2 - 10}{3 - 1}$

$\frac{dy}{dx} = \frac{-12}{2} = -6$

$\therefore m_1 = -6$

For eqn of tangent

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

$= (y - 2) = -6(x - 1)$

$y - 2 = -6x + 6$

$y = -6x + 6 + 2$

$y = -6x + 8$

For eqn of Normal,

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

$m_2 = \frac{+1}{+6} = \frac{1}{6}$

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

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

$6y - 12 = x - 1$

$6y = x - 1 + 12$

$6y = x + 11$

$y = \frac{1}{6}x + \frac{11}{6}$