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

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

$7y + 8x = 8 + 14$

$7y + 8x = 22$

$7y + 8x - 22 = 0$

∴ The equation for tangent is $7y + 8x - 22 = 0$

b) For the equation of the normal

$$m_2 = \frac{-1}{m_1} = \frac{-1}{1} \times \frac{7}{8} = \frac{7}{8}$$

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

$$y - y_1 = m_2(x_2 - x_1)$$

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

Cross multiply

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

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

$8y - 16 = 7x - 7$

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

$8y - 7x = 9$

$8y - 7x - 9 = 0$

∴ The equation of the normal is $8y - 7x - 9 = 0$

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(1)

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

Soln

Let $A = y - 3x - 2 = 0$

$= dy/dx - 3 - 0 = 0$

$= dy/dx - 3 = 0$

$= dy/dx = 3$

Let $B = 3y + x + 9 = 0$

$3\,dy/dx + 1 + 0 = 0$

$3\,dy/dx + 1 = 0$

$dy/dx = -1/3$

$A + B$

i.e $y - 2x - 2 = 0$ is perpendicular to $3y + x + 9 = 0$

Solution:

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

$m = \frac{dy}{dx}$

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

Differentiating by implicit method

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

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

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

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

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

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

a) For the equation of the tangent:

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

$m_1 = \left.\frac{dy}{dx}\right|_{x = x_1}$

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

$\frac{dy}{dx} = \frac{-8}{7}$

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

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

Cross multiply

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

(2)

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

Solu

$3y - 4 = 2x + 3$ ..... equ 1

Make y the subject of the formular

$3y = 2x + 3 + 4$

Divide through by 3

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

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

Recall, $y = mx + c$

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

$y - 5 = x + 6$

make y the subject of the formular

$y = x + 6 + 5$

$y = x + 11$

Recall, $y = mx + c$

$\therefore m_2 = 1$

$m_1 m_2 = -1$ [For perpendicularity]

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

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

$\therefore$ The lines $3y - 4 = 2x + 3$ and $y - 5 = x + 3$ are not perpendicular.

(3)

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