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

$7y + 8x - 14 - 8 = 0$

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

(b) Equation of normal.

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

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

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

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

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

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

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

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

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

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

$\frac{dy}{dx}$

$2x+2y\frac{dy}{dx}+3\left(x\cdot\frac{dy}{dx}+y\cdot 1\right)=0$.

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

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

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

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

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

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

(a) Equation of tangent

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

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

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

(2.) $3y - 4 = 2x + 3$ — (1)

$y - 5 = x + 6$ — (2)

Making y the subject of formula in 1.

$3y = 2x + 3 + 4$

$3y = 2x + 7$

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

By comparing with $y = mx + c$.

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

Making y the subject of formula in 2.

$y - 5 = x + 6$

$y = x + 6 + 5$

$y = x + 11$

By comparing with $y = mx + c$.

$m_2 = 1$.

But for the lines to be perpendicular;

$m_1 m_2 = -1$.

$m_1 m_2 = 2/3 \times 1 = 2/3$

$m_1 m_2 \neq -1$

Hence the lines $3y - 4 = 2x + 3$ and $y - 5 = x + 6$ are not PERPENDICULAR.

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

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

(3) Find the equation of the tangent and normal of the curve $x^2+y^2+3xy-4=0$ and point $x=1, y=2$

Solution

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

$3y+x+9=0$

Recall perpendicular: $m_1m_2=-1$

$y-3x-2=0$

$y=+3x+2$

$y=3x+2$

$y=mx+c$ — compare.

$m_1=3$

$3y+x+9=0$

making y the subject of the formular.

$3y=-x-9$

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

$y=mx+c$ — compare.

$dy/dx=-1/3$

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