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MATH104 ASSIGNMENT.

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

Solution

1. $y-3x-2=0$ -eq(1), $3y+x+9=0$ -eq(2)

For the lines to be perpendicular $m_1m_2=-1$

$y=3x+2$     $3y+x+9=0$

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

$m_1=3$

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

$$y=-\frac{1}{3}x-\frac{9}{3}$$

$$m_2=-1/3$$

$m_1m_2=-1$

$3\times-\frac{1}{3}=-1$

$\therefore y-3x-2=0$ and $3y+x+9=0$ are perpendicular to each other.

2. $3y-4=2x+3$ -eq(1), $y-5=x+6$ -eq(2)

~~For~~

$3y=2x+3+4$

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

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

$M_1=2/3$

$y=x+6+5$

$y=x+11$

$m_2=1$

$m_1 \times m_2 = -1$

$\frac{2}{3} \times 1 \neq 1$

$\therefore$ the lines $3y-4=2x+3$ and $y-5=x+6$ are not perpendicular to each other.

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

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

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

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

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

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

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

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

a) Equation of a tangent

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

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

$7y-14=-8(x-1)$

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

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

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

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b. $m_1 m_2 = -1$

$m_2 = -1/m_1$

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

$= \frac{7}{8}$

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

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

$8y - 16 = 7x - 7$

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

$8y - 7x - 9 = 0$ -> equantion of the normal.

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