NAME: Abdulsalam Omar
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1) $y - 3x - 2 = 0$ and $3y + x + 9 = 0$.

$y - 3x - 2 = 0$

$y = 3x + 2$

But $y = mx + c$

$\therefore m_1 = 3$

$3y + x + 9 = 0$

$3y = -x - 9$

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

$m_2 = -1/3$

$m_1 m_2 = -1$

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

Therefore both lines are perpendicular.

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

$3y - 4 = 2x + 3$

$3y = 2x + 3 + 4$

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

$m_1 = 2/3$

$y - 5 = x + 6$

$y = x + 6 + 5$

$y = x + 11$

$m_2 = 1$

$m_1 m_2 = -1$

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

$2/3 \neq -1$

Therefore the lines are not perpendicular

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

SOLUTION.

$2x+2y\,dy/dx+3(x\cdot dy/dx+y\cdot 1)=0$

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

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

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

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

When $x_1=1$, $y_1=2$.

$m=\frac{-3(2)-2(1)}{2(2)+3(1)}$

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

$m=\frac{-8}{7}$

Eqn of a tangent

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

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

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

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

$7y+8x-22=0$

Eqn of the normal.

$m_1m_2=-1$

$\frac{-8}{7}\,m_2=-1$

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

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

$y-y_1=\frac{-1}{m_2}(x-x_1)$

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

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

$8y-16=7x-7$

$8y-7x-9=0$