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MATRIC NO: 19/MHS01/107
SERIAL NO: 025
DEPARTMENT: MEDICINE AND SURGERY
MAT 104 ASSIGNMENT.

1. $y-3x-2=0$ and $3y+x+9=0$.
Solution
Taking the first equation $y-3x-2=0$;
Equation of a straight line; $y=mx+c$.
The two are then compared.
$y-3x-2=0 \;=\; y=3x+2$
$y=3x+2$; $m_1=3$.

Taking the second equation $3y+x+9=0$
Equation of a straight line; $y=mx+c$.
Comparing the two,
$3y+x+9=0$,
$3y=-x-9$
$y=\frac{-x}{3}-\frac{9}{3}$

$y=\frac{-x}{3}-3$; $m_2=-1/3$.

For two lines to be perpendicular; $M_1M_2=-1$
$M_1=3$ $M_2=-1/3$
$\cancel{3} \times -\frac{1}{\cancel{3}} = -1$.

∴ The two lines $3y+x+9=0$ and $y-3x-2=0$ are perpendicular to each other.

2) $3y-4=2x+3$ and $y-5=x+6$.
Taking the first equation $3y-4=2x+3$
Equation of a straight line; $y=mx+c$.

Comparing the two;

$3y = 2x + 3 + 4$

$3y = 2x + 7$

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

$M_1 = \frac{2}{3}.$

Taking the second equation $y - 5 = x + 6$

Comparing to equation of a straight line $y = mx + c$,

$y = x + 6 + 5$

$y = x + 11$

$M_2 = 1$

For two lines to be perpendicular ; $M_1 M_2 = -1$

$1 \times \frac{2}{3} = \frac{2}{3}.$

$\therefore$ The two 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 $x = 1, y = 2.$

Solution

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

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

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

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

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

$\left.\frac{dy}{dx}\right|_{x=1, y=2} = \frac{-8}{7} = M_1.$

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

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

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

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

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

$M_1 M_2 = -1$

$M_2 = -1 / -8/7 \quad = 7/8.$

Equation of the normal.

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

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

$8y - 16 = 7x - 7$

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

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