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1 Examine whether or not these pair of lines are perpendicular to each other.

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

Solution

For them to be perpendicular to each other $M_1M_2=-1$

$y-3x-2=0 \ldots$ eq(i)

make y the subject

$y=3x+2$

$y=mx+c$

$M_1=3$

eq(ii)

$3y+x+9=0$

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

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

$m_2=-1/3$

$M_1M_2=-1$

$3\times-1/3=-1$

$\therefore$ The lines are perpendicular to each other.

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

$3y-4=2x+3 \cdots eq(i)$

~~make~~ making y subject of the formula

$3y=2x+3+4$

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

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

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

$y-5=x+6 \cdots eq(ii)$

making y subject of formula

$y=x+6+5$

$y=x+11$

$m_2=1$

For the two lines to be perpendicular $M_1M_2=-1$

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

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

$\therefore$ The lines are not perpendicular to each ot

3 Find the equations of the tangent and normal to the circle

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

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

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

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

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

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

$\frac{dy}{dx}=\frac{-2-6}{4+3}=\frac{-8}{7}$

$M=-8/7$

$y-y_1=M[x-x_1]$

$y-2=-8/7\,[x-1]$

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

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

For eq of normal

$M_1M_2=-1$

$-8/7 \cdot M_2=-1$

$M_2=-1/-8/7$

$M_2=-1\times\frac{7}{8}$

$M_2=7/8$

$$y - y_1 = M_2[x - x_1]$$

$$y - 2 = 7/8\,[x - 1]$$

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

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