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Question

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

Solution

1. a) $y-3x-2=0$

b) $3y+x+9=0$

For perpendicular lines $\therefore M_1M_2 = -1$

equation of line $= y = Mx + c$

equation (a) $y-3x-2=0$

$y = Mx + c$

$y = 3x + 2$

$M_1 = 3$

equation (b) $3y + x + 9 = 0$

$y = Mx + c$

$3y = -x + 9$

$\cancel{y = \frac{1}{3}x + 3}$ $y = \frac{-1}{3}x + 3$

$M = -1/3$

$M_1 \cdot M_2 = 3 \times -1/3 = -1$

Therefore The Two pair of lines $y-3x-2=0$ and $3y+x+9=0$ are perpendicular

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

Solution

equation (a); $3y-4=2x+3$

$3y = 2x+3+4$

$3y = 2x+7$

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

$M = 2/3$

equation b, $y-5=x+6$

$y = x+6+5$

$y = x+11$

$M = 1$

$M_1 \cdot M_2 = 2/3 \times 1 = 2/3$

= not equal to -1

$\therefore$ The two pairs of lines $3y-4=2x+3$ and $y-5=x+6$ are not perpendicular

3) Find the equation of the tangent and normal to the curve

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

$2x+2y\,dy/dx+3(x+dy/dx+y\times1)=0$

$2x+2y\,dy/dx+3x\,dy/dx+3y=0$

$2y\,dy/dx+3x\,dy/dx=-2x-3y$

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

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

where $x=1$ and $y=2$

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

$$=-\frac{(2+6)}{4+3}=\frac{-8}{7}$$

$\therefore\ M=-8/7$

a) equation of the tangent to a curve

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

$y-2=-8/7\,(x-1)$

$y-2=-\frac{8x}{7}+8/7$

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

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

$8x+7y-22=0$

$7y+8x-22=0$

b) Equation of the normal to a curve

$y-y_1=-1/M\,(x-x_1)$

$y-2=-1/-8/7\,(x-1)$

$y-2=7/8\,(x-1)$

$y-2=7x/8-7/8$

$8y-16=7x-7$

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

$8y-7x=9$

$8y-7x-9=0$