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19/ENG06/010

Math 102 — Mechanical Engineering

(1) $x^2+y^2-5x-y+4=0$ at $(1,0):(x_2,y_2)$

Let $2gx = -5x$, $g = -5/2$, $a = 5/2$

Let $2fy = -y$; $f = -1/2$, $\therefore b = 1/2$

Gradient; $m_T = \frac{y_2-y_1}{x_2-x_1}$

$= \frac{0-5/2}{1-1/2} = \frac{-5/2}{1/2} = \frac{-5}{2} \div \frac{1}{2} = -\frac{5}{1} \times \frac{2}{1} = -5$

For perpendicularity, $m_T = 1/5$

Now, equation of Tangent

$\Rightarrow y-y_1 = m_T(x-x_1)$

$\Rightarrow y-0 = \frac{1}{5}(x-1)$

$\Rightarrow 5(y) = 1(x-1)$

$5y = x+1$

$5y-x-1=0$ [This is the required equation]

Note: For perpendicularity $m_1 m_2 = -1$, i.e, $-5 \times \frac{1}{5} = -1$

(2) $x^2+y^2-12x-12y+47=0$ at $(1,0)$

Let $2gx = -12x$, $g = -6$, $\therefore a = 6$

Let $2fy = -12y$, $f = -6$, $\therefore b = 6$

Gradient, $m_T = \frac{y_2-y_1}{x_2-x_1}$, $\frac{0-6}{1-6} = \frac{-6}{-5} = \frac{6}{5}$

$\therefore$ For perpendicularity, $m_T = -5/6$

Now equation of tangent

$\Rightarrow y-y_1 = m_T(x-x_1)$

$\Rightarrow y-0 = \frac{-5}{6}(x-1)$

$6y = -5x+5$

$6y+5x-5=0$ (This is the required Equation)

(3) $x^2+y^2-8x+14y+40=0$ at $(1,0)$

Centre of the circle

$C(4,-7)$

Hence, the gradient is $\frac{0-(-7)}{1-4}=\frac{7}{-3}$

∴ The tangent has a gradient of $3/7$ so, its equation is:

$y-0=3/7(x-1)$

$7y-3x+3=0$ (The required Equation of the tangential line to the circle)