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① Find the equation of the tangent at the point (1,0) on the circle $x^2+y^2-5x-y+4=0$

where $x^2+y^2+2gx+2fy+c=0$ @equation of a circle

$2gx = -5x$ $\quad$ $2fy = -y$

$2g = -5$; $g = -5/2$ $\quad$ $2f = -1$; $f = -1/2$

$a = -g$ $\quad$ $-f = b$

$\therefore a = 5/2$ $\quad$ $\therefore b = 1/2$

$a = 5/2$; $b = 1/2$; $c = 4$

$c = a^2+b^2-r^2$; $r^2 = a^2+b^2-c$

$r^2 = (5/2)^2+(1/2)^2-6$

$r^2 = 25/4 + 1/4 - 4$

$r^2 = 10/4$

$r = \sqrt{10/4}$

Centre of the Circle: $(\overset{x_1}{5/2}, \overset{y_1}{1/2})$; Point $(\overset{x_2}{1}, \overset{y_2}{0})$

$$m_1 = \frac{y_2-y_1}{x_2-x_1} = \frac{0-1/2}{1-5/2} = \frac{-1/2}{-3/2} = 1/3$$

$m_2 \times m_1 = -1$

$m_2 \times 1/3 = -1$

$m_2 = -3$

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

$y - 0 = m(x - 1)$

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

$y = -3x + 3$

② Find the equation of the tangent at the point (1,0) on the circle $x^2 + y^2 - 12x - 12y + 47 = 0$

Comparing with $x^2 + y^2 + 2gx + 2fy + c = 0$

$2gx = -12x$ $\qquad$ $2fy = -12y$

$g = -6$; $a = 6$ $\qquad$ $f = -6$; $b = 6$

$\therefore a = 6$, $b = 6$, $c = 47$

$r^2 = a^2 + b^2 - c$

$= 6^2 + 6^2 - 47$

$= 36 + 36 - 47$

$= 25$

$\therefore r = 5$

finding gradient $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ @ (1,0) ; (6,6)

$= \dfrac{0 - 6}{1 - 6} = \dfrac{-6}{-5} = \dfrac{6}{5}$

$m_2 \times m_1 = -1$

$m_2 \times \frac{6}{5} = -1$

$m_2 = -\frac{5}{6}$

Equation of tangent to the circle

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

$y - 0 = -5/6 (x - 1)$

$y - 0 = -5/6 x + 5/6$

$\therefore y = -5/6 x + 5/6$

(3) Find the equation of the tangent at the point (1, 0) on the circle

$x^2 + y^2 - 8x + 14y + 40 = 0$

comparing $x^2 + y^2 + 2gx + 2fy + c = 0$

$2gx = -8x$ $\qquad$ $2fy = 14y$

$g = -4$; $a = 4$ $\qquad$ $y = 7$; $b = -7$

$\therefore a = 4, b = -7, c = 40$

Centre of the circle = $(4, -7)$

finding gradient @ $(1, 0) = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{0 + 7}{1 - 4} = \dfrac{7}{-3}$

$m_2 \times m_1 = -1$

$m_2 \times 7/-3 = -1$

$\therefore m_2 = 3/7$

Equation of tangent to the circle = $y - y_1 = m(x - x_1)$

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

$y = 3/7 x - 3/7$

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