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

(a) $x=1 \quad y=0$

$\frac{\Delta y}{\Delta x}$: $2x + 2y\frac{dy}{dx} - 5 - \frac{\Delta y}{\Delta x} = 0$

$2x - 5 = -2y\frac{\Delta y}{\Delta x} + \frac{\Delta y}{\Delta x}$

$2x - 5 = \frac{\Delta y}{\Delta x}(-2y+1)$

$\frac{2x-5}{-2y+1} = \frac{\Delta y}{\Delta x}$ $(x=1, y=0)$

$\frac{\Delta y}{\Delta x} = \frac{2(1)-5}{0+1}$

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

$y = mx + c$; $y = -3x + c$

$0 = -3(1) + c$

$c = 3$

∴ equation of tangent: $y = -3x + 3$

② $x^2+y^2-12x-12y+47=0$ at (1, 0)

$\frac{\Delta y}{\Delta x}$: $2x + 2y - 12 - 12\frac{\Delta y}{\Delta x} = 0$

$\frac{2x-12}{-(2y-12)} = \frac{\Delta y}{\Delta x} = M$

$x=1, y=0 \quad \frac{\Delta y}{\Delta x} = \frac{2(1)-12}{-(12)} = \frac{-10}{12} = M$

$M = -5/6$

$y = mx + c$

$0 = -5/6(1) + c$

$c = 5/6$

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

OR $6y = -5x + 5$

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

$\frac{\Delta y}{\Delta x}$: $2x + 2y - 8 + 14\frac{\Delta y}{\Delta x} = 0$

$$\frac{2x - 8}{-(2y + 14)} = \frac{\Delta y}{\Delta x} = M$$

$(x = 1,\ y = 0)$ $\quad \frac{2(1) - 8}{-(2(0) + 14)} = \frac{2 - 8}{14} = \frac{-6}{-14} = \frac{\Delta y}{\Delta x}$

$$\frac{\Delta y}{\Delta x} = M = \frac{6}{14} = \frac{3}{7}$$

$y = mx + c$

$y = 3/7\,x + c$

$0 = 3/7\,(1) + c$

$c = -3/7$

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