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**Question**

(1) Find the equation of the tangent at the point (1,0) on the circle  x2+ y2 - 5x - y + 4 = 0

(2) (1) Find the equation of the tangent at the point (1,0) on the circle  x2+ y2 - 12x - 12y + 47 = 0

(3) (1) Find the equation of the tangent at the point (1,0) on the circle  x2+ y2 - 8x  + 14y + 40 = 0

**Solution**

**(1)**

 x2+ y2 - 5x - y + 4 = 0

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

2y$\frac{dy}{dx}$ - $\frac{dy}{dx}$ =5 – 2x

$\frac{dy}{dx}$(2y – 1) = 5 -2x

$\frac{dy}{dx}$ = $\frac{5-2x}{2y-1}$

At (1, 0), $\frac{dy}{dx}$ = $\frac{5-2(1)}{2(0)-1}$ = $\frac{5-5}{-1}=\frac{0}{-1}$ =0

Let $\frac{dy}{dx}$ = m

 m = $\frac{5-2x}{2y-1}$

5 – 2x = m ( 2y -1)

5 – 2x = 2ym –m

**(2)**

x2+ y2 - 12x - 12y + 47 = 0

2x + 2y$\frac{dy}{dx}$ – 12 -12$\frac{dy}{dx}$ + 0 = 0

2y$\frac{dy}{dx}$ – 12$\frac{dy}{dx}=12-2x$

$\frac{dy}{dx}$(2y – 12) = 12 – 2x

$\frac{dy}{dx}$ = $\frac{12-2x}{2y-12}$

At (1, 0), $\frac{dy}{dx}$ = $\frac{12-2(1)}{2(0)-12}$ =$\frac{12-2}{-12}$

Let $\frac{dy}{dx}$ = m

m = $\frac{10}{12} = \frac{-5}{6}$

$$\frac{-5}{6}= \frac{12-2x}{2y-12}$$

-5(2y-12) = 6(12-2x)

-10y + 60 = 72 – 12x

60 -72 + 12x = 10y

10y = 12x -12

5y = 6x – 6

y = $\frac{6}{5}x$ -$\frac{6}{5}$

**(3)**

x2+ y2 - 8x  + 14y + 40 = 0

2x + 2y$\frac{dy}{dx}$ -8 + 14$\frac{dy}{dx}$ + 40 = 0

2y$\frac{dy}{dx}$ - 14$\frac{dy}{dx}$ = 8-2x

$\frac{dy}{dx}$(2y-14) = 8-2x

$\frac{dy}{dx}$ = $\frac{8 - 2x}{2y-14}$

At (1, 0), $\frac{dy}{dx}$ = $\frac{8 - 2(1)}{2(0)-14}$

 = $\frac{dy}{dx}$ $\frac{8-2}{-14}$ = $\frac{6}{-14}$ = - $\frac{3}{7}$

Let $\frac{dy}{dx}$ = m

m = $\frac{8-2x}{2y-14 }$

$-\frac{3}{7}$ = $\frac{8-2x}{2y-14 }$

-3(2y-14) = 7(8 -2x)

-6y + 42 = 56 -14x

14x – 56 + 42 = 6y

14x -14 = 6y

y = $\frac{14}{6}x- \frac{14}{6}$

y = $\frac{7}{3}x- \frac{7}{3}$