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MATH 102
AERONAUTICAL ENGINEERING
18/ENG07/004
DEPT OF UNILORIN

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

Solution

Given $x^2+y^2-5x-y+4=0$ to be equation of

equation of a line is $y-y_1=m(x-x_1)$

$x^2-5x+y^2+y+4=0$ by factorising

$\left(x-\frac{5}{2}\right)^2=\frac{-25}{4}-\left(y+\frac{1}{2}\right)^2=\frac{-1}{4}+y=0$

Collect like terms

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

$\left(x-\frac{5}{2}\right)^2-\left(y-\frac{1}{2}\right)^2=\frac{5}{2}$

The centre of the circle is $\left(\frac{5}{2},\frac{1}{2}\right)$ and radius is $\frac{5}{2}$

$P=(5,1)$

Gradient (m) of $PC=\frac{\Delta y}{\Delta x}=\frac{0-\frac{5}{2}}{1-\frac{1}{2}}=\frac{-\frac{5}{2}}{\frac{1}{2}}$

Gradient (m) of $PC=\frac{-5}{2}\times\frac{2}{1}=-5$

Since they are perpendicular, i.e at 90°, gradient of their tangent $=\frac{1}{5}$

Equation of the tangent therefore $=$

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

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

$y=\frac{x}{5}+\frac{1}{5}$

2/ Find the equation of the tangent at the point (1,5) on the circle $x^2 + y^2 - 12x - 12y + 47 = 0$

Solution

Given equation $x^2 + y^2 - 12x - 12y + 47 = 0$

Re-arranging

$x^2 - 12x + y^2 - 12y + 47 = 0$

Completing the square

$(x-6)^2 + (y-6)^2 + 25 = 0$

$(x-6)^2 + (y-6)^2 = 25$

Centre of circle $= (h,k) = (6,6)$ and radius $= \sqrt{25} = 5$

Gradient $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-6}{1-6} = \frac{+1}{-5} = \frac{1}{5}$

They are perpendicular

Gradient of tangent $= -\frac{5}{1}$

Equation of tangent $0 = y - y_1 = m(x - x_1)$

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

$y = -\frac{5}{1}x + \frac{5}{1}$

8 Find the equation of the tangent at the point (4,5) on the circle $x^2 + y^2 - 8x + 4y + 10 = 0$

$x^2 + y^2 - 8x + 4y + 10 = 0$ ... equation (1)

$(x-4)^2 - 16 + (y+2)^2 - 4 + 10 = 0$

$(x-4)^2 + (y+2)^2 + 20 = 0$

$(x-4)^2 + (y+2)^2 = -20$

$(h,k) = (4,-2)$ $r = \sqrt{-20}$

Gradient of CP $= \frac{\Delta y}{\Delta x} = \frac{7-(-2)}{4-4} = \frac{9}{0}$

Gradient of the tangent $= 0$

The equation of the tangent

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

$y - 5 = 0(x-4)$

$y = 5$