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MECHATRONICS ENGINEERING

MAT 102 ASSIGNMENT

~~Elijah~~

Q4 Find the point of intersection of the following line on the circle:

(1) $x - y - 14 = 0$ and $x^2 + y^2 - 6x + 8y = 0$

let $x - y - 14 = 0$ ... (1)

$x^2 + y^2 - 6x + 8y = 0$ ... (2)

from eqn (1) $x - y - 14 = 0$

$\therefore y = x - 14$ ... (3)

Substitute eqn (3) into eqn (2)

$\therefore x^2 + (x-14)^2 - 6x + 8(x-14) = 0$

$x^2 + x^2 - 28x + 196 - 6x + 8x - 112 = 0$

$\frac{2x^2}{2} - \frac{26x}{2} + \frac{84}{2} = 0$

$x^2 - 13x + 42 = 0$

$x^2 - 6x - 7x + 42 = 0$

$x(x-6) - 7(x-6) = 0$

$(x-6)(x-7) = 0$

$\therefore x = 6$ or 7,

Recall that $y = x - 14$

$\therefore$ where $x = 6$; $y = 6 - 14$

$y = -8$,

$\therefore$ Co-ordinates of intersection $(6, -8)$

$\therefore$ when $x = 7$; $y = 7 - 14$

$y = -7$,

$\therefore$ Co-ordinates of intersection $(7, -7)$,

(2) $2x+y-10=0$ ... (1)

$x^2+y^2+4x-6y=0$ ... (2)

from eqn (1) $y = 10-2x$ (3)

∴ substitute eqn (3) into eqn (2)

$\therefore x^2+(10-2x)^2+4x-6(10-2x)=0$

$x^2+100-40x+4x^2+4x-60+12x=0$

$5x^2-24x+40=0$

$x_1 = \frac{12}{5}+\frac{2\sqrt{14}}{5}i$ and $x_2 = \frac{12}{5}-\frac{2\sqrt{14}}{5}i$

Since the values of x are imaginary, The lines and circle do not intersect.

(3) $x-5y-2=0$ ... (1)

$x^2+25y^2-6xy-16=0$ ... (2)

$x = 2+5y$ ... (3)

Substitute eqn (3) into (2)

$\therefore (2+5y)^2+25y^2-6y(2+5y)-16=0$

$4+20y+25y^2+25y^2-12y-30y^2-16=0$

$50y^2-30y^2+20y-12y+4-16=0$

$\frac{20y^2}{4}+\frac{8y}{4}-\frac{12}{4}=0$

$5y^2+2y-3=0$

$5y^2+5y-3y-3=0$

$5y(y+1)-3(y+1)=0$

$(5y-3)(y+1)=0$

$\therefore y=-1$ or $3/5$.

∴ Recall that $x = 2+5y$

when $y=-1$: $x=2+5(-1)$, $x=2-5$, $x=-3$.

when $y=3/5$: $x=2+5(3/5)$, $x=2+3$, $x=5$.

∴ The co-ordinates of intersection are $(-3,-1)$ & $(5, 3/5)$.