

LECTURER'S NAME: MR OKUNLOLA

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NAME OF STUDENT: ABE OLUWATOMISIN THADEUS.

DEPARTMENT: MECHANICAL.

MATRIC NO: 191ENG051001.

Assignment

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

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

SOLUTION

$$x - y - 14 = 0 \text{ and } x^2 + y^2 - 6x + 8y = 0.$$

$$x - y - 14 = 0 \text{ --- (i)}$$

$$-y = -x + 14$$

$$y = x - 14$$

$$y = x - 14 \text{ --- (ii)}$$

$$x^2 + y^2 - 6x + 8y = 0 \text{ --- (iii)}$$

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

$$x^2 + (x - 14)(x - 14) - 6x + 8x - 112 = 0.$$

$$x^2 + x^2 - 14x - 14x + 196 + 2x - 112 = 0.$$

$$2x^2 - 28x + 2x + 196 - 112 = 0.$$

$$2x^2 - 26x + 84 = 0.$$

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

Factors: 7 & 6

$$(x^2 + 7x) + (6x + 42) = 0$$

$$x(x + 7) + 6(x + 7) = 0.$$

$$(x + 6)(x + 7) = 0.$$

$$(x + 6) = 0 \quad (x + 7) = 0$$

$$x = -6 \quad \& \quad -7$$

$$x^2 + y^2 - 6x + 8y = 0 \quad \dots \text{--- (ii)}$$

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

$$x^2 + (x-14)(x-14) - 6x + 8x - 112 = 0$$

$$x^2 + x^2 - 14x - 14x + 196 + 2x - 112 = 0$$

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

$$2x^2 - 26x + 84 = 0$$

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

factors: 7 & 6

$$(x^2 + 7x) + (6x + 42) = 0$$

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

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

$$(x+6) = 0 \quad (x+7) = 0$$

$$x = -6 \quad \& \quad -7$$

substituting $x = -6$ in equation (i)

$$y = x - 14$$

$$y = -6 - 14$$

$$y = -20$$

Point of intersection on the circle is $(-6, -20)$

substituting $x = -7$ in equation (i)

$$y = x - 14$$

$$y = -7 - 14$$

$$y = -21$$

Point of intersection on the circle is $(-7, -21)$

$$2. \quad x - 5y - 2 = 0 \text{ and } x^2 + 25y^2 - 6xy - 16 = 0.$$

solution

$$x - 5y - 2 = 0 \text{ and } x^2 + 25y^2 - 6xy - 16 = 0$$

$$x - 5y - 2 = 0 \quad \dots (i)$$

$$x = 0 + 5y + 2$$

$$x = 5y + 2 \quad \dots (ii)$$

$$x^2 + 25y^2 - 6xy - 16 = 0 \quad \dots (iii)$$

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

$$(5y + 2)(5y + 2) + 25y^2 - 30y^2 - 12y - 16 = 0$$

$$25y^2 + 10y + 10y + 4 + 25y^2 - 30y^2 - 12y - 16 = 0.$$

$$25y^2 + 25y^2 - 30y^2 - 12y + 10y + 10y + 4 - 16 = 0.$$

$$20y^2 - 30y^2 + 8y - 12 = 0.$$

$$-10y^2 + 8y - 12 = 0.$$

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

$$a = 5 \quad b = 2 \quad c = -3.$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(5)(-3)}}{2(5)}$$

$$x = \frac{-2 \pm \sqrt{4 - (-60)}}{10}$$

$$x = \frac{-2 \pm \sqrt{4 + 60}}{10}$$

$$x = \frac{-2 \pm \sqrt{64}}{10}$$

$$x = \frac{-2 + \sqrt{64}}{10} \quad \text{or} \quad x = \frac{-2 - \sqrt{64}}{10}$$

$$x = \frac{-2 + 8}{10} \quad = \quad \frac{-2 - 8}{10}$$

$$25y^2 + 25y^2 - 20y^2 - 12y + 10y + 10y + 4 = 1620$$

$$30y^2 - 20y^2 + 10y - 1220$$

$$10y^2 + 10y - 1220$$

$$6y^2 + 2y - 320$$

$$a=6 \quad b=2 \quad c=-320$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(6)(-320)}}{2(6)}$$

$$x = \frac{-2 \pm \sqrt{4 - 600}}{10}$$

$$x = \frac{-2 \pm \sqrt{4 + 600}}{10}$$

$$x = \frac{-2 \pm \sqrt{604}}{10}$$

$$x = \frac{-2 + \sqrt{604}}{10} \quad \text{or} \quad x = \frac{-2 - \sqrt{604}}{10}$$

$$x = \frac{-2 + 8}{10} \quad \text{or} \quad \frac{-2 - 8}{10}$$

$$= \frac{6}{10} \quad \text{or} \quad \frac{-10}{10}$$

$$= \frac{3}{5} \quad \text{or} \quad -1$$

substituting $x = \frac{3}{5}$ in equation

$$x = 5y + 2$$

$$\frac{3}{5} = 5y + 2$$

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

$$3 = 25y + 10$$

$$3 - 10 = 25y$$

$$-7 = 25y$$

$$y = \frac{-7}{25}$$

Point of intersection is $\left[\frac{3}{5}, -\frac{7}{25}\right]$

Substituting $x = -1$ in equation

$$x = 5y + 2$$

$$-1 = 5y + 2$$

$$-1 - 2 = 5y$$

$$-3 = 5y$$

$$y = -3/5$$

Point of intersection is $(-1, -3/5)$.

3. $2x + y - 10 = 0$ and $x^2 + y^2 + 4x - 6y = 0$.

Solution

$$2x + y - 10 = 0 \text{ and } x^2 + y^2 + 4x - 6y = 0.$$

$$y = 10 - 2x \text{ --- (1)}$$

$$x^2 + y^2 + 4x - 6y = 0 \text{ --- (2)}$$

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

$$x^2 + (10 - 2x)(10 - 2x) + 4x - 60 + 12x = 0.$$

$$x^2 + 100 - 20x - 20x + 4x^2 + 4x - 60 + 12x = 0.$$

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

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

$$x_1 = 2.4 + 1.4967i \quad x_2 = 2.4 - 1.4967i.$$

Substitute $x = 2.4 + 1.4967i$ in equation

$$y = 10 - 2x$$

$$y = 10 - 2(2.4 + 1.4967i)$$

$$y = 5.2 - 2.9934i$$

Substitute $x = 2.4 - 1.4967i$ in equation.

$$y = 10 - 2x$$

$$y = 10 - 2(2.4 - 1.4967i)$$

$$y = 4.9 + 2.9934i$$

Point of intersections:

$$(2.4 + 1.4967i, 5.2 - 2.9934i)$$

$$(2.4 - 1.4967i, 4.9 + 2.9934i)$$