1.5.16

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Question:
Find the point A where AB is a diameter of a circle with center $(3, -1)$ and the point B is $(2, 6)$

Point	Vector
B	$\begin{pmatrix} 2 \\ 6 \end{pmatrix}$
C	$\begin{pmatrix} 3 \\ -1 \end{pmatrix}$

Using rank of matrix: Three points $\mathbf{A}, \mathbf{C}, \mathbf{B}$ are collinear if

$$\text{rank}\begin{pmatrix} \mathbf{C}-\mathbf{A} & \mathbf{B}-\mathbf{A} \end{pmatrix} = 1$$

$$\mathbf{C}-\mathbf{A} = \begin{pmatrix} 3-x \\ -1-y \end{pmatrix}, \quad \mathbf{B}-\mathbf{A} = \begin{pmatrix} 2-x \\ 6-y \end{pmatrix}$$

Form matrix:

$$\begin{pmatrix} 3-x & 2-x \\ -1-y & 6-y \end{pmatrix}$$

Apply row operation:

$$R_2 \to (3-x)R_2 - (-1-y)R_1$$

$$(3-x)(6-y) + (1+y)(2-x) = 0 \Rightarrow 20 - y - 7x = 0 \Rightarrow \boxed{7x + y = 20}$$

Using midpoint formula:

$$\mathbf{C} = \frac{\mathbf{A} + \mathbf{B}}{2} \Rightarrow \mathbf{A} = 2\mathbf{C} - \mathbf{B}$$

$$\mathbf{A} = 2\begin{pmatrix} 3 \\ -1 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \boxed{\mathbf{A} = \begin{pmatrix} 4 \\ -8 \end{pmatrix}}$$

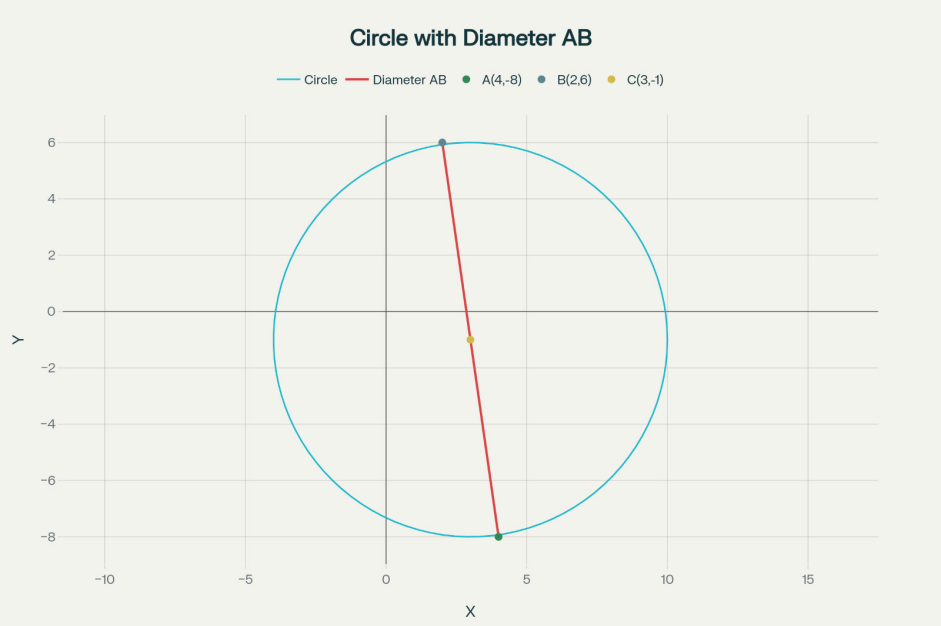
Circle with Diameter AB
Circle
Diameter AB
A(4,-8)
B(2,6)
C(3,-1)
6
4
2
0
−2
−4
−6
−8
Y
−10
−5
0
5
10
15
X

Figure: