Applied Physics (NS-1001)   **Quiz # 1A**   **Fall 2025**

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Name: **Roll #:**

Section: BCS-A   **CLO1**   **Date: 03-09-2025** .

Q.1: The rectangle shown in Figure.1 has sides parallel to the x and y-axes. The position vectors of two corners are A = 10.0 m at 50.0° and B = 12.0 m at 30.0°. (a) Find the perimeter of the rectangle. (b) Find the magnitude and direction of the vector from the origin to the upper right corner of the rectangle. (7M)
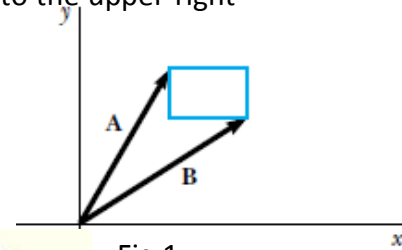
Solution:

Fig.1

(a) Consider the rectangle in the figure to have height H and width W. The vectors

$\vec{A}$ and $\vec{B}$ are related by $\vec{A} + \vec{ab} + \vec{bc} = \vec{B}$, where

$\vec{A} = (10.0\text{m})(\cos 50.0^0)\hat{i} + (10.0\text{m})(\sin 50.0^0)\hat{j}$

$\vec{A} = (6.42\hat{i} + 7.66\hat{j})\text{m}$

$\vec{B} = (12.0\text{m})(\cos 30.0^0)\hat{i} + (12.0\text{m})(\sin 30.0^0)\hat{j}$

$\vec{B} = (10.4\hat{i} + 6.00\hat{j})\text{m}$

$\vec{ab} = -H\hat{j}$ and $\vec{bc} = W\hat{i}$

Therefore,

$\vec{B} - \vec{A} = \vec{ab} + \vec{bc}$

$(3.96\hat{i} - 1.66\hat{j})\text{m} = W\hat{i} - H\hat{j} \rightarrow W = 3.96\text{m}$ and $H = 1.66\text{m}$

The perimeter measures $2(H + W) = 11.24\text{m}$.

(b) The vector from the origin to the upper-right corner of the rectangle (point d) is

$\vec{B} + H\hat{j} = 10.4\text{m}\hat{i} + (6.00\text{m} + 1.66\text{m})\hat{j} = 10.4\text{m}\hat{i} + 7.66\text{m}\hat{j}$

magnitude: $\sqrt{(10.4\text{m})^2 + (7.66\text{m})^2} = 12.9\text{m}$

direction: $\tan^{-1}(7.66/10.4) = 36.4^0$ above +x axis (first quadrant).