Math Document Template

C ANISH

Abstract—**This is a document explaining a question about the concept of vector addition.**

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1 PROBLEM

A motorboat is racing towards north at 25 km/h and the water current in that region is 10 km/h in the direction of 60° east of south. Find the resultant velocity of the boat.
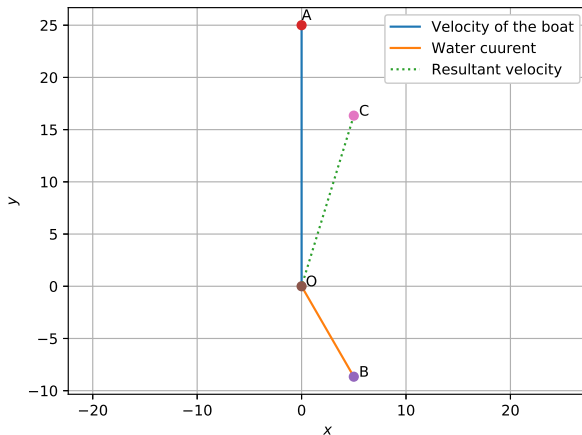
2 CONSTRUCTION

2.1. Draw Fig. 2.1.

Fig. 2.1: Vectorial representation of velocities generated using python

Solution: The following Python code generates Fig. 2.1

codes/motion_plane.py

3 SOLUTION

Solution: Let **A** denote the velocity of the boat and **B** denote the water current and **C** represent the resultant velocity.

$$\mathbf{A} = \begin{pmatrix} 0 \\ 25 \end{pmatrix} \tag{1.1}$$

$$\mathbf{B} = \begin{pmatrix} 5 \\ -8.67 \end{pmatrix} \tag{1.2}$$

$$\mathbf{C} = \mathbf{A} + \mathbf{B} \tag{1.3}$$

$$\mathbf{C} = \begin{pmatrix} 5 \\ 16.34 \end{pmatrix} \tag{1.4}$$

Magnitude of the resulant velocity:

$$\|\mathbf{C}\| = 17.08 \tag{1.5}$$

Direction of resultant velocity:

$$\cos\theta = \frac{(\mathbf{A})^T (\mathbf{C})}{\|\mathbf{A}\| \, \|\mathbf{C}\|} \tag{1.6}$$

$$\theta = 17.01° \tag{1.7}$$

∴ The resulant velocity is 17.08 km/h at an angle of 17.01° east of north.