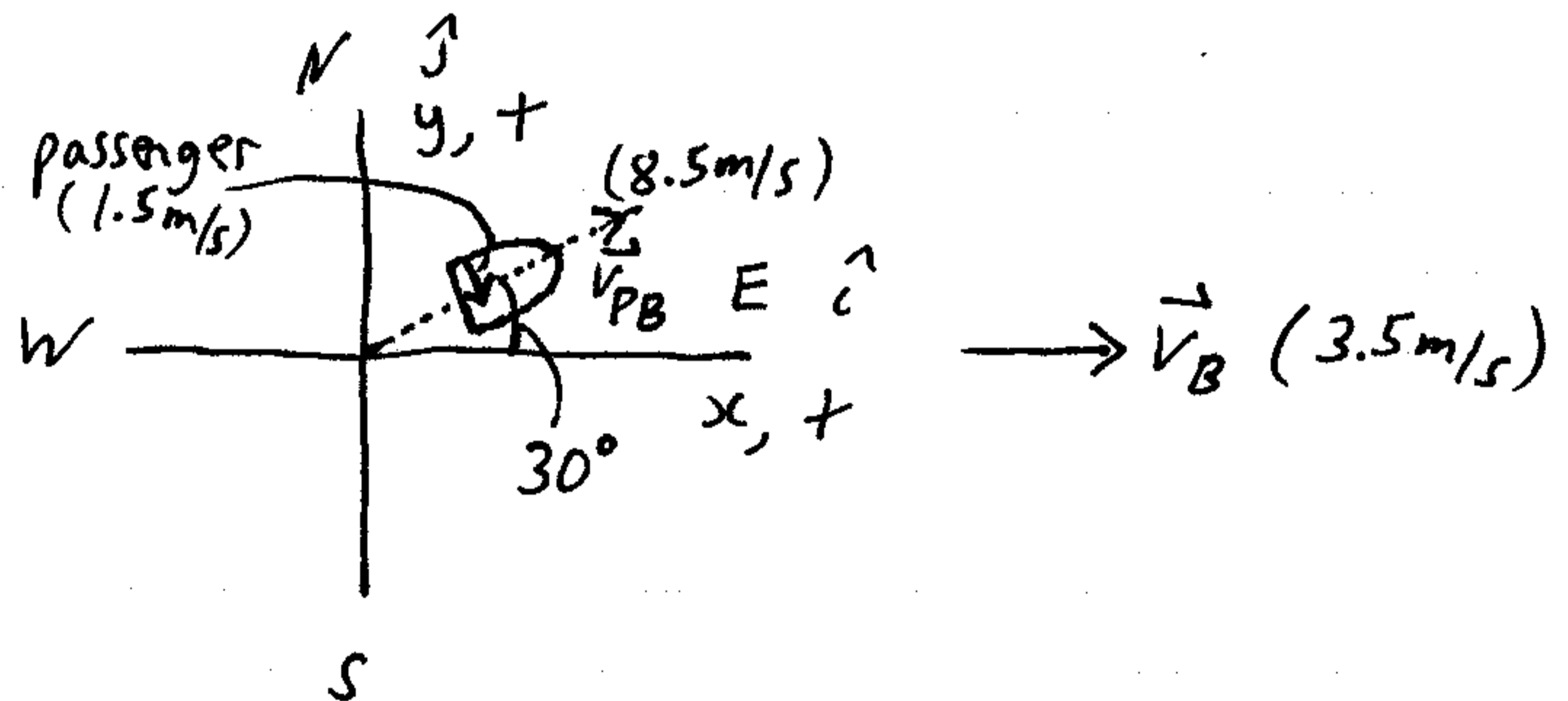


This is a 2-D problem involving relative motion.

A river flows in the east direction at 3.5 m/s . A boat with a speed of 8.5 m/s , relative to the water sets a course that is pointed in a direction 30° north of east. Once the boat is in motion, one of the passengers walks from the left side of the boat directly to the right side of the boat at a speed of 1.5 m/s relative to the boat. What is the velocity of the passenger relative to the ground?

Solution:



Use the vector equation: $\vec{v}_p = \vec{v}_B + \vec{v}_{PB}$ (1)

$\vec{v}_p = ?$ (velocity of the passenger relative to the ground)

$\vec{v}_B = 3.5 \hat{i}$ (velocity of the river relative to the ground)

$\vec{v}_{PB} = ?$ (velocity of the passenger relative to the water)

$$\vec{V}_{PB} = (\text{velocity of boat relative to the water}) \\ + \\ (\text{velocity of passenger relative to the boat})$$

Then,

$$\vec{V}_{PB} = (8.5 \cos 30^\circ \hat{i} + 8.5 \sin 30^\circ \hat{j}) + (1.5 \cos 60^\circ \hat{i} - 1.5 \sin 60^\circ \hat{j})$$

$$\vec{V}_{PB} = 8.11 \hat{i} + 2.95 \hat{j}$$

Substitute into equation (1):

$$\vec{V}_p = 3.5 \hat{i} + 8.11 \hat{i} + 2.95 \hat{j}$$

$$\vec{V}_p = 11.6 \hat{i} + 2.95 \hat{j} \quad (\text{answer})$$