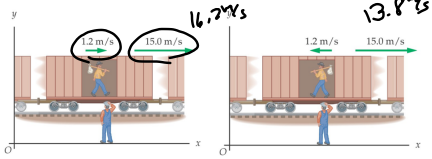
4.3 Relative Motion

4.4 I can solve relative velocity problems.

Relative Motion

The speed of the passenger with respect to the ground depends on the relative directions of the passenger's speed and the train's speed.

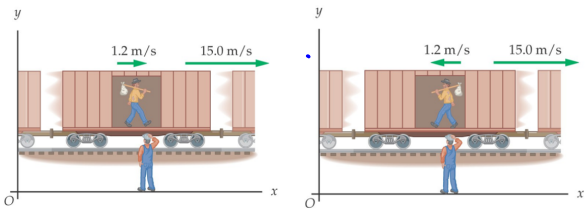


$$V_{P,T} + V_{T,G} = V_{P,G}$$

$$V_{A,B} + V_{B,C} =$$

Relative Motion

$$\vec{v}_{ab} + \vec{v}_{bc} = \vec{v}_{ac}$$

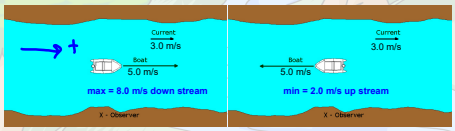


RIVER BOAT

A boat has a maximum speed of 5.0 m/s relative to the water. If the boat is in a river that is flowing at 3.0 m/s south, what are the maximum and minimum velocities that the boat can obtain relative to the shore?

RIVER BOAT

A boat has a maximum speed of 5.0 m/s relative to the water. If the boat is in a river that is flowing at 3.0 m/s south, what are the maximum and minimum velocities that the boat can obtain relative to the shore?



$V_{B,W} + V_{W,S} = V_{B,S}$

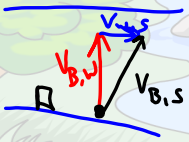
$5\,m/s + 3\,m/s = 8\,m/s$

$-5\,m/s + 3\,m/s = -2\,m/s$

$5\,m/s + 3\,m/s = 5.8\,m/s$

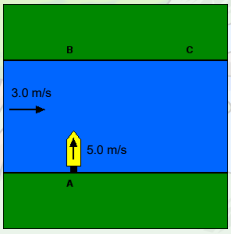
RIVER BOAT

A boat has a maximum speed of 5.0 m/s relative to the water. If the boat drives due east across the river that is flowing 3.0 m/s south, what is the resulting velocity of the boat relative to the shore?



RIVER BOAT

A boat has a maximum speed of 5.0 m/s relative to the water. If the boat drives due east across the river that is flowing 3.0 m/s south, what is the resulting velocity of the boat relative to the shore?



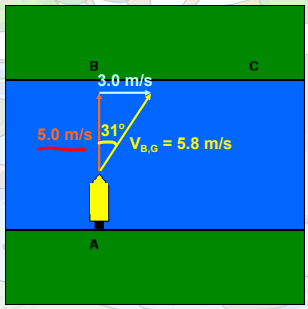
RIVER BOAT

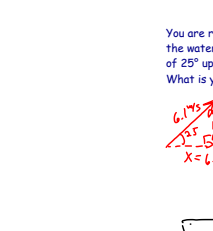
$V_{B,G} = \sqrt{((5.0\ m/s)^2+(3.0\ m/s)^2)}$

$V_{B,G} = 5.8\,m/s$

$\theta = \tan^{-1}(3/5)$

$\theta = 31°$ S of E





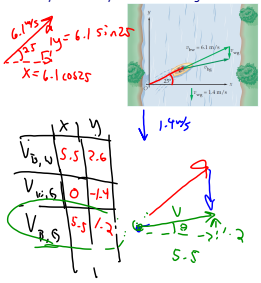
Crossing a River

You are riding in a boat whose speed relative to the water is 6.1 m/s. The boat points at an angle of 25° upstream on a river flowing at 1.4 m/s. What is your velocity relative to the ground?

$V_{B,W} + V_{W,G} = V_{B,G}$

Crossing a River

You are riding in a boat whose speed relative to the water is 6.1 m/s. The boat points at an angle of 25° upstream on a river flowing at 1.4 m/s. What is your velocity relative to the ground?

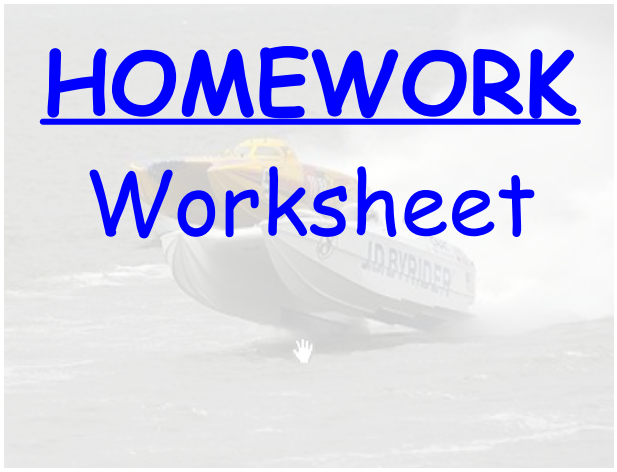


$V_{B,G} = \sqrt{5.5^2 + 1.2^2} = 5.6\,m/s$

$\theta = \tan^{-1}\left(\frac{1.2}{5.5}\right) = 12°$ upstream

HOMEWORK

Worksheet



Attachments

River Crossing.ppt