Relative Motion

By: Aarzoo Walia

+919779077730

1. A train moves at 20 km/h east. A passenger on the train moves towards the front of the train at a velocity of 3 km/h. What is the passenger's velocity relative to a person standing on the ground?
2. A train moves at 20 km/h. A person on the train moves towards the back at 3 km/h. What is the person's velocity relative to the ground?
3. A goose is flying 30 km/h south. A hunter is driving due North at 60 km/h. Determine the
    a. Velocity of the goose with respect to the hunter
    b. Velocity of the hunter with respect to the goose
4. A motorboat whose speed in still water is 3.60 m/s must aim upstream at an angle of 27.5˚ (with respect to a line perpendicular to the shore) in order to travel directly across the stream.
    a. What is the speed of the current?
    b. What is the resultant speed of the boat with respect to the shore?
5. Huck Finn walks at a speed of 1 m/s across his raft (that is, he walks perpendicular to the raft's motion relative to the shore). The raft is travelling down the Mississippi River at a speed of 2.7 m/s relative to the river bank. What is the velocity (speed and direction) of Huck relative to the river bank?
6. A boat can travel 2.30 m/s in still water.
    a. If the boat points its prow directly across a stream whose current is 1.20 m/s, what is the velocity (magnitude and direction) of the boat relative to the shore?
7. The captain of a boat wants to travel straight (not move up or down stream) across a river 200 m wide in 120 seconds. The river is flowing at 5 m/s. In what direction (show an angle) and with what speed does the boat have?
8. The captain of a boat points his boat at an angle of 20˚ upstream with a speed of 3 m/s in still water. If he actually travels straight across stream, what is the current?
9. A person going for a morning walk on the deck of a cruise ship is walking towards the bow (front) of the ship at 2 m/s while the ship is moving forward at 8.5 m/s.
    a. What is the velocity of the jogger relative to the water?

b. Later, the walker is moving towards the stern (rear) of the ship. What is the walker's velocity to the water now?

10. Two planes approach each other head-on. Each has a speed of 835 km/h, and they spot each other when they are initially 10 km apart.
    a. What is the speed of one pilot relative to another?
    b. How much time does each pilot have to take evasive action to avoid a mid-air collision?
11. An airplane is heading south at a speed of 500 km/hr. If a wind begins blowing East at a speed of 100 km/h, calculate the velocity (magnitude and direction) of the plane relative to the ground.
12. A 200 m wide river flows due east at a uniform speed of 2 m/s. A boat with a speed of 8 m/s relative to the water leaves the south bank and aims directly across the river to the north bank.
    a. What is the boat's velocity (magnitude and direction) relative to the shore?
    b. How long does it take the boat to cross the river?
    c. How far downstream from a point directly across on the opposite shore does the boat dock?
13. A river is flowing 12 m/s east. If your boat is capable of sailing at 4 m/s in still water, with what velocity (magnitude and direction) should the boat have to travel directly across the river?