

**Worksheet**  
**Relative Displacements and Velocities in One Dimension**

1. If a person's displacement relative to the earth is 8 m [W] and a car's displacement relative to that person is 3 m [E], then what is the car's displacement relative to the earth?
2. You are in a car traveling at 13.0 m/s toward the North. A snowmobile located in front of you is also going North but at 7.2 m/s. What is your velocity relative to a passenger on the snowmobile?
3. While travelling on a train, two boys play catch in the aisle. The train is moving north at 30.0 m/s. The ball is tossed front to back at 5.0 m/s relative to the boys. A bystander on the highway observes the ball being tossed toward the back. To the bystander, what is the relative speed of the ball?
4. A helicopter is traveling northwest at 210 km/h relative to a car. The car is traveling at 30 km/h southward relative to the earth. Find the velocity of the earth relative to the helicopter. Be careful.
5. A police car is chasing a stolen car ahead of it. If the police car is traveling at 150 km/h [N] and the stolen car is traveling at 120 km/h [N], then determine:
  - (A) the velocity of the police car relative to the ground.
  - (B) the velocity to the police car relative to the stolen car.
  - (C) the velocity of the stolen car relative to the police car.
6. What is the velocity of John relative the bus in each of the following situations:
  - (A) John is sitting on the street and the bus is moving at 30 m/s [S] toward him?
  - (B) John is sitting in his car traveling North at 25 m/s toward a stationary bus?
  - (C) John is sitting in his car traveling North at 35 m/s and the bus is moving 15 m/s [S] toward him?
7. The current in a river moves at 4.8 m/s [E]. How fast and in what direction must a swimmer move through the water in order to have a resultant velocity relative to the river bank of:
  - (a) 3.4 m/s [W]
  - (b) 8.6 m/s [E]
8. The current in a river moves at 3.0 m/s [N]. How fast and in what direction must a swimmer move through the water in order to have a resultant velocity relative to the river bank of:
  - (a) 5.8 m/s [S]
  - (b) 5.8 m/s [N]
9. Kermit the crab is crawling along the bottom of a river. He checks his speedometer and finds he is moving upstream at 2 m/s relative to the bottom. Floyd the flounder is swimming downstream. Floyd can swim at 4 m/s in still water, but the river is moving at 1 m/s. How fast is Floyd moving relative to Kermit?
10. A bus is moving East at 45.0 m/s, while a car moves toward it at 65.0 m/s. If a man walks from the back to the front of the bus at 5.5 m/s, what is the velocity of the man relative to the car?