

Relative Motion Worksheet

1. A passenger at the rear of a train traveling at 15 m/s relative to Earth throws a baseball with a speed of 15 m/s in the direction opposite the motion of the train. What is the velocity of the baseball relative to Earth as it leaves the thrower's hand?
2. A spy runs from the front to the back of an aircraft carrier at a velocity of 3.5 m/s. If the aircraft carrier is moving forward at 18.0 m/s, how fast does the spy appear to be running when viewed by an observer on a nearby stationary submarine?
3. A ferry is crossing a river. If the ferry is headed due north with a speed of 2.5 m/s relative to the water and the river's velocity is 3.0 m/s to the east, what will the boat's velocity relative to Earth be? (Hint: Remember to include the direction in describing the velocity.)
4. A girl at an airport rolls a ball north on a moving walkway that moves east. If the ball's speed with respect to the walkway is 0.15 m/s and the walkway moves at a speed of 1.50 m/s, what is the velocity of the ball relative to the ground?
5. Describe the motion of the following objects if they are observed from the stated frames of reference:
 - a. a person standing on a platform viewed from a train traveling north
 - b. a train traveling north viewed by a person standing on a platform
 - c. a ball dropped by a boy walking at a speed of 1 m/s viewed by the boy
 - d. a ball dropped by a boy walking 1 m/s as seen by a nearby viewer who is stationary
6. If the Green Goblin is riding his Goblin Glider in an effort to evade Spiderman. Spiderman is running at 10.0 m/s toward the front on top of a train traveling at 15.0 m/s East. Green Goblin decides to run at 5.0 m/s W across his glider that is moving at 23.0 m/s North in an attempt to jump off and avoid Spiderman's web. What is Green Goblin's speed relative to Spiderman so Spiderman can accurately shot his web?
7. A plane traveling north at 100.0 km/h through the air gets caught in a 40.0 km/h crosswind blowing west. This turbulence caused a beverage cart to brake free and begin rolling at 20.0 km/h toward the tail of the plane. What is the velocity of the cart relative to the ground? (you do not have to convert these since they are all the same unit)

Honors Only

8. A pet-store supply truck moves at 25.0 m/s north along a highway. Inside, a dog moves at 1.75 m/s at an angle of N 35.0° E. What is the velocity of the dog relative to the road?
9. Captain America is chasing Red Skull. He plans to throw his shield to knock down Red Skull but needs to know how fast Red Skull is moving relative to himself. If Red Skull is running at 3.50 m/s at an angle of 45.0° toward the left front of a truck that is moving at 12.5 m/s N, and Captain America is running at 4.00 m/s at an angle of 45.0° to the front left of a second truck moving South at 15.0 m/s, find the relative velocity for Captain America to hit Red Skull.