

Vectors Practice Problems

1. A roller coaster moves 85 m horizontally, then travels 45 m at an angle of 30 degrees above the horizontal. What is the displacement from its starting point? Use graphical techniques.
2. A novice pilot sets a plane's controls, thinking the plane will fly at 250 km/h to the north. If the wind blows at 75 km/h toward the southeast, what is the plane's resultant velocity.
3. Emily passes a soccer ball 6.0 m directly across the field to Kara, who then kicks the ball 14.5 m directly down the field to Luisa. What is the ball's displacement as it travels between Emily and Luisa?
4. A hummingbird flies 1.2 m along a straight path at a height of 3.4 m above the ground. Upon spotting a flower below, the hummingbird drops directly downward 1.4 m to hover in front of the flower. What is the hummingbird's displacement?
5. Find the horizontal and vertical components of the 125 m displacement of a superhero who flies down from the top of a tall building at an angle of 25 degrees below the horizontal.
6. A boat heading north crosses a wide river with a velocity of 10.00 km/h relative to the water. The river has a uniform velocity of 5.00 km/h due east. Determine the boat's velocity with respect to an observer on shore.
7. 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 be relative to the shore? (Hint: Remember to include the direction in describing the velocity.)
8. A golfer takes two putts to sink his ball in the hole once he is on the green. The first putt displaces the ball 6.00 m east, and the second putt displaces it 5.40 m south. What displacement would put the ball in the hole in a single putt?
9. A roller coaster travels 41.1 m at an angle of 40 degrees above the horizontal. How far does it move horizontally and vertically?
10. The pilot of a plane measures an air velocity of 165 km/h south. An observer on the ground sees the plane pass overhead at a velocity of 145 km/h toward the north. What is the velocity of the wind that is affecting the plane?
11. A river flows due east at 1.50 m/s. A boat crosses the river from the south shore to the north shore by maintaining a constant velocity of 10.0 m/s due north relative to the water.
 - a. What is the velocity of the boat as viewed by an observer on shore?
 - b. If the river is 325 m wide, how far downstream has the boat moved by the time it reaches the north shore?
12. A swimmer can swim in still water at a speed of 9.5 m/s. He intends to swim directly across a river that has a downstream current of 3.75 m/s.
 - a. What must the swimmer's heading be?
 - b. What is his velocity relative to the bank?
13. A man is pulling on his dog with a force of 70.0 N directed at an angle of +30.0 degrees to the horizontal.
 - a. Find the x component of this force.
 - b. Find the y component of this force.