

Use the information below to answer questions 9–12.

A girl riding a bicycle at 2.0 m/s throws a tennis ball horizontally forward at a speed of 1.0 m/s from a height of 1.5 m. At the same moment, a boy standing on the sidewalk drops a tennis ball straight down from a height of 1.5 m.

9. What is the initial speed of the girl's ball relative to the boy?
 - A. 1.0 m/s
 - B. 1.5 m/s
 - C. 2.0 m/s
 - D. 3.0 m/s
10. If air resistance is disregarded, which ball will hit the ground first?
 - F. the boy's ball
 - G. the girl's ball
 - H. neither
 - J. The answer cannot be determined from the given information.
11. If air resistance is disregarded, which ball will have a greater speed (relative to the ground) when it hits the ground?
 - A. the boy's ball
 - B. the girl's ball
 - C. neither
 - D. The answer cannot be determined from the given information.
12. What is the speed of the girl's ball when it hits the ground?
 - F. 1.0 m/s
 - G. 3.0 m/s
 - H. 6.2 m/s
 - J. 8.4 m/s

SHORT RESPONSE

13. If one of the components of one vector along the direction of another vector is zero, what can you conclude about these two vectors?

14. A roller coaster travels 41.1 m at an angle of 40.0° above the horizontal. How far does it move horizontally and vertically?
15. A ball is thrown straight upward and returns to the thrower's hand after 3.00 s in the air. A second ball is thrown at an angle of 30.0° with the horizontal. At what speed must the second ball be thrown to reach the same height as the one thrown vertically?

EXTENDED RESPONSE

16. A human cannonball is shot out of a cannon at 45.0° to the horizontal with an initial speed of 25.0 m/s. A net is positioned at a horizontal distance of 50.0 m from the cannon. At what height above the cannon should the net be placed in order to catch the human cannonball? Show your work.

Read the following passage to answer question 17.

Three airline executives are discussing ideas for developing flights that are more energy efficient.

Executive A: Because the Earth rotates from west to east, we could operate “static flights”—a helicopter or airship could begin by rising straight up from New York City and then descend straight down four hours later when San Francisco arrives below.

Executive B: This approach could work for one-way flights, but the return trip would take 20 hours.

Executive C: That approach will never work. Think about it. When you throw a ball straight up in the air, it comes straight back down to the same point.

Executive A: The ball returns to the same point because Earth's motion is not significant during such a short time.

17. In a paragraph, state which of the executives is correct, and explain why.

Test TIP

If you get stuck answering a question, move on. You can return to the question later if you have time.