

Quiz 1

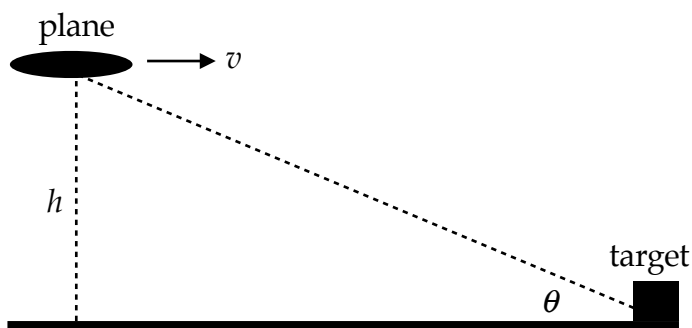
Solutions

Choose the best answer.

1. An object travels on the x -axis with velocity given [SI units] by $v(t) = 10 - 10t$. Which of the following is *wrong*?
 - A. It reverses direction at $t = 1$ s.
 - B. Its acceleration is -10 m/s^2 .
 - C. It will return to its starting point at $t = 2$ s.
 - ➡D. One of the above is wrong. [They are all correct]

Choose T or F depending on whether the statement is true or false.

2. If a race ends at the same point where it started, all runners who finish have the same average velocity. T [The total displacement is zero for all of them.]
3. Bombers in World War II had optical devices to help them. When the target appeared in the center of the field of view of the device, the bombs would be released. Shown is the situation at the instant when the bombs are released, with the device aimed at the target, and the plane flying horizontally at height h and speed v . [Express answers in terms of given quantities and g .]
 - a. How long does it take the bombs to reach the target?
 - b. What is the angle θ ?
 - c. A movie camera underneath the plane follows the bombs as they fall. At what angle, relative to the horizontal, is it aimed? Explain.



- a. They reach the target and the ground at the same time, so use the vertical motion:

$$0 = h - \frac{1}{2}gt^2, \text{ or } t = \sqrt{\frac{2h}{g}}.$$

- b. In that time they move horizontally a distance $x = vt = v\sqrt{\frac{2h}{g}}$. From the right

triangle, $\tan \theta = h/x = \frac{1}{v}\sqrt{\frac{gh}{2}}$.

- c. The horizontal motion of the bombs and the plane is the same, so the plane is always directly above the bombs. The camera should be pointed directly downward toward the ground.