

CHAPTER 3 | *KINEMATICS IN TWO DIMENSIONS*

ANSWERS TO FOCUS ON CONCEPTS QUESTIONS

- (a) The horizontal component v_x of the projectile's velocity remains constant throughout the motion, since the acceleration a_x in the horizontal direction is zero ($a_x = 0 \text{ m/s}^2$). The vertical component v_y , however, changes as the projectile moves. This component is greatest at point 1, decreases to zero at point 2 at the top of the trajectory, and then increases to a magnitude less than that at point 1 as the projectile approaches point 3.
- (c) The acceleration due to gravity is the same for both balls, despite the fact that they have different velocities.
- (d) The acceleration of a projectile is the same at all points on the trajectory. It points downward, toward the earth, and has a magnitude of 9.80 m/s^2 .
- (c) The time for a projectile to reach the ground depends only on the y component (or vertical component) of its variables, i.e., y , v_{0y} , and a_y . These variables are the same for both balls. The fact that Ball 1 is moving horizontally at the top of its trajectory does not play a role in the time it takes for it to reach the ground.
- (a) The time a projectile is in the air is equal to twice the time it takes to fall from its maximum height. Projectile 1 reaches the greater height, so it spends the greater amount of time in the air.
- (c) The velocity \mathbf{v}_{PC} of the passenger relative to the car is given by $\mathbf{v}_{\text{PC}} = \mathbf{v}_{\text{PB}} + \mathbf{v}_{\text{BC}}$, according to the subscripting method discussed in Section 3.4. However, the last term on the right of this equation is given by $\mathbf{v}_{\text{BC}} = \mathbf{v}_{\text{BG}} + \mathbf{v}_{\text{GC}}$. So, $\mathbf{v}_{\text{PC}} = \mathbf{v}_{\text{PB}} + \mathbf{v}_{\text{BG}} + \mathbf{v}_{\text{GC}} = +2 \text{ m/s} + 16 \text{ m/s} + (-12 \text{ m/s}) = +6 \text{ m/s}$.
- (b) The velocity of the jeep relative to you is zero. Thus, the horizontal component of the tire's velocity relative to you is also zero. Since this component of the velocity never changes as the tire falls, the car cannot hit the tire, regardless of how close the car is to the jeep.

16. The magnitude v_{AB} of the velocity of car A relative to car B is $v_{AB} = 34.2$ m/s. The angle that the velocity \mathbf{v}_{AB} makes with respect to due east is $\theta = 37.9^\circ$ south of east.