

77. A police car at rest, passed by a speeder traveling at a constant 120 km/h, takes off in hot pursuit. The police officer catches up to the speeder in 750 m, maintaining a constant acceleration. (a) Qualitatively plot the position vs. time graph for both cars from the police car's start to the catch-up point. Calculate (b) how long it took the police officer to overtake the speeder, (c) the required police car acceleration, and (d) the speed of the police car at the overtaking point.
78. A stone is dropped from the roof of a building; 2.00 s after that, a second stone is thrown straight down with an initial speed of 25.0 m/s, and the two stones land at the same time. (a) How long did it take the first stone to reach the ground? (b) How high is the building? (c) What are the speeds of the two stones just before they hit the ground?
79. Two stones are thrown vertically up at the same time. The first stone is thrown with an initial velocity of 11.0 m/s from a 12th-floor balcony of a building and hits the ground after 4.5 s. With what initial velocity should the second stone be thrown from a 4th-floor balcony so that it hits the ground at the same time as the first stone? Make simple assumptions, like equal-height floors.
80. If there were no air resistance, how long would it take a free-falling parachutist to fall from a plane at 3200 m to an altitude of 350 m, where she will pull her ripcord? What would her speed be at 350 m? (In reality, the air resistance will restrict her speed to perhaps 150 km/h.)
81. A fast-food restaurant uses a conveyor belt to send the burgers through a grilling machine. If the grilling machine is 1.1 m long and the burgers require 2.5 min to cook, how fast must the conveyor belt travel? If the burgers are spaced 15 cm apart, what is the rate of burger production (in burgers/min)?
82. Bill can throw a ball vertically at a speed 1.5 times faster than Joe can. How many times higher will Bill's ball go than Joe's?
83. You stand at the top of a cliff while your friend stands on the ground below you. You drop a ball from rest and see that it takes 1.2 s for the ball to hit the ground below. Your friend then picks up the ball and throws it up to you, such that it just comes to rest in your hand. What is the speed with which your friend threw the ball?
84. Two students are asked to find the height of a particular building using a barometer. Instead of using the barometer as an altitude-measuring device, they take it to the roof of the building and drop it off, timing its fall. One student reports a fall time of 2.0 s, and the other, 2.3 s. How much difference does the 0.3 s make for the estimates of the building's height?
- * 85. Figure 2-43 shows the position vs. time graph for two bicycles, A and B. (a) Is there any instant at which the two bicycles have the same velocity? (b) Which bicycle has the larger acceleration? (c) At which instant(s) are the bicycles passing each other? Which bicycle is passing the other? (d) Which bicycle has the highest instantaneous velocity? (e) Which bicycle has the higher average velocity?

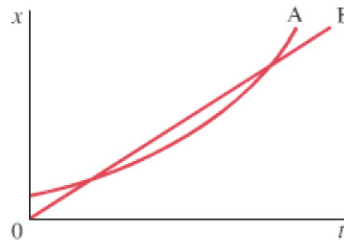


FIGURE 2-43 Problem 85.

Answers to Exercises

- A:** (b).
B: (a) +; (b) -; (c) -; (d) +.
C: (c).
D: 4.9 m/s².
E: That plane on which a smooth ball will not roll; or perpendicular to vertical.