Section one: Motion

Student ID Name

Part one:

A wildlife biologist is studying the hunting patterns of tigers. She anesthetizes a tiger and attaches a GPS collar to track its movements. The collar transmits data on the tiger's position and velocity. Figure 1.1 shows the tiger's velocity as a function of time as it moves on a one-dimensional path

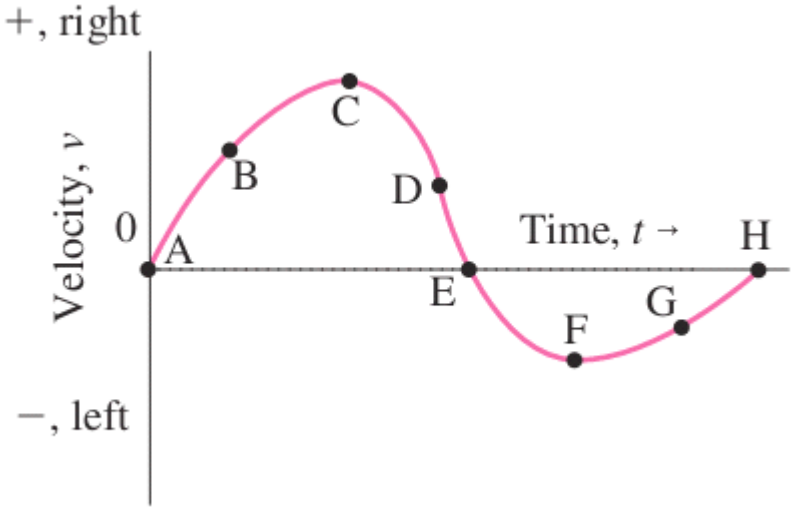

FIGURE 1.1 The tiger's velocity

1. At which marked point(s) is the tiger not moving?

a. E only

b. A, E, and H

c. C and F

d. none of the points (it's always moving)

2. At which marked point(s) is the tiger not accelerating?

a. E only

b. A, E, and H

c. C and F

d. all of the points (it's never accelerating)

3. At which point does the tiger have the greatest speed?

a. B

b. C

c. D

d. F

4. At which point does the tiger's acceleration have the greatest magnitude?

a. B

b. C

c. D

d. F

5. At which point is the tiger farthest from its starting position at t=0 ?

a. C

b. E

c. F

d. H

Alice (A), Bob (B), and Carrie (C) all start from their dorm and head for the library for an evening study session. Alice takes a straight path, while the paths Bob and Carrie follow are portions of circular arcs, as shown in Fig. 1.2. Each student walks at a constant speed. All three leave the dorm at the same time, and they arrive simultaneously at the library.

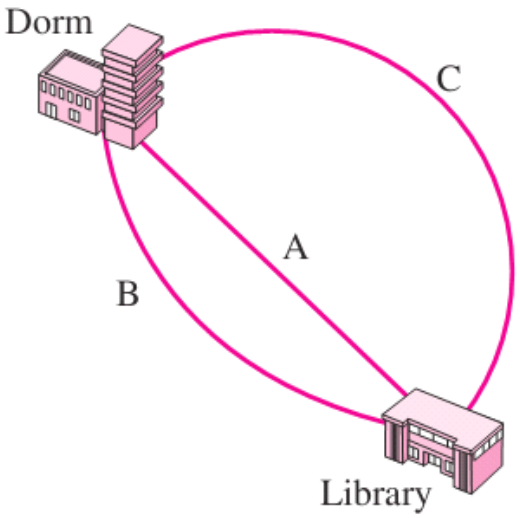

FIGURE 1.2

6. Which statement characterizes the distances the students travel?

a. They're equal.

b. C>A>B

c. C>B>A

d. B>C>A

7. Which statement characterizes the students' displacements?

a. They're equal.

b. C>A>B

c. C>B>A

d. B>C>A

8. Which statement characterizes their average speeds?

a. They're equal.

b. C>A>B

c. C>B>A

d. B>C>A

9. Which statement characterizes their accelerations while walking (not starting and stopping)?

a. They're equal.

b. None accelerates.

c. C>A>B

d. C>B>A

e. B>C>A

f. There's not enough information to decide.

PART TWO:

1 If you can throw a stone straight up to height h, what's the maximum horizontal distance you could throw it over level ground?

Solution:

2 Your alpine rescue team is using a slingshot to send an emergency medical packet to climbers stranded on a ledge, as shown in Fig. 1.3; your job is to calculate the launch speed. What do you report?

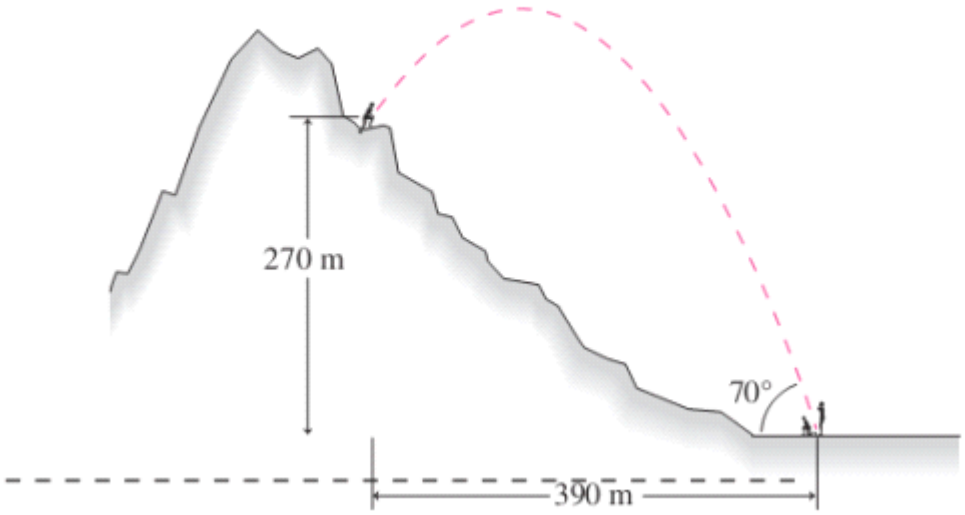

Figure 1.3

Solution:

3 At t_1= 2.00 s, the acceleration of a particle in counter-clockwise circular motion is (6.00 m/s^2)*i* + (4.00 m/s^2)*j*. It moves at constant speed. At time t_2=5.00 s, its acceleration is (4.00 m/s^2)*i* + (-6.00 m/s^2)*j*. What is the radius of the path taken by the particle if t_2-t_1 is less than one period?
Solution:

4 A 200-m-wide river flows due east at a uniform speed of 2.0 m/s. A boat with a speed of 8.0 m/s relative to the water leaves the south bank pointed in a direction 30 degrees west of north. What are the (a) magnitude and (b) direction of the boat's velocity relative to the ground? (c.) How long does the boat take to cross the river?
Solution: