- **Instantaneous Velocity**
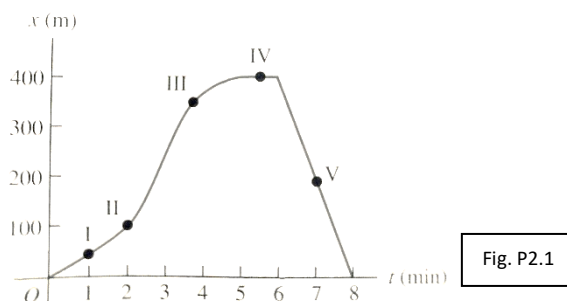
Ran leaves her office and walks along the sidewalk toward Colonial Williamsburg Merchants Square. After 5 minutes it starts to rain, and she returns to the office. Her distance from her office as a function of time is shown in Fig. P2.1. At which of the labeled points is her velocity

a) Zero?
b) Constant and positive?
c) Constant and negative?
d) Increasing in magnitude?
e) Decreasing in magnitude?

Fig. P2.1

- **Motion with constant acceleration**

A small rock is thrown vertically upward with a speed of 22.0 m/s from the edge of the roof of a 30.0-m-tall building. The rock doesn't hit the building on its way back down and lands on the street below. Ignore air resistance.

a) What's the speed of the rock just before it hits the street?
b) How much time elapses from when the rock is thrown until it hits the street?
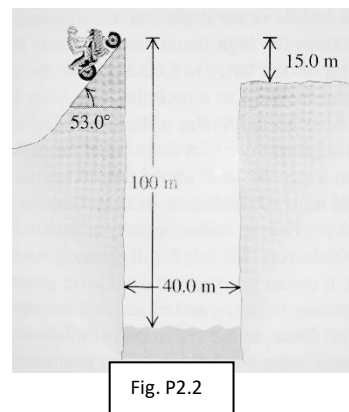
- **Position and Velocity Vectors**

A web page designer creates an animation in which a dot on a computer screen has position

$$\vec{r} = \left[4.0 \; cm + (2.5\frac{cm}{s^2})t^2\right]\hat{\imath} + \left(5.0\frac{cm}{s}\right)t\hat{\jmath}$$

a) Find the magnitude and direction of the dot's average velocity between t= 0 and t= 2.0 s.
b) Find the magnitude and direction of the instantaneous velocity at t = 0, t = 1.0 s, and t = 2.0 s.

- **Projectile Motion**

My buddy Duffy did daredevil stunts in his spare time. His last stunt was an attempt to jump across a river on a motorcycle (Fig. P2.2). The takeoff ramp was inclined at 53.0°, the river was 40.0 m wide, and the far bank was 15.0 m lower than the top of the ramp. The river itself was 100 m below the ramp. Ignore air resistance.

a) What should Duffy's speed have been at the top of the ramp to have just made it to the edge of the far bank?
b) If his speed was only half the value found in part (a), where did he land?

Fig. P2.2