35. A particle moves from point A to point B along the semicircular path of radius R, as shown in Fig. 7-29. It is subject to a force of constant magnitude F. Find the work done by the force (a) if the force always points upward in Fig. 7-29, (b) if the force always points to the right in Fig. 7-29, and (c) if the force always points in the direction of the particle's motion.

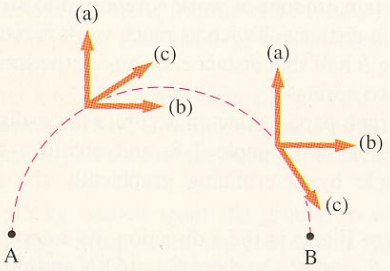

FIGURE 7-29 Problem 35. Arrows are force vectors, labeled to correspond to parts (a), (b), and (c) of the problem.

36. A cylindrical log of radius R lies half buried in the ground, as shown in Fig. 7-30. An ant of mass m climbs to the top of the log. Show that the work done by gravity on the ant is $-mgR$.

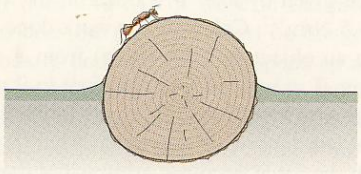

FIGURE 7-30 Problem 36.

37. A particle of mass m moves from the origin to the point $x = 3\,\text{m}$, $y = 6\,\text{m}$ along the curve $y = ax^2 - bx$, where $a = 2\ \text{m}^{-1}$ and $b = 4$. It is subject to a force $\mathbf{F} = cxy\hat{\mathbf{i}} + d\hat{\mathbf{j}}$, where $c = 10\ \text{N/m}^2$ and $d = 15\ \text{N}$. Calculate the work done by the force.
38. Repeat the preceding problem for the case when the particle moves first along the x axis from the origin to the point (3,0), then parallel to the y axis until it reaches (3,6).

53 •• SSM A cannon placed at the top of a cliff of height H fires a cannonball into the air with an initial speed v_0, shooting directly upward. The cannonball rises, falls back down, missing the cannon by a little bit, and lands at the foot of the cliff. Neglecting air resistance, calculate the velocity $\vec{v}(t)$ for all times while the cannonball is in the air, and show explicitly that the integral of $\vec{F} \cdot \vec{v}$ over the time that the cannonball spends in the air is equal to the change in the kinetic energy of the cannonball.