1. (25 pts) A bicyclist (plus bike) has a total weight of 180 lb. The speed is 6 ft/sec at point A. Neglecting resistance due to the wind and the ground, determine:
(a) the normal force on the bicycle at point A, and
(b) the acceleration at point A. Note that the radius of curvature at point A is 41.43 ft.
2. (25 pts) The ball at A is kicked at an angle $\theta_A$. If it hits the sloping ground at $x = x_0$ ft and $y = y_0$ ft, determine:

(a) the speed at which it is kicked, and
(b) the speed at which it strikes the ground.
(c) A second player runs from the opposite direction, diving horizontally toward the ball at $v_2$ ft/sec as it hits the ground. What is the relative velocity between player and ball at the moment of impact?
3. (25 pts) A 2 kg ball is thrown at the suspended 20 kg block with a speed of 4 m/s. If the coefficient of restitution between the ball and the block is $e=0.8$, determine the maximum height $h$ to which the block will swing before it reverses direction.
4. (25 pts) The slotted link is pinned at O. The link is driven at the constant angular velocity $\dot{\theta} = 3 \text{ rad/sec}$; it drives the peg P for a short distance along the spiral guide $r = 0.4\theta$ m, where $\theta$ is in radians. Determine the velocity and acceleration vectors at the instant when $\theta = \pi / 3 \text{ rad}$. 