HOMEWORK – 1

Deadline: 21-25 October 2013

1. A commuter train travels between two downtown stations. Because the stations are only 1.00 km apart, the train never reaches its maximum possible cruising speed. During rush hour the engineer minimizes the time interval Δt between two stations by accelerating for a time interval Δt_1 at a rate $a_1 = 0.100\ \mathrm{m/s^2}$ and then immediately braking with acceleration $a_2 = -0.500\ \mathrm{m/s^2}$ for a time interval Δt_2. Find the minimum time interval of travel Δt and the time interval Δt_1.

2.

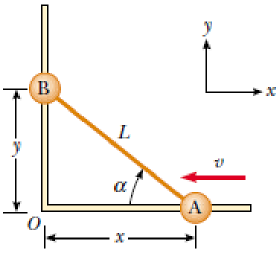

Figure 1

Two objects, A and B, are connected by a rigid rod that has a length L. The objects slide along perpendicular guide rails, as shown in Figure 1. If A slides to the left with a constant speed v, find the velocity of B when α= 60.0°.

3.

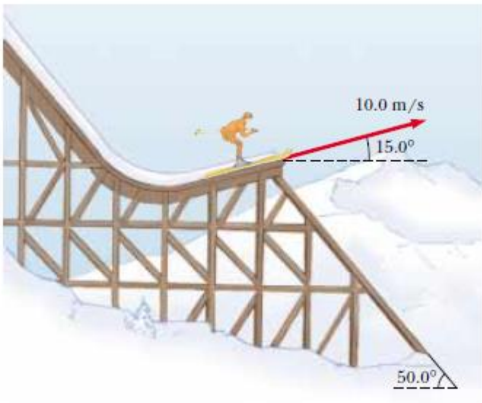

Figure 2

A skier leaves the ramp of a ski jump with a velocity of 10.0 m/s, 15.0° above the horizontal, as in Figure 2. The slope is inclined at 50.0°, and air resistance is negligible. Find (a) the distance from the ramp to where the jumper lands and (b) the velocity components just before the landing. (How do you think the results might be affected if air resistance were included? Note that jumpers lean forward in the shape of an airfoil, with their hands at their sides, to increase their distance. Why does this work?

4. A person standing at the top of a hemispherical rock of radius *R* kicks a ball (initially at rest on the top of the rock) to give it horizontal velocity $\boldsymbol{v_i}$ as in Figure 3. (a) What must be its minimum initial speed if the ball is never to hit the rock after it is kicked? (b) With this initial speed, how far from the base of the rock does the ball hit the ground?

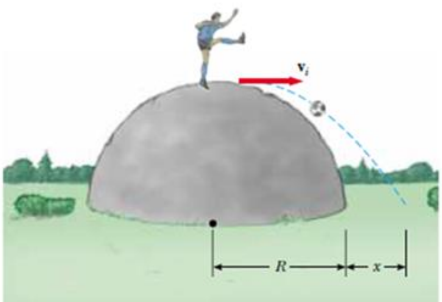

Figure 3