KK Ch 5: 5.2, 5.4, 5.7, 5.8

S 6.1 The figure to the right shows a cart with mass m_A and velocity v_{0A} along with a second cart with mass m_B and velocity v_{0B}.

(a) Under what condition will the two cars collide? They are constrained to move in one dimension.

(b) A collision happens, and is elastic, meaning that the collision conserves energy. If v_A and v_B are the velocities of cart A and B respectively, show that after the collision,

$$v_A = \left(\frac{m_A - m_B}{m_A + m_B}\right) v_{0A} + \left(\frac{2m_B}{m_A + m_B}\right) v_{0B},$$

$$v_B = -\left(\frac{m_A - m_B}{m_A + m_B}\right) v_{0B} + \left(\frac{2m_A}{m_A + m_B}\right) v_{0A}. \tag{1}$$

S 6.2 The figure below shows a small block with mass m on a hill with height H. At the bottom of the hill is a large block with mass $M > m$. All surfaces are frictionless, and the collision between the two blocks is elastic.

(a) What is the velocity of the large block u_1 after the first collision?

(b) After the first collision the small block bounces backward is travels up the hill. What is the height h_1 up the hill it reaches?

(c) How many times with the small block collide with the large block?

Comments:

- For problem KK 5.8, the mass comes to rest a distance x_i from the equilibrium position.

- Problem S 6.1b could require a good amount of algebra to solve ... or not.

- You can use the results of S 6.1 to solve S 6.2.