Name____________________________
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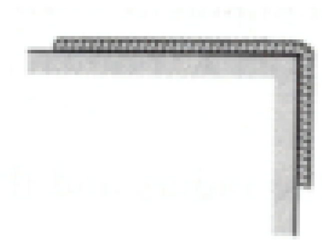
UNIT II: Worksheet 3

1. A uniform 2 kg chain of length 50 cm rests on a frictionless table. A tiny segment of the chain hangs off of the edge of the table and the chain is held in place.



   a. Derive a differential equation for the velocity of the chain with respect to how far it has fallen off the edge of the table.

The chain is released and falls off the edge of the table.

   b. Use your differential equation to solve for the velocity of the chain after it has just finished sliding off of the surface of the table.

   c. Use your differential equation to solve for the velocity of the chain after it has fallen half way off the surface of the table.

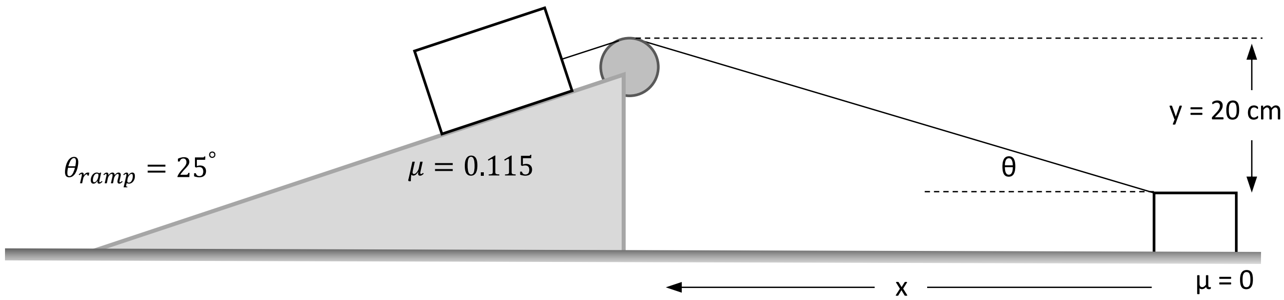
   d. Use your differential equation to solve for the velocity of the chain after it has just finished sliding off of the surface of the table assuming half the chain was already off of the table when it was initially held at rest.

2. A real chain doesn't slide perfectly sideways and then down. Sketch how a chain would actually fall for the following two situations:

   a. The length of the chain is much less than the height of the table

   b. The length of the chain is significantly more than the height of the table

3. An Atwood machine is used to pull a box across a floor. The crate on the ramp has a mass of 8 kg and the box on the floor has a mass of 3 kg. Friction causes the block on the ramp to slide at a constant velocity. Assume the length of the ramp is long enough that the large box remains on the ramp the entire time.



a. Sketch a free body diagram for the box on the floor and write the summation equation.

b. Use your equation and separation of variables, to create a differential equation relating position to velocity. (Hint: put θ in terms of x and y)

c. Solve for the velocity of the box after it has traveled 0.5m (Hint: $\int \frac{x\,dx}{\sqrt{x^2 \pm a^2}} = \sqrt{x^2 \pm a^2}$).

d. Sketch a tension vs position graph for the box as it slides along the table, starting at rest.