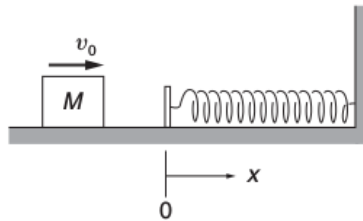


5. {2,5,7,8,10}

**1 - Block, spring, and friction - KK 5.2** A block of mass  $M$  slides along a horizontal table with speed  $v_0$ . At  $x = 0$  it hits a spring with spring constant  $k$  and begins to experience a friction force, as indicated in the sketch. The coefficient of friction is variable and is given by  $\mu = bx$ , where  $b$  is a constant. Find the distance  $l$  the block travels before coming to a permanent stop.

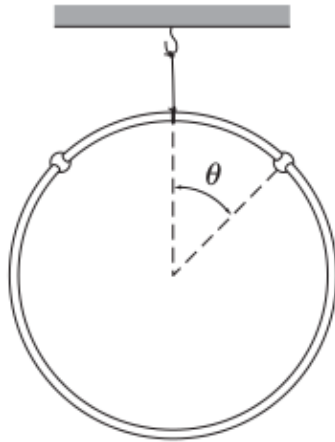


**2 - Work on a whirling mass - KK 5.5** Mass  $m$  whirls on a frictionless table, held to circular motion by a string which passes through a hole in the table. The string is pulled so that the radius of the circle changes from  $r_i$  to  $r_f$ .

- (a) Show that the quantity  $L = mr^2\dot{\theta}$  remains constant.
- (b) Show that the work in pulling the string equals the increase in kinetic energy of the mass.

■

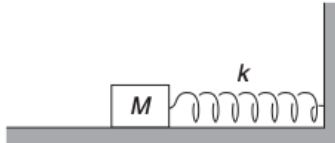
**3 - Beads on hanging ring\* - KK 5.7** A ring of mass  $M$  hangs from a thread, and two beads of mass  $m$  slide on it without friction, as shown. The beads are released simultaneously from the top of the ring and slide down opposite sides. Show that the ring will start to rise if  $m > 3M/2$ , and find the angle at which this occurs.



■

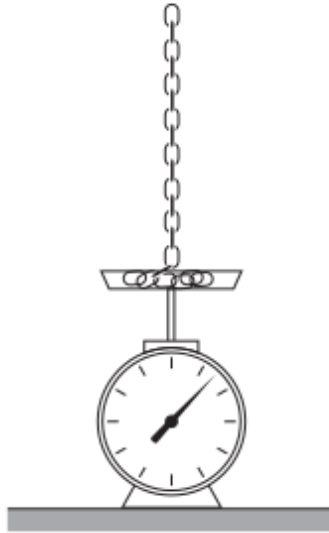
**4 - Damped oscillation\* - KK 5.8** The block shown in the drawing is acted on by a spring with spring constant  $k$  and a weak friction force of constant magnitude  $f$ . The block is pulled distance  $x_0$  from equilibrium and released. It oscillates many times and eventually comes to rest.

- (a) Show that the decrease of amplitude is the same for each cycle of oscillation.
- (b) Find the number of cycles  $n$  the mass oscillates before coming to rest.



■

**5 - Falling chain\* - KK 5.10** A chain of total mass  $M$  and length  $l$  is suspended vertically with its lowest end touching a scale. The chain is released and falls onto the scale. What is the reading of the scale when a length of chain,  $x$ , has fallen? (Neglect the size of individual links.)



■