A bar of mass $m$ and negligible height is lying horizontally across and perpendicular to a pair of counter rotating rollers as shown in the figure. The rollers are separated by a distance $D$. There is a coefficient of kinetic friction $\mu_k$ between each roller and the bar. Assume that the bar remains horizontal and never comes off the rollers, and that its speed is always less than the surface speed of the rollers.

a) Find the normal forces $N_L$ and $N_R$ exerted by the left and right rollers on the bar when the center of the bar is displaced a distance $x$ from the position midway between the rollers.

b) Find the differential equation governing the horizontal displacement of the bar $x(t)$.

c) The bar is released from rest at $x = x_0$ at $t = 0$. Find the subsequent location of the center of the bar, $x(t)$. 