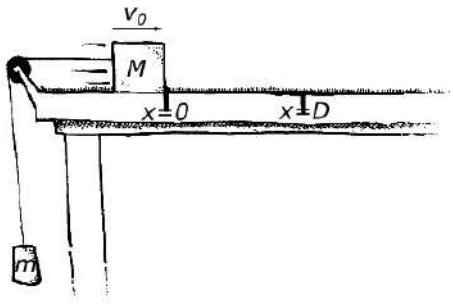
NAME _____ DATE _____

Scenario

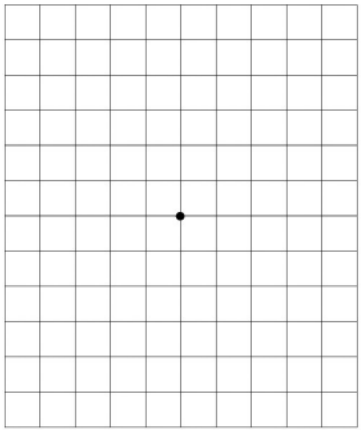
In the diagram shown to the right a block of mass M has taken a quick hit from a bat. After the strike, its front end is at position $x = 0$ at time $t = 0$ and it is moving to the right with initial speed v_0. The block slides on a rough surface and is also connected to a hanging mass object of mass m by a string that passes over an ideal pulley. The front end of the block reaches position $x = D$ at time $t = t_1$, the instant that the block comes to rest. The block then returns to position $x = 0$ at time $t = t_2$, having a leftward speed v_2 at that time.



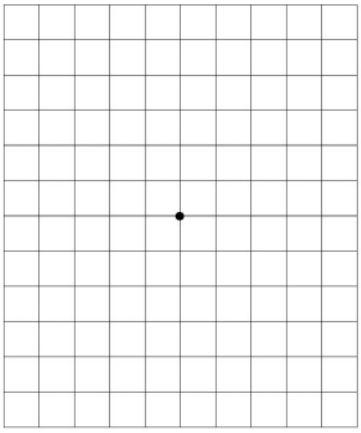
Using Representations

PART A: The dots below represent the block on the table during the interval $0 < t < t_1$ and $t_1 < t < t_2$. Draw free-body diagrams showing and labeling the forces (not components) exerted on the block during each of those intervals. Draw the relative lengths of all vectors to reflect the relative magnitudes of all the forces. Each force should be a single arrow that originates on the dot.

Forces during $0 < t < t_1$



Forces during $t_1 < t < t_2$



Analyze Data

PART B: Is the magnitude of the block's acceleration greater before the block reaches $x = D$ or after? Explain your reasoning in terms of the forces that you drew in the above diagrams.

PART C: On the grid below, sketch a graph of the block's velocity as a function of time, taking right to be positive. Label the values v_0, t_1, and t_2 on the axes. Make sure that your graph is sketched to show that the block travels the same distance forward and backward.