Problem 3 (20 points):

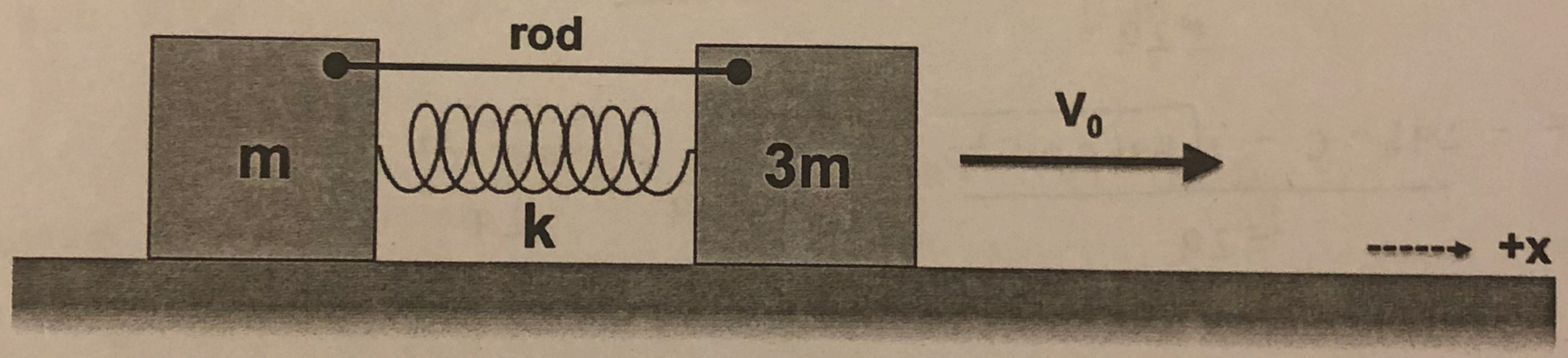
As shown in **Figure 2** below, two blocks of masses m and $3m$ are connected by a massless rigid rod. An ideal, massless spring of spring constant k is inserted between the blocks, requiring it to be compressed by a distance l_0 from its relaxed length. The entire system is initially sliding along a frictionless horizontal surface in the $+x$ direction at speed V_0. The rod suddenly snaps, allowing the spring to decompress and push the blocks apart. The spring is not fixed to the blocks, so it simply falls to the horizontal surface when it returns to its relaxed length.

Find the x-velocities of each block after the spring returns to its relaxed length and falls away. Express your answers in terms of m, k, l_0, and V_0. You can assume that the transfer of energy from the spring to the two blocks is perfect. *(Hint: to simplify the algebra, solve this problem in the center-of-mass reference frame first and then convert back to the reference frame of* **Figure 2.**)

Figure 2

before rod snaps:

$$\frac{1}{2}(4m)v_0^2 + \frac{1}{2}k(l_0)^2$$



after rod snaps:

$$\frac{1}{2}mv_1^2 + \frac{3m}{2}v_2^2$$

$\leftarrow v_1$ $\rightarrow v_2$