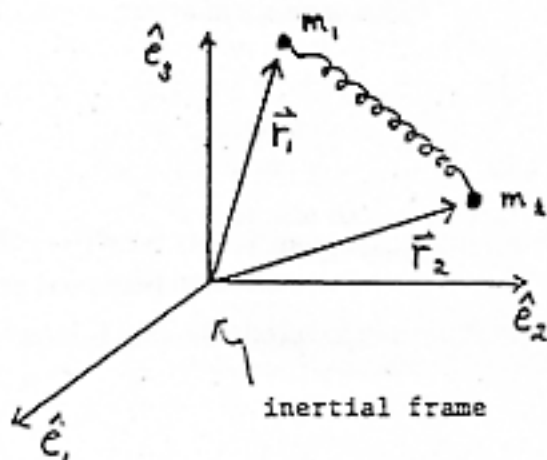


PART II (85 points)

7. (20 pts) Two point masses m_1 and m_2 are joined by a spring having zero natural length and spring constant k . They are thrown out at $t = 0$ into intergalactic space (no gravity) as shown below.



- (a) Neglecting the gravitational interaction between the particles and their possible collision, write the Lagrangian describing their motion.

$$L(r_1, r_2; \dot{r}_1, \dot{r}_2) = \frac{1}{2} m_1 \dot{\vec{r}}_1^2 + \frac{1}{2} m_2 \dot{\vec{r}}_2^2 - \frac{1}{2} k (\vec{r}_1 - \vec{r}_2)^2$$

- (b) Define the center of mass coordinate R and relative coordinate r .

$$R = \frac{m_1 \vec{r}_1 + m_2 \vec{r}_2}{m_1 + m_2}$$

$$r = \vec{r}_1 - \vec{r}_2$$